

## Helix Nebula – The Science Cloud

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## Table of Abbreviations

AWS	Amazon Web Services
BB	Business Broker
BM	Business Model
BMI	Business Model Innovation
BYOD	Bring-Your-Own Device
CERN	European Organization for Nuclear Research
cf.	compare
e.g.	for example
EC	European Commission
EGI	European Grid Infrastructure
EMBL	European Molecular Biology Laboratory
ESA	European Space Agency
etc.	et cetera
EU	European Union
EU BFC	European Union Bilateral Framework Contract
EU GFC	European Union Group Framework Contract
HN	Helix Nebula
HPC	High-Performance Computing
HTC	High-Throughput Computing
IaaS	Infrastructure as a Service
ICT	Information and Communication
IDC	International Data Corporation
iPaaS	Integration Platform as a Service
ISV	Independent Software Vendor
LHC	Large Hadron Collider
MTC	Many-Task Computing
NE	Network Effect
OBR	Overarching Broker Role
PaaS	Platform as a Service
PPP	Public-Private Partnership
R&D	Research and Development
resp.	respectively
SLA	Service Level Agreement
SaaS	Software as a Service
TB	Technology Broker
UIS	UNESCO Institute for Statistics



VAR

Value Added Reseller

XaaS

Anything as a Service



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## 1 Executive Summary

This document provides a synthesis and analysis of business models for the further development of the Helix Nebula initiative resulting in seven potential business models with and without specific broker roles. Overarching and specific broker roles are required to manage the Helix Nebula ecosystem more effectively as bilateral communications cause higher risks and costs. The description of the roles and the business models follow a defined qualitative framework incorporating amongst others abstract costs, margins and risk assessment criteria. As the business models are closely correlated to procurement and budgeting processes of the first three customers' use cases within supranational public organisations, a set of recommended changes and adaptations for collaborative procurement and accounting procedures are provided. These recommendations are based on the gap analysis of existing procurement and budgeting processes (cf. deliverable 7.1). The business model concepts were developed in close collaboration with representatives of the Helix Nebula supply side in two strategy workshops in Regensdorf/Switzerland on 2<sup>nd</sup> and 15<sup>th</sup> May 2013. SAP Research elaborated the business models without distorting the primal ideas. An evaluation based on structured interviews with twelve cloud computing experts with a business background from SAP and the Helix Nebula supply side revealed that the business model with the highest revenue potential is **"Information as a Service"**. Capturing, processing, analysing and archiving highly attractive data from ESA and EMBL has the potential to cooperate with further data providers in order to enrich the data in its context. The selling of resulting data sets and knowledge is evaluated as the most promising business model in terms of market need, impact on critical mass, differentiation, and thought leadership. Yet, the required time for implementation is long. The second best revenue potential is represented by **"Worldwide All-In-One Enterprise Cloud"** which eventually paves the way for a cloud computing platform that offers a unique resource to governments, businesses and citizens. This is an aim defined by the European Union. It can be the long term model for a partner network of major cloud computing providers consolidating different business activities and strategies, including an ecosystem approach or comprehensive Software as a Service model.

**Chapter two** specifies the theoretical foundation of this document. It defines SAP's understanding of business models concerning relevance, term definition, appropriate description templates, and existing business model patterns. **Chapter three** describes the systematic, integrated business model innovation approach of SAP encompassing the phases pre-analysis, analysis, design, and validation. **Chapter four** presents the business model description framework, the overarching broker roles required in all models, and the business models with their specific broker roles themselves. A collection of data edited in tables, radars, and matrices enables a profound decision making. The problem to initiate business models successfully is answered in the chapter "network effects". Network effects occur if the number of users increases the perceived value of a product or service. In **chapter five** potential solutions for public procurement of cloud computing services are explained on the basis of several procurement scenarios incorporating the requirements of the three flagships. The deliverable concludes with **chapter six** providing a summary and a set of next steps to be taken in order to accelerate the progress of Helix Nebula regarding business models and broker roles.

## 2 SAP's Understanding of Business Models

A profound and unambiguous synthesis and analysis of business models (BM) requires a defined terminology synchronizing the understanding of all stakeholders of the Helix Nebula (HN) project. For this reason, but also in order to establish the theoretical foundation for SAP's Business Model Innovation (BMI) approach, we prepend this chapter that encompasses a motivation of the relevance of BMs, a term definition, ways of describing BMs, and the introduction to a concept of BM patterns.

### 2.1 Relevance of Business Models

In a nutshell, leading BM research tells us three things that are introduced with the following bold sentences including statements of research thought leaders.

**Firstly, research and development is necessary, but not enough.** "There was a time, not so long ago, when 'innovation' meant that companies needed to invest in extensive internal research laboratories, hire the most brilliant people they could find, and then wait patiently for novel products to emerge" (Chesbrough 2007). This is not enough anymore. Today, "technological innovation does not guarantee business success. New product or service development efforts should be coupled with a business model defining 'go-to-market' and 'capturing value' strategies" (Teece 2010). Further, "the rise of new technology-based and low-cost rivals [in the commoditized generic cloud computing market] is threatening incumbents, reshaping industries, and redistributing profits" (Casadesus-Masanell and Ricart 2011).

**Secondly, BMs are not only one factor amongst many for success, but they are decisive.** In future, competition takes place not between products or companies, but between BMs (Hamel 2008). That means that "great business models can reshape industries and drive spectacular growth" (Johnson et al. 2008). Without BMs you can't even measure success since "technology by itself has no single objective value. The economic value of a technology remains latent until it is commercialized in some way via a business model. The same technology commercialized in two different ways will yield two different returns" (Chesbrough 2010).

**Thirdly, systematically developed BM innovations enable competitive advantages.** While products and services can often easily be copied, BM innovations allow companies to change established market facts (Kim and Mauborgne 1999). In the cloud computing market such a fact is the "shortening of service lives meaning that even [this] great technology no longer can be relied upon to earn a satisfactory profit before it becomes commoditized" (Chesbrough 2007). Yet, "few companies understand their existing business model well enough – the premise behind its development, its natural interdependencies, and its strengths and limitations. So they don't know when they can leverage their core business and when success requires a new business model" (Johnson et al. 2008). The status quo in practice regarding systematic business model innovation is sobering. While most companies have got formal processes and leverage best-

practices for product innovations, only a few companies have formal processes for BMI. Most companies have line organizations and clear responsibilities for product innovations, but almost no company today is on the same level for BMI. Companies see the potential of BMI, yet still only 10% of innovation investments at global companies are focused on BMI. New entrants capitalize new business models more often than incumbents with their brands, people and resources. ([American Management Association 2006](#), [Bucherer et al. 2011](#), [McGrath 2010](#))

Now knowing about the importance of BMs, the next questions that arise are what exactly hides behind the term “Business Model” and how can BMs be described.

## 2.2 Definition of the Term “Business Model”

A business model abstracts the complexity of a company (or business unit) by reducing it to its core elements and their interrelations. It specifies the core business logic of the firm relevant for its competitive advantage and has to be built according to the firm’s strategy. It is an instantiation of the strategy and facilitates the description, analysis and innovation of the business.

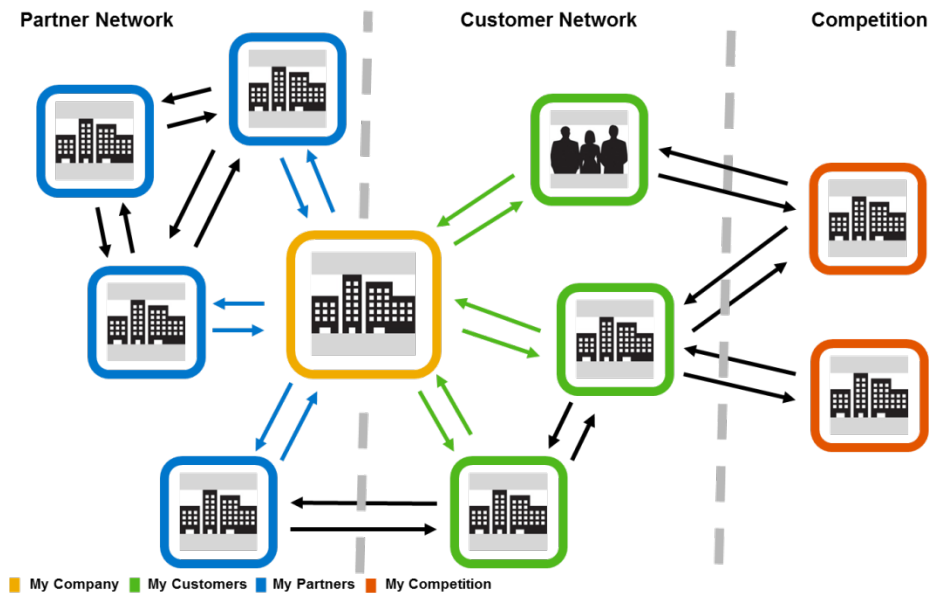
## 2.3 Description of Business Models

Every BM description should capture the key aspects of the model and its surrounding business network. The key aspects should answer four questions.

- What are the offered value propositions?
- Who are the customers?
- How do operations have to work?
- Why is the BM financially interesting?

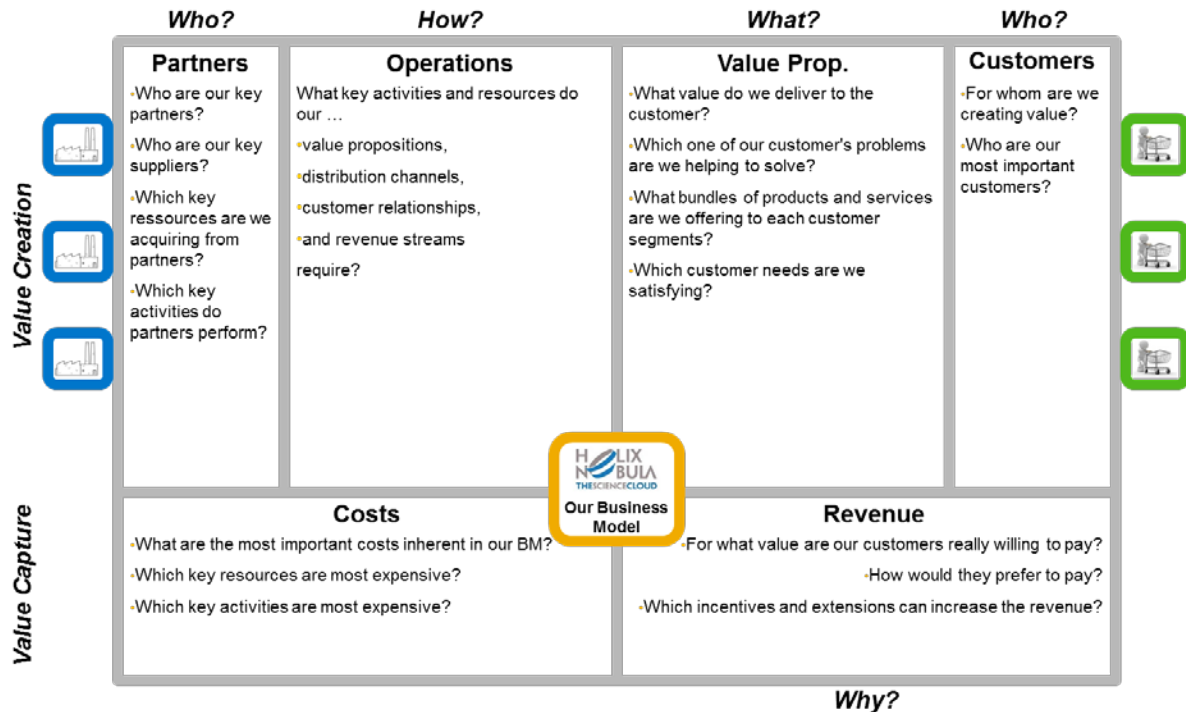
BM descriptions can be adapted to the specifics of a company or for certain objectives. There are no right or wrong descriptions, only appropriate and inappropriate ones. SAP’s BMI approach is based on SAP’s specially developed description. However, it can be easily transferred to other descriptions. In order to capture the key aspects of the model and its surrounding business network, SAP uses an enterprise view (cf. figure 1) and a network view (cf. figure 2).

Both representations are assumed to complement each other in a way that the **network view** describes the value creation out of the perspective of the whole business network; it highlights the entirety of the business network and its interrelations. Whereas the **enterprise view** describes the value creation out of the perspective of a single company participating in the business network and shows how the networks value creation relates to and is implemented by its own business elements.



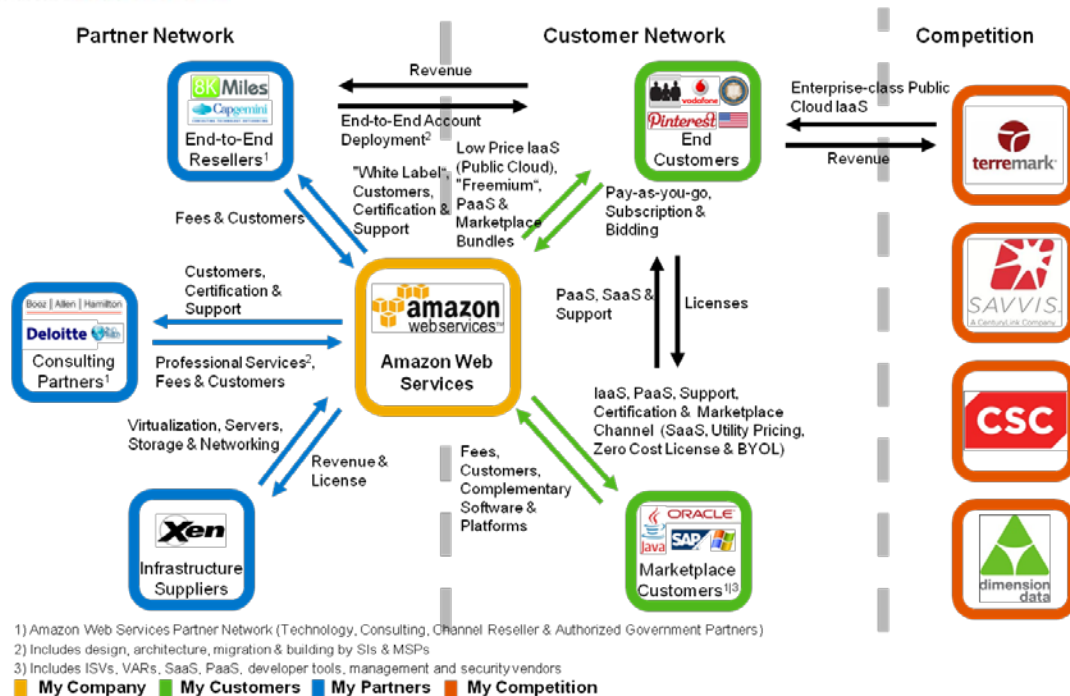
*Figure 1 SAP's Network View Template*

There are further representations to describe BMs in literature. Well known representations are the Osterwalder-Canvas or the LEAN Canvas (Osterwalder 2009). SAP's Enterprise View can easily be transferred into an Osterwalder-Canvas or LEAN Canvas and vice versa. The difference in SAP's model is the reduction to four basic categories for the sake of complexity reduction. SAP's view collects multiple other canvases' elements in one category. E.g., the category "Operations" includes key activities and resources.



*Figure 2 SAP's Enterprise View Template*

The following description of Amazon Web Services' (AWS) BM serves as an example in this context (cf. figure 3 & figure 4). Figure 3 shows, in accordance with [Leong et al.](#) at Gartner (2012), that AWS has a very large partner ecosystem.



**Figure 3 Business Model Description of Amazon Web Services (Network View)**

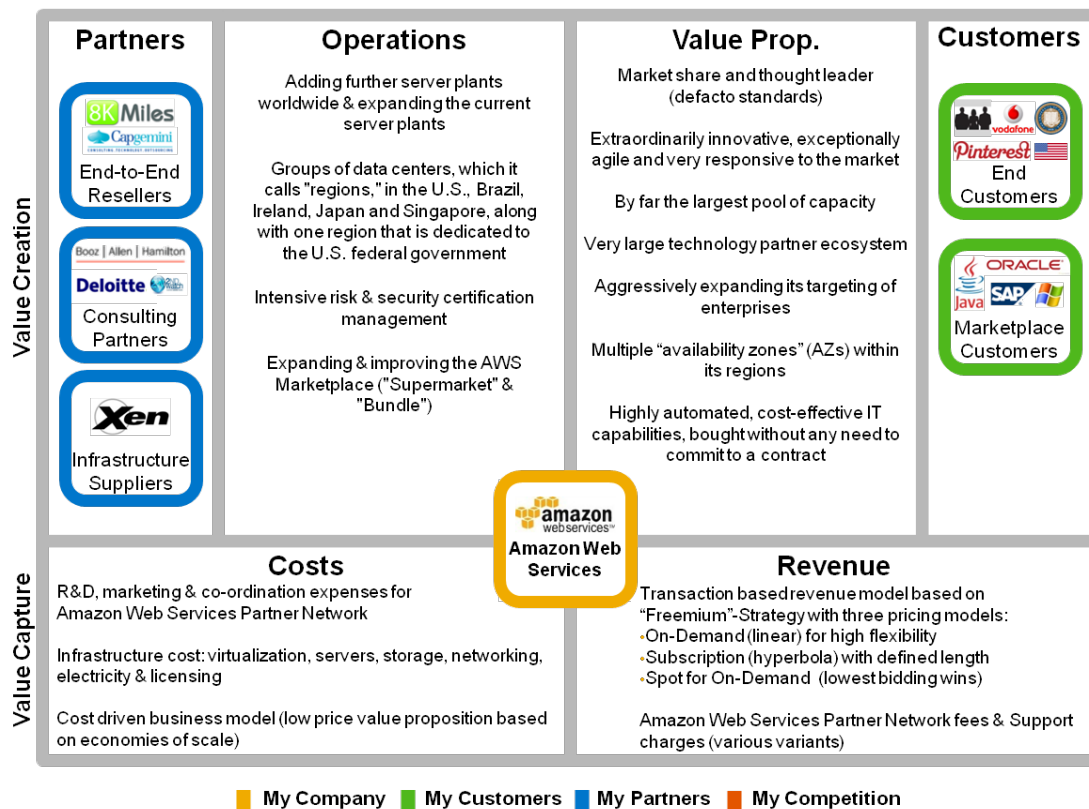
The "Amazon Web Services Partner Network" encompasses technology partners, consulting partners, channel resellers, and authorized government partners. The technology partners are named "Marketplace Customers" since they sell their products on AWS's marketplace. The details on the arrows reveal AWS's differentiation, thought, and market share leadership. To mention two of the details, we see that AWS aggressively defends its status of being "...extraordinarily innovative, exceptionally agile and very responsive to the market" (Leong et al. at Gartner 2012) by, firstly, constantly lowering its prices due to a cost driven business model with a low price value proposition based on economies of scale. Secondly, AWS enables its marketplace customers to use four different BMs "SaaS", "Utility Pricing", "Zero Cost License", and "Bring Your Own License" to participate in the marketplace. We have a close look on "Bring Your Own License". This model is advantageous for the technology partners, as no change is required to existing channel models, sales compensation plans, marketing, and revenue reorganization practices. End users procure Software on Amazon EC2, similar to deploying on physical hardware.

Looking on the right side "competition", the Terremark Infrastructure & Cloud Services is fighting AWS with enterprise-class public cloud IaaS based on a value driven business model focusing on premium value creation.

Turning to figure 4, we learn that AWS's cost driven BM is not enough for enterprises which much more need flexible (hybrid use cases) and safe (licenses & SLAs) value propositions. AWS has been aggressively expanding its targeting of enterprises by obtaining many security and compliance-related certifications and



audits over the last years. In addition, AWS has multiple “availability zones” within its regions that enable failure independence, stability, meet legal requirements and make the locality of each EC2 resource unambiguous. If one of the instances fails, you can design your application so the instances in the remaining availability zones handle the requests (Leong et al. at Gartner 2012).



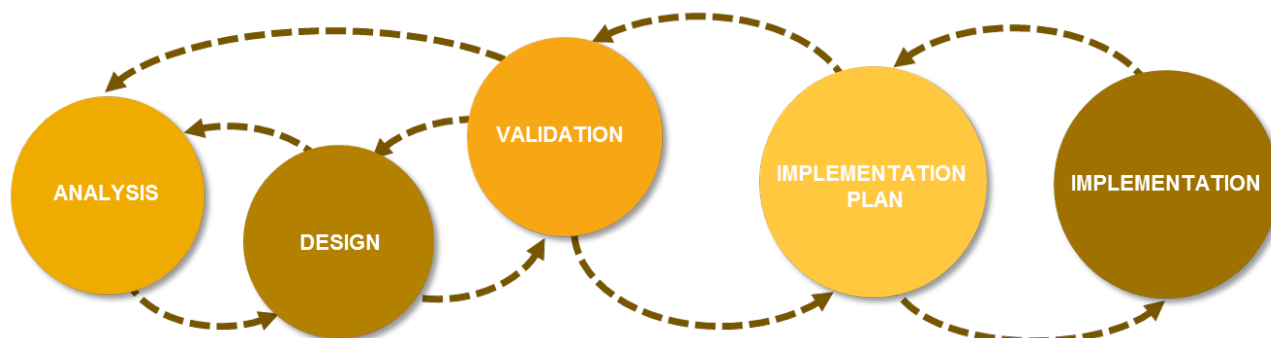
**Figure 4 Business Model Description of Amazon Web Services (Enterprise View)**

## 2.4 Business Model Patterns

When developing or innovating BMs, it is important not to reinvent the wheel. It is much easier to leverage existing BMs which is proven by scientific findings. 90% of all new BM innovations are re-combinations of existing BMs (Gassmann et al. 2013). Not every game-changing BM must be cut from whole cloth. Sometimes it is enough to employ a familiar one in a new way. “Companies can adopt business models pioneered in one space into another” (Teece 2010). Therefore, SAP uses amongst others methods that re-use such BMs in the form of basic business model patterns. This enables learn from other successful businesses. However, they are supposed to be understood and adapted. Simple copying is not enough. With that knowledge SAP’s integrated BMI approach can be introduced.

### 3 SAP's Integrated Business Model Innovation Process

For HN, SAP Research chose its systematic, integrated approach to synthesize and analyse overall business models. It follows five phases (cf. figure 5). For the purpose of transparency of what SAP did to find potential BMs, we will at first look closely on the process and document relevant findings and information in the context of HN. If you want to look on the resulting BMs straight away, please skip to chapter four. The first phase is the analysis phase. It contains a pre-analysis phase which is presented first.



*Figure 5 Integrated Business Model Innovation at SAP*

#### 3.1 The Pre-Analysis Phase

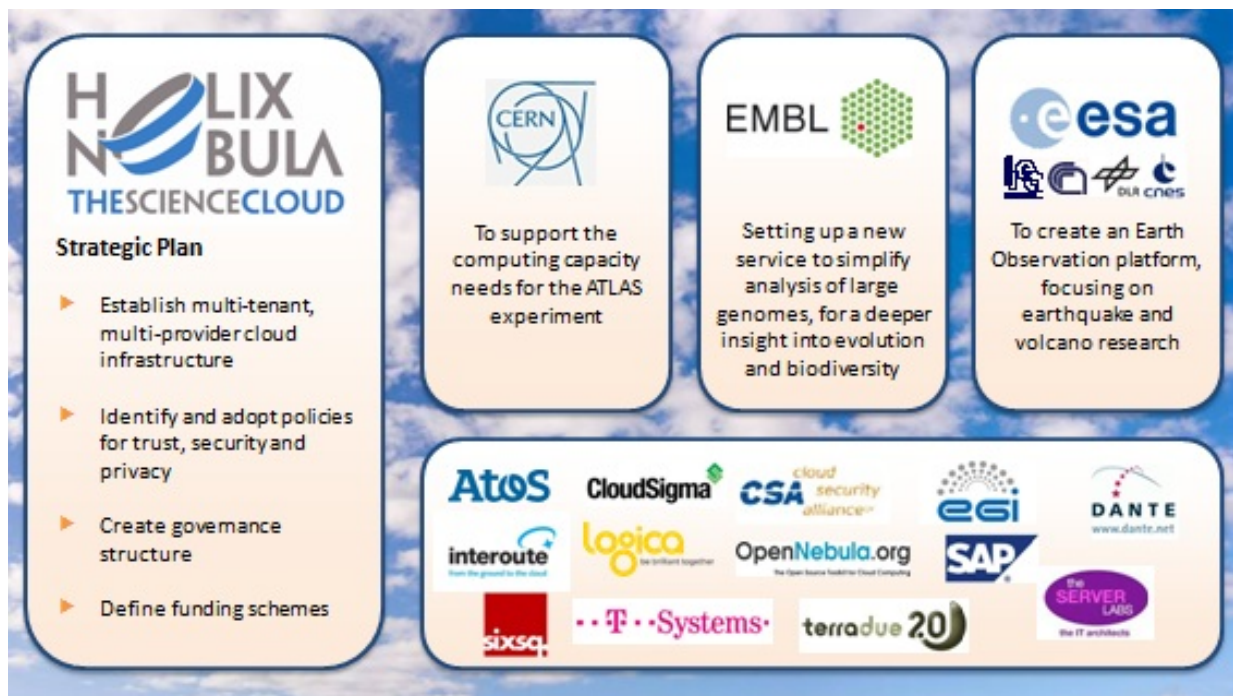


*Figure 6 The Helix Nebula pre-analysis phase*

The first step in the pre-analysis phase is to **understand the service vision** (cf. figure 6). Under the name “HELIX NEBULA – the Science Cloud” this project is a preliminary step towards a European cloud-based scientific e-infrastructure. The initial BM called “Generic Cloud Computing for European Science” (cf. figure 7) is the proof of concept on a long way to a worldwide wholesale cloud computing provider. The three flagship use cases to support the computing capacity needs for the European Organization for Nuclear Research (CERN)’s ATLAS experiment, to simplify the European Molecular Biology Laboratory (EMBL)’s



analysis of large genomes, and to trigger the European Space Agency (ESA)'s earth observation will be used to enable a cost-benefit analysis in the next deliverable 7.3. Thus, the BM is based on the needs of European big-science and brings together leading IaaS providers and the three research centres CERN, EMBL, and ESA in order to provide data storage and processing that elastically meet big science's growing demand for computing power. Yet, the final aim is a "Worldwide All-In-One Enterprise Cloud"-BM that offers a unique resource to governments, businesses and citizens. In order to establish a realistic roadmap from the initial BM to the ultimate "Worldwide All-In-One Enterprise Cloud" SAP's BMI approach is used to synthesise and analyse BM that pave the way to our common aim.



*Figure 7 Helix Nebula's initial BM named "Generic Cloud Computing for European Science"*

The **clarified outcomes** of this BMI process are the following tasks of deliverable 7.2.

- Multiple potential overall business models for the flagship cases ESA, CERN, and ESA including the possibility of an explicit broker role
- A qualitative framework incorporating abstract costs, margins and risk assessment criteria for the evaluation of each BM

In addition, based on these first two outcomes, deliverable 7.2 also includes the following two tasks which are addressed in chapter five.

- Gap analysis of existing procurement and budgeting processes
- A set of recommended changes and adaptations for collaborative procurement and accounting procedures

Determined **design considerations** were defined in cooperation with representatives of the supplier side. Potential BMs are categorized into initial and future BMs. *Initial BMs* can be realized soon. They had to be created systematically and incrementally with a current HN perspective. Yet, HN's vision also aims for the inclusion of other stakeholders' needs (governments, businesses and citizens) as addressed in *future BMs* which required effort to think outside the box. Therefore, disruptive, imaginative approaches with a global perspective were used.

In order to determine **constraints** we chose to ask the three flagship customers CERN, EMBL and ESA for further constraints on HN besides well-known requirements such as flexibility, transparency, on demand resources etc. In a survey conducted we asked for must-haves and deal breakers, e.g. certain functionalities. We clustered the answers to four categories.

- **Cost:**
  - No customer lock-in: high switching cost & long term contracts with suppliers turning uncompetitive have to be avoided
  - Comparability to legacy cost: cost using HN must be equivalent to in-house resources
- **Legal:**
  - Scientific data processing: framework procurement with acceptable terms and conditions
  - Administrative workloads: higher service level agreements (SLA) and recognition of the diplomatic status of CERN as an inter-governmental organization. EMBL does not have a 'diplomatic status' but has the status of an intergovernmental organization with certain privileges and immunities (such as immunity from jurisdiction and execution, and exemption from taxation and customs duties). It is crucially important that EMBL's status as an intergovernmental organization as well as its privileges and immunities are ensured. ESA needs to be seen as an inter-governmental organization which implicates no VAT payments and a special extraterritorial status. Yet, ESA does not have a 'diplomatic status'.
- **Simplicity:**
  - Easy invoicing: preferable via one step reducing procurement overhead
  - Easy service catalogue: memory, core, data access must match data volumes
  - Easy account set up for users: Marketplace without "big" bureaucracy for newcomers
- **Transparency:** Dashboard showing real-time cost and utilization statistics

In the pre-analysis phase possible **methods** that are helping in generating BM ideas are identified. At that point in time when the strategy workshops were conducted there was a toolset of six methods. The question which one was to be used and why it was used will be answered in the beginning of the design phase section. But at first, information about the project and its environment has to be gathered in the analysis phase (cf. figure 8).

## 3.2 The Analysis Phase



**Figure 8** The Helix Nebula analysis phase

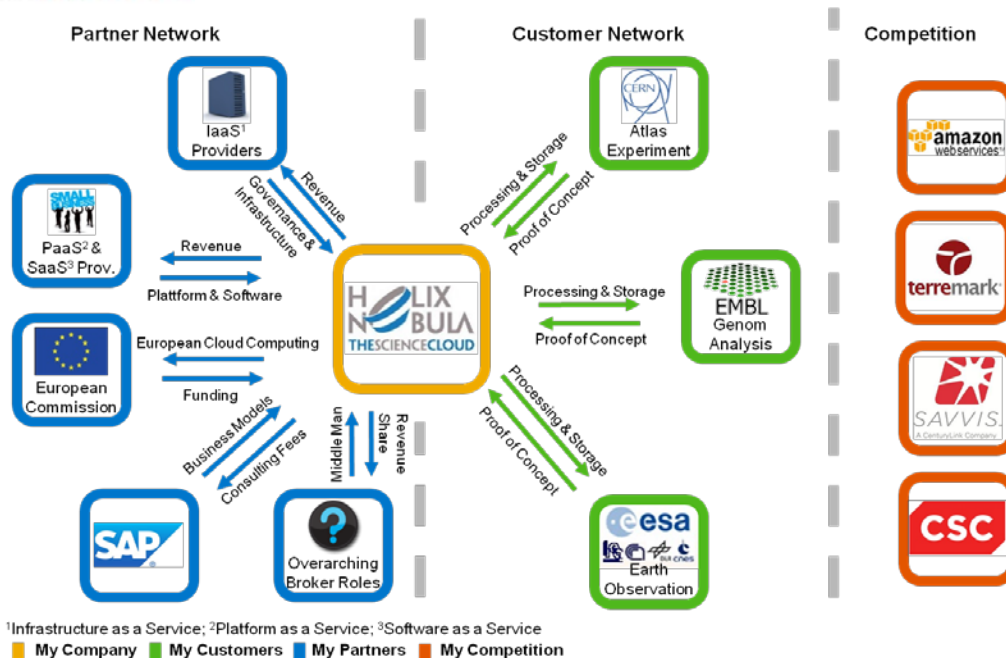
The **triggers** are internal and external factors that motivate a company to innovate their business model such as a new emerging demand at the market. In the context of HN we also took the customers' motivation to participate in HN into account. This is, amongst others, used in the evaluation phase in order to validate that opportunities were exploited and threats weakened.

The motivation for the provider side to enter the market of big science can easily be found by looking at computational and data-driven sciences in general in a first step. Therefore, we cite an excerpt from the 4<sup>th</sup> Workshop on Scientific Cloud Computing 2013. "Computational and data-driven sciences have become the third and fourth pillar of scientific discovery in addition to experimental and theoretical sciences. Scientific computing has already begun to change how science is done, enabling scientific breakthroughs through new kinds of experiments that would have been impossible only a decade ago. Today's "Big Data" science is generating datasets that are increasing exponentially in both complexity and volume, making their analysis, archival, and sharing one of the grand challenges of the 21<sup>st</sup> century. The support for data intensive computing is critical to advance modern science as storage systems have exposed a widening gap between their capacity and their bandwidth by more than 10-fold over the last decade. There is a growing need for advanced techniques to manipulate, visualize and interpret large datasets. Scientific computing is the key to solving grand challenges in many domains and providing breakthroughs in new knowledge, and it comes in many shapes and forms: high-performance computing (HPC) which is heavily focused on compute-intensive applications; high-throughput computing (HTC) which focuses on using many computing resources over long periods of time to accomplish its computational tasks; many-task computing (MTC) which aims to bridge the gap between HPC and HTC by focusing on using many resources over short periods of time; and data-intensive computing which is heavily focused on data distribution, data-parallel

execution, and harnessing data locality by scheduling of computations close to the data” (4<sup>th</sup> Workshop on Scientific Cloud Computing 2013).

In a second step we asked the three flagship customers EMBL, ESA, and CERN for their motivation to participate in HN. The answers are clustered as follows.

- **Internal opportunity:**
  - CERN’s Large Hadron Collider (LHC) restart in 2015: more flexible data and more IT resource consumption is required
  - Core business concentration: less IT and data management consideration
  - Cost savings and better data exploitation: recognition and support from their Member States and the EU
- **External opportunities:**
  - New storage and processor technologies: more bytes/flops per euro & more energy efficiency
  - Sustainable business models: “open & free” research data will finally be exploited by and accessible to a wider public
  - Identification of missing research instrumentation: higher quality of research questions and therefore advance in science and business
  - Fostering a cross-domain science approach to solve more complex questions e.g. in climate change, health care or biotechnology
  - “Big picture” point of view: more synergy could be exploited
- **Internal threats:** Flat IT budgets for the foreseeable future & fixed power envelope
- **External threats:**
  - Current ecosystems don’t provide standing contracts and new competences
  - Spiralling software licensing costs



**Figure 9** The current HN business model named “Generic Cloud Computing for European Science”  
(Network View)

The **current business model of HN** was established in a strategy workshop with the representatives of infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), and network as a service (NaaS) providers. Named “Generic Cloud Computing for European Science”, it is the proof of concept on a long way to a worldwide wholesale cloud computing provider. It is based on the needs of European big-science and brings together leading IaaS providers and the three research centres CERN, EMBL, and ESA in order to provide data capture, processing, analysis and archiving that elastically meet big science’s growing demand for computing power. Its description follows using SAP’s network and enterprise view (cf. figures 9 and 10).



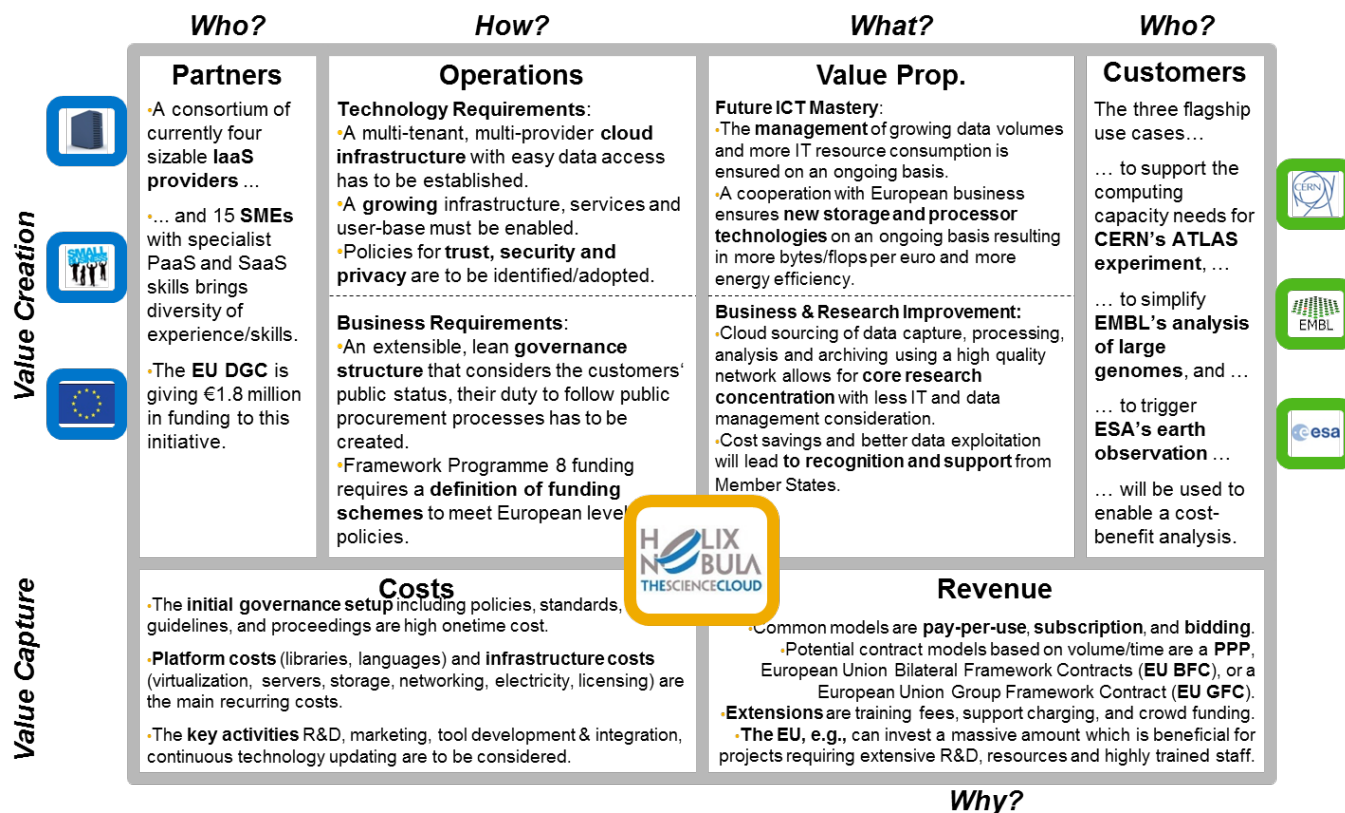


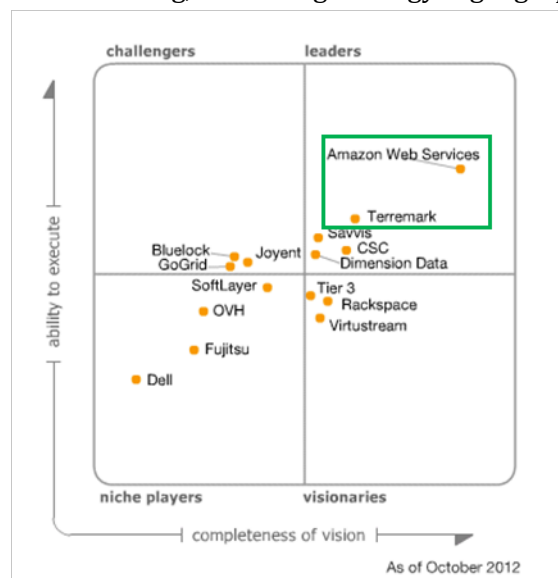
Figure 10 The current HN business model named "Generic Cloud Computing for European Science" (Enterprise View)

The **customer needs** are a further source for improvements. Thus, we asked them in a survey to list further jobs they have to do besides well-known jobs such as data processing and storing, that HN could simplify. Our clustered summary follows.

- **Community building:**
  - "Dropbox"-style service for file/data transfer between research laboratories
  - Indico service hosting (free software tool that allows you to manage complex conferences, workshops and meetings)
  - Users shall have no other wish than going on HN
- **Scientific workloads:**
  - LHC simulation & analysis, Hadoop as a Service & ROOT (framework for data processing and analysis), MS Office 365, Matlab Service
  - Processing of products (including new suppliers) should avoid ordering, delaying access to the data, but rather enable easy data access.
- **Administrative workloads:** Oracle based service for support of electronic document handling system.

The next step was the **investigation of competitive business models**. There are a variety of cloud resources available in both academic and commercial space. In our further research we concentrate on commercial suppliers since HN is supposed to be only initially based on the needs of European big-science. The three flagship use cases will be utilised to validate the approach and to enable a cost-benefit analysis. The HN vision is more extensive since it defines the aim of ultimately paving "... the way for a Cloud Computing platform that offers a unique resource to governments, businesses and citizens" (["Helix Nebula Vision" 2013](#)). This wider customer distribution puts HN into direct competition with established commercial cloud computing suppliers. Further, major players in the cloud computing market could represent potential new entrants in the market of big science, if it proves to be profitable.

Following Gartner's "Magic Quadrant for Public Cloud Infrastructure as a Service" ([Leong et al. at Gartner 2012](#)) (cf. figure 11) as of October 2012 **AWS** and **Terremark Infrastructure & Cloud Services** are the undisputed market leaders in Public Cloud IaaS with the highest ability to execute (including criteria like product & service quality, operations & sales execution/pricing) and the highest completeness of vision (including criteria like market understanding, marketing strategy & geographic strategy).



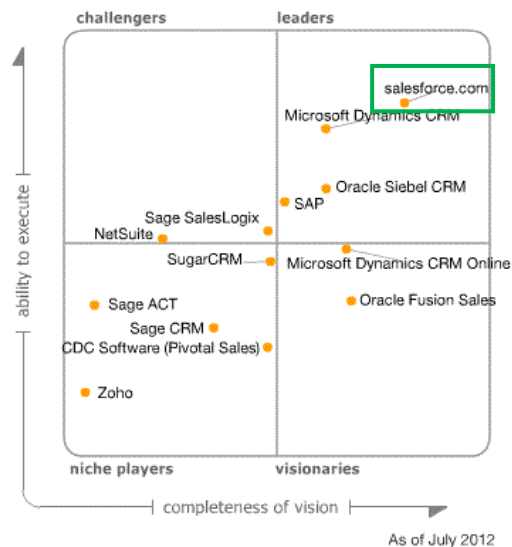
**Figure 11** Magic Quadrant for Public Cloud Infrastructure as a Service ([Leong et al. at Gartner 2012](#))

International Data Corporation (IDC) compared "Worldwide Public Platform as a Service 2011 Vendor Shares" ([Hendrick et al. at IDC 2011](#)) (cf. figure 12) including market shares of 2011 and growth rates from 2010 to 2011. As the market shares of Salesforce.com and AWS were similar to GXS, but their growth rates were by far higher, we interpret them to be market leaders in PaaS today.

TABLE 4						
Worldwide Public Platform-as-a-Service Revenue by Vendor, 2008–2011 (\$M)						
	2008	2009	2010	2011	2011 Share (%)	2010–2011 Growth (%)
GXS	403.5	379.0	332.4	363.7	14.2	9.4
Salesforce.com	78.8	159.3	233.4	319.8	12.5	37.0
Amazon.com Inc.	19.4	61.4	113.2	263.9	10.3	133.1

**Figure 12** Worldwide Public Platform as a Service 2011 Vendor Shares (*Hendrick et al.* at IDC 2011)

Salesforce.com is not only a successful PaaS-vendor, but also the leader in its niche of Sales Force Automation as a Service. This can be insightful, since HN also plans to address a niche of the cloud computing market. Salesforce will be used as a leading example of SaaS, which can be deduced from Gartner’s “Magic Quadrant for Sales Force Automation” (*Desisto* at Gartner 2012) (cf. figure 13).



**Figure 13** Magic Quadrant for Sales Force Automation (*Desisto* at Gartner 2012)

These three sources are the reason why we focus on AWS, Terremark Infrastructure & Cloud Services and Salesforce.com. We investigated AWS’s business model in chapter 2.3 (cf. figure 3 & figure 4). The detailed versions of Terremark’s and Salesforce.com’s business models can be found in the appendix (cf. appendix figure 1-4). The more interesting question is what we can learn from the investigation of their business models in terms of strengths and weaknesses. In the following, we outline the characteristic and essential key strength and weakness of each competitor by citing key sentences from Gartner’s “Magic Quadrant for Sales Force Automation” and Gartner’s “Magic Quadrant for Public Cloud Infrastructure as a Service”. As Gartner’s research on cloud computing competitors is very in-depth, we highly recommend those two sources for deeper insights.



“**AWS** is a cloud-focused service provider with a very pure vision of highly automated, cost-effective IT capabilities, bought without any need to commit to a contract. (...) [In its position as a] (...) market share leader, and a thought leader, it is extraordinarily innovative, exceptionally agile and very responsive to the market. It has the richest IaaS product portfolio, and is constantly expanding its service offerings and reducing its prices. (...) [Yet, it remains] (...) a best-effort cloud. Its weak, narrowly defined SLA requires that the customer runs workloads in at least two AZs within a region; a violation requires that connectivity to both AZs be unavailable. The SLA does not include Elastic Block Store (known as EBS), which most customers use for persistent storage. However, unlike most other providers, AWS does not have any SLA exclusions for maintenance windows, and it offers continuous availability on its portal and API” (Leong et al. at Gartner 2012).

“**Terremark**, a Verizon company, encompasses Verizon's data center, cloud and security businesses. (...) Terremark, via the standard Enterprise Cloud service, is the market share leader in VMware-virtualized cloud IaaS. It has the longest track record in the market for enterprise-class public cloud IaaS, and among the best feature sets. (...) Until Terremark launches its new unified platform, customers must be careful to match the service they choose to their particular use case. Customers should also be aware that while Terremark is continuing to enhance existing offerings, its engineering focus has shifted to the new platform” (Leong et al. at Gartner 2012).

“**Salesforce.com** continues to lead the SFA market, as demonstrated by its business growth and innovation; however, it remains expensive. (...) Salesforce.com continues to push innovation by increasing the breadth and capabilities available for social media technology, Chatter and mobile offerings, such as the iPad. (...) [But] the vendor provides [only] a basic Master Services Agreement; however, it continues to lag in its ability to provide a strong SLA, including penalties with its customers” (Desisto at Gartner 2012).

The information just given is reflected in the analysis of the competitor's BMs (cf. appendix figure 1-4).

The **environment analysis** for Helix Nebula bases on cloud computing market trends of 2013. There is a very distinct, inconclusive discussion going on about how cloud computing will develop. Therefore, we decided to abide by the most reliable sources on the market which are those of commercial providers. We consider five quantitative (left side) and five qualitative trends (right side) to be relevant for business model development in cloud computing (cf. figure 14). To briefly outline the trends, the cloud market has evolved rapidly over the past few years and platform, integration, and specialization remain crucial to expansion.



**Sources:**

<sup>1</sup>IDC – ‘Predictions 2013: Competing on the 3<sup>rd</sup> platform’ – Doc # 238044 – Nov 2012

<sup>2</sup>Gartner – ‘Market Trends: Platform as a Service, Worldwide, 2012 – 2016, 2h12 Update’ Oct 2012

<sup>3</sup>Gartner – ‘Emerging Technology Analysis: How Consumer Device Technologies Can Support Cloud Adoption’ – Mar 2012

<sup>4</sup>Gartner – ‘Forecast: Public Cloud Services, Worldwide, 2010 – 2016, 3Q 12 Update’ – Sep 2012

<sup>5</sup>IDC – ‘Insights Predictions 2013: The CIO Agenda’ – Doc # 238464 – Dec 2012

<sup>6</sup>Ovum – ‘2013 Trends to watch: Cloud Services’ – Oct 2012

<sup>7</sup>Gartner – ‘Top 10 Strategic Technology Trends for 2013’ – Oct 2012

**Figure 14** Qualitative (left column) and Quantitative (right column) Cloud Computing Market Trends 2013

- “As the cloud market matures, niche vendors continue to be consolidated; it is expected that SaaS acquisitions would exceed \$25 billion over the next 20 months, a 50% increase from the past 20 months” ([Narayanan](#) at SAP 2012 based on [Gens et al.](#) at IDC 2012). Since the ecosystem of HN is supposed to grow, we recommend finding and binding new partners fast potentially in a time frame of one year.
- “As hybrid deployments and heterogeneous landscapes proliferate, integration will continue to dominate the cloud discussions. Analysts predict that the integration services market [Integration Platform as a Service (iPaaS)] will grow nearly 35% in 2013” ([Narayanan](#) at SAP 2012 based on [Biscotti et al.](#) at Gartner 2012). Therefore, it is of special interest to find partners that have the capabilities to offer iPaaS and thereby enrich the ecosystem. Especially a marketplace as Helix Nebula requires integration either of various software offers or of customers’ various hybrid systems.
- “Industry-specific PaaS offerings will continue to emerge in 2013. (...) It is interesting to note that these offerings are built by industry-specific players rather than IT vendors. It is expected that the “generic” (horizontal) PaaS market will become commoditized” ([Narayanan](#) at SAP 2012 based on [Gens et al.](#) at IDC 2012). With HN’s concentration on science, this risk is lowered.

- “Cloud is also making its way into IT organizations within the enterprises. CIOs’ adoption of a ‘cloud first’ strategy will double to 70% by 2016 as CIOs define architecture standards and service management processes. Skill gaps will be a critical issue in enabling this transformation. As PaaS gains popularity, it will be embraced as the next generation platform by CIOs. IT organizations will play a key role in providing cloud brokerage services in the future months” (Narayanan at SAP 2012 based on McNally et al. at IDC 2012). HN’s BMs encompass a number of diverse business and technology broker roles to (a) manage the HN partner network more effectively as bilateral communications would cause higher risks and costs as well as to (b) provide better service quality. Thus, the above explained trend is met strategically by the consortium. A Forrester Consulting paper commissioned by Cordys B.V. examined the impact of cloud brokers (“[Cloud Brokers Will Reshape The Cloud](#)” 2012). Its lecture reveals the potential of HN as all three key findings are either accomplished or advantageous within HN.
  - HN is started in a time in which cloud brokers are still evolving. This allows (a) ensuring market shares in a growing market as well as (b) setting trends and standards in BMs as they continue to change based on new technology and a growing user base.
  - The BM of cloud brokers is more competitive than classic cloud providers as new value is provided to both SMBs and large enterprises. “The SMBs focus more on SaaS applications, while enterprises look more for a broker service around dynamic provisioning of infrastructure services” (“[Cloud Brokers Will Reshape The Cloud](#)” 2012). HN satisfies these needs as both SaaS and IaaS diversity is ensured.
  - HN also meets the adoption factor of integrating technical broker components. Diverse technology broker roles ensure service app stores, workload management, and elasticity management.
- “Mid-market companies will also leverage more cloud services in 2013. Service providers are expected to play a major role in providing specific, targeted solutions to midmarket companies. Private cloud engagements in particular will gain traction among SMBs in the U.S. – more than 25% of midmarket firms will leverage this in 2013” (Narayanan at SAP 2012 based on Escherich et al. at Gartner 2012). This trend is considered in HN’s future BM “Worldwide All-In-One Enterprise Cloud” as described in chapter 4.
- “Cloud security will be another significant growth pillar. While North America will continue to have the largest revenue share, analysts predict emerging markets and Eastern Europe to have the fastest growth” (Narayanan at SAP 2012 based on Anderson et al. at Gartner 2012). As cloud security is still one of the most important adoption obstacles, we recommend including security services in HN.

The **synthesis** of these input factors teaches us the lesson that generic cloud computing services will be more and more commoditized. In a commoditized market „... all suppliers offer identical products or services, which can be easily substituted for each other, competing primarily on price” (Barton 2006). AWS’s cost driven business model with a low price value proposition based on economies of scale and IDC’s prediction of price decline of generic PaaS explain that. Yet, this pricing pressure and commoditization of

cloud services deemphasizes enterprise requirements such as guaranteed levels of performance, uptime, and vendor responsiveness (Durkee 2010). Terremark Infrastructure & Cloud Services has successfully realized the undersupply of enterprise needs. It has a value driven BM that focuses on premium value creation of enterprise cloud offerings. Thus, industry-specific and customer-specific offerings might be a chance to establish a cloud computing vendor. Looking on the project triggers, there is a growing need for advanced techniques to manipulate, visualize and interpret large datasets. Thus, in the initial phase such differentiators could be tailored HPC, HTC, MTC, and data-intensive computing services for the customer group of European research.

In another strategy workshop with the supply side including amongst others T-Systems, Atos, and EGI the analysis and its synthesis was used to derive the **problems, objectives and challenges** for the initial HN phase. This step is crucial for the synthesis and evaluation of sustainable BMs in the upcoming design phase. Following, the result of that exercise is briefly summarized.

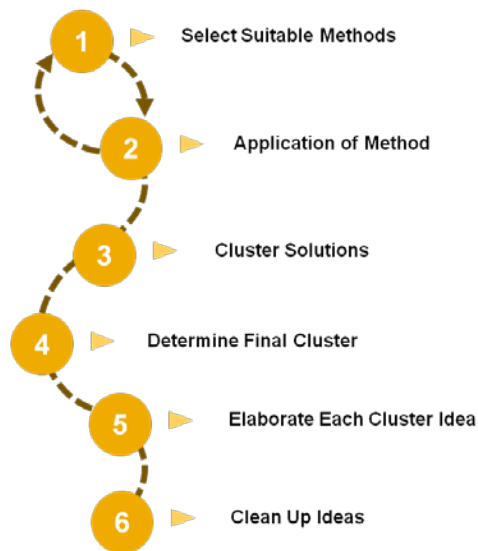
1. **Antitrust guidelines:** The cooperation of many suppliers brings along the risk of being ranked as a cartel by competition authorities.
2. **Data storage, management, and exploitation:** CERN's mass-storage systems, for example, are hanging onto 100 quadrillion bytes of data to analyse, most of which was acquired over the past year. That amount of data is equivalent to about 700 years' worth of HD-quality movies (Boyle 2013). Necessary staff qualifications like e.g. data mining knowledge and technologies have to be ensured by the suppliers.
3. **European Grid Infrastructure (EGI) interoperation:** A way to interoperate EGI's resources has to be found.
4. **The "long tail" of science:** Customer segments and services for the "long tail" of science need to be developed for the BMs.
5. **Information to be published:** If context enriched data is sold, a security process will be required to ensure reliability of potential purchasers.
6. **Customer segments to be addressed:** As the synthesis shows, customization is to be preferred to generic services. Therefore, customer segments and appropriate versions must be defined.
7. **Definition of the service portfolio:** An unambiguous definition of the IaaS, PaaS and SaaS offerings is necessary and further services like integration, support, and consulting are to be considered.
8. **Supply side expansion:** A defined core team of suppliers establishes HN. Yet, a governance structure to incorporate further suppliers needs to be found. This brings opportunities of new revenue streams. In a next step, data context enrichment and supply side expansion might turn more lucrative and enrich the service portfolio, if non-European partners like the NASA or the GNU operating system will be admitted. Both for European and Non-European partners (in case of consortium approval), models for their incorporation are required.
9. **Limits of liability:** The co-operation of many suppliers brings along the necessity of liability. Yet, release clauses for risk reduction are to be considered.

10. **Revenue model of a “broker” with many partners:** A role in each BM has to be defined and staffed to bear billing risks and ensure payments operations out of one hand. Further, a revenue split has to be managed.
11. **Definition of HN’s juridical status:** It is still unclear which status HN is supposed to have. Options are a separate legal entity, a joint venture or simply a brand with a logo.
12. **Public-private partnership (PPP) as revenue model:** A business relationship between a private-sector company and a government agency for the purpose of completing a project that will serve the public is a serious option. Financing a project through a PPP can allow a project to be completed sooner or to make it a possibility in the first place.
13. **BM awakening factors:** As motivational factors (in terms of network effects) ideas like easy entry (freemium), usability, consulting services, low costs, “gamification” should be elaborated separately. The effect of the factors on costs, risks and effects on the network is crucial. We recommend realizing the sandbox idea from the supply side and easing the entry for customers by free usage of it. In case the customers decide for a migration to the HN cloud, they move to a more premium solution than the sandbox and, thus, need to pay.

The analysis phase with its synthesis and objectives allows the proceeding to the central design phase with the aim to generate BM ideas whilst taking into account the derived problems, objectives and challenges (cf. figure 15). Findings by McKinsey & Company explain and summarize the problems we identified in the analysis phase well. The fundamental problem for the design phase is to both “see with a microscope and a telescope” ([Barton et al. 2012](#)). On the one hand, the microscope view scrutinizes **problems, objectives and challenges** of the moment at intense magnification. The most critical current success factors are the revenue split between the HN partners and the limits of liability. Going live most intensively depends on the solution of these challenges. On the other hand, the telescope view considers **opportunities** far into the future. In our opinion, the most promising future trend for HN – as explained in the environment analysis – is the provisioning of cloud broker services by cloud computing partner networks (“[Cloud Brokers Will Reshape The Cloud](#)” 2012).



### 3.3 The Design Phase

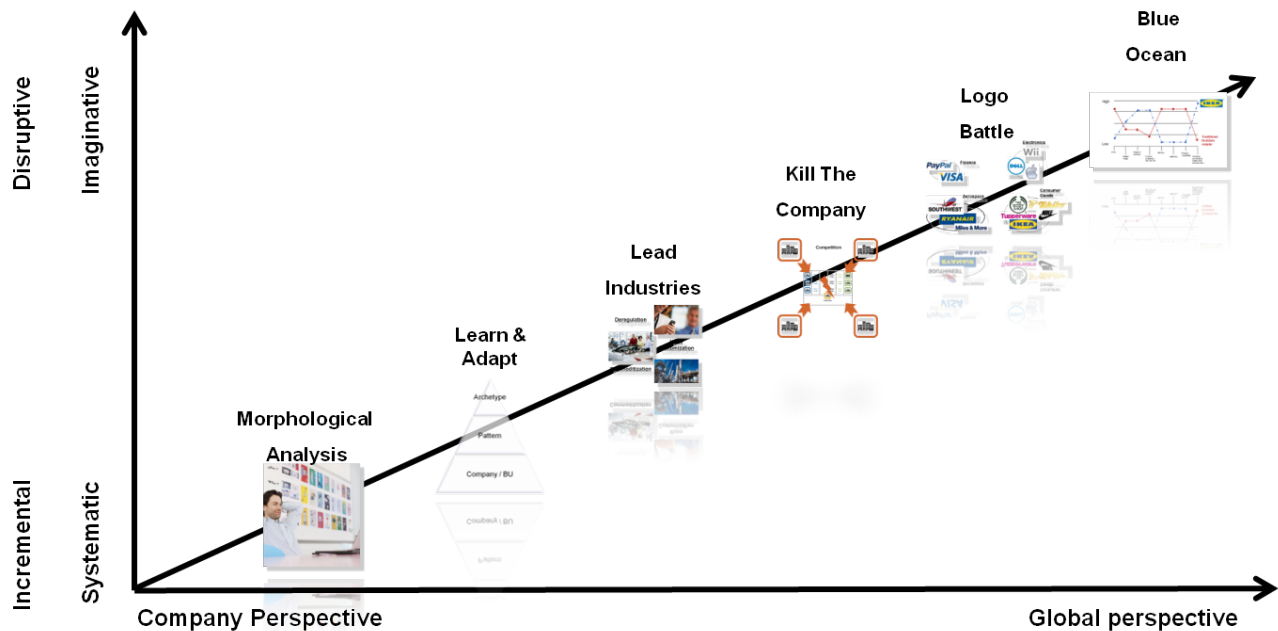


*Figure 15 The Helix Nebula design phase*

The BMI uses **methods to generate ideas** that depend on two dimensions (cf. figure 16).

- **Degree of innovation:** incremental/systematic vs. disruptive/imaginative
- **Point of view:** company perspective vs. global perspective

The methods go beyond classical brainstorming, which is like shooting in the dark. Instead, our method-set is output-aware and boosts the HN project team's creativity.



*Figure 16 Identification of Appropriate BMI Methods*

In the pre-analysis phase design considerations were defined in cooperation with representatives of the supplier side. These considerations are necessary for the **selection of suitable methods**. In order to ensure that we can provide Business Models that can be implemented in an early phase of Helix Nebula we utilized methods on the incremental side. Further, to also allow Helix Nebula to evolve into an innovative big player in the market according to its vision we also conducted methods that lead to rather innovative and disruptive BMs.

Based on this we categorized potential BMs into initial and future BMs. *Initial BMs* can be realized soon. They should be created systematically and incrementally with a HN perspective. Therefore, the “Morphological Analysis” and “Learn & Adapt” were chosen.

Yet, HN’s vision to also allow the inclusion of other stakeholders’ needs (governments, businesses and citizens) in *future BMs* requires efforts to think outside the box. Therefore, “Kill The Company” (Bodel 2012) and “Logo Battle” as disruptive, imaginative approaches with a global perspective were used.

During the “Morphological Analysis” each element of the business model is reconsidered separately whilst taking into account the derived problems, objectives and challenges:

- How? (Operations)
- What? (Value Proposition)
- Who? (Customers, Partners)
- Why? (Financials)

For this, attributes are systematically altered in order to find new value generating modifications. A split up into more fine-granular elements is possible.

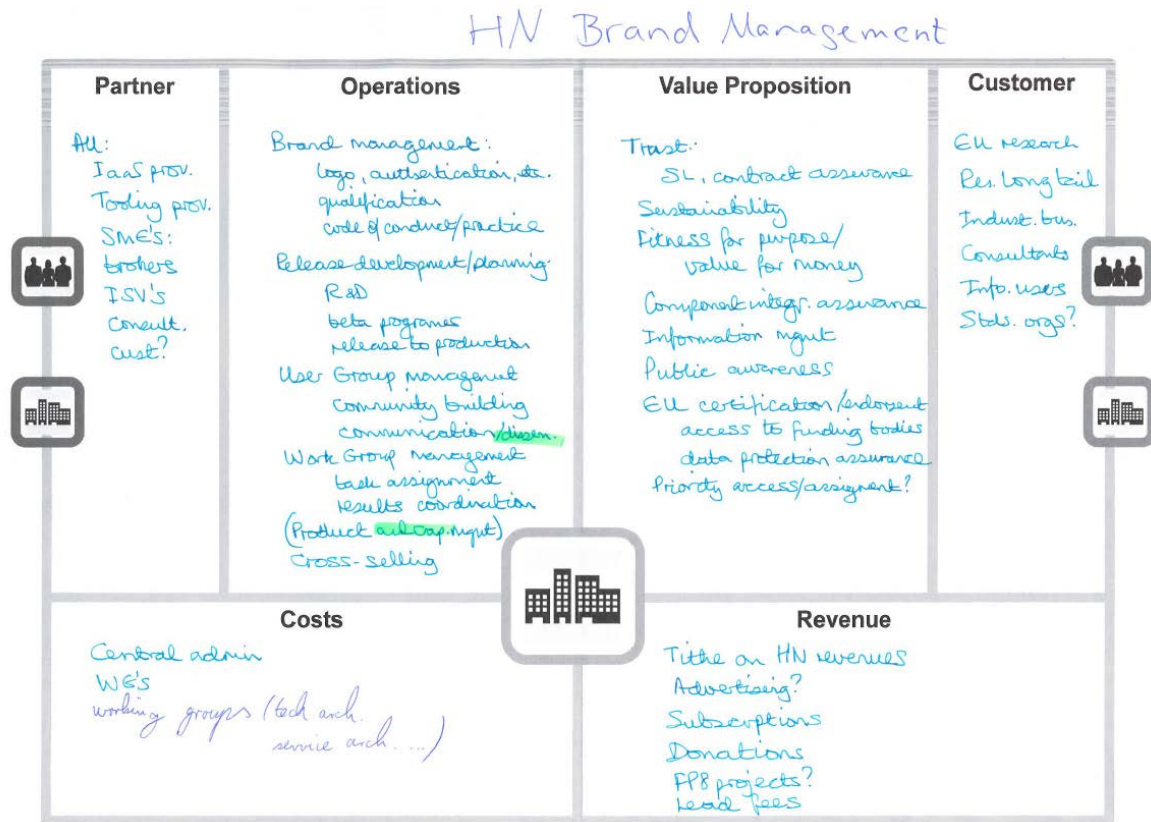
“Learn & Adapt” ensures the reutilisation of existing BMs (cf. chapter 2.4) to generate more ideas for each element (value proposition etc.) or to further elaborate ideas of the “Morphological Analysis”. To ease this process, the University of St. Gallen has condensed 55 successful BM patterns into a handy set of pattern cards (Gassmann et al. 2013). Each pattern card contains the essential information that is needed to understand the logic and concept behind the pattern. Concrete successful examples illustrate possible implementations of the business model pattern. Several years of executive education and BM projects have shown that ideation can be accelerated and directed a lot. Depending on the concrete issues one tries to understand what others did to address them.

“Kill the Company” (Bodel 2012) was developed to facilitate an outside-in view and to break down an innovation adverse culture. Imagine you are your own competitor with unlimited resources and you want to kill your company. What would you do? What would be most important?

For BMI it can be used to understand your major competitive weaknesses and to create ideas that address these best.

The “Logo Battle” method uses innovative, well-known company examples to trigger associations with a certain business model and hence, inspire new aspects for the elements. Appendix figure 5 gives an impression of an exemplary “Logo Battle” instantiation.

The methods were **applied** in two BMI workshops in Zurich in April and May 2013 (cf. appendix figure 6). The work took place in diverse teams with supplier representatives to develop a broad range of solutions and bring in different perspectives and ideas. After each method many similar ideas were developed. Thus, they were **clustered** to basic core ideas (cf. appendix figure 7), before starting with the next method. After the last method final solutions were developed by further **elaborating** the clusters to establish the major idea and impact of this solution. Then the clusters were **cleaned up** by ensuring consistency and completeness (cf. figure 17). In the design phase the focus is on generating ideas without judging the ideas of others, in order to give room to innovative ideas that might not seem viable in the moment. They could still turn out to be the most profitable and promising ones, which would make their implementation worthwhile. The ideas will be ranked and evaluated in a later phase, which will give insights into their potential impact and the effort to implement them. At this stage, each BM idea has to answer the four key questions and provide a clear picture in terms of the surrounding business network.

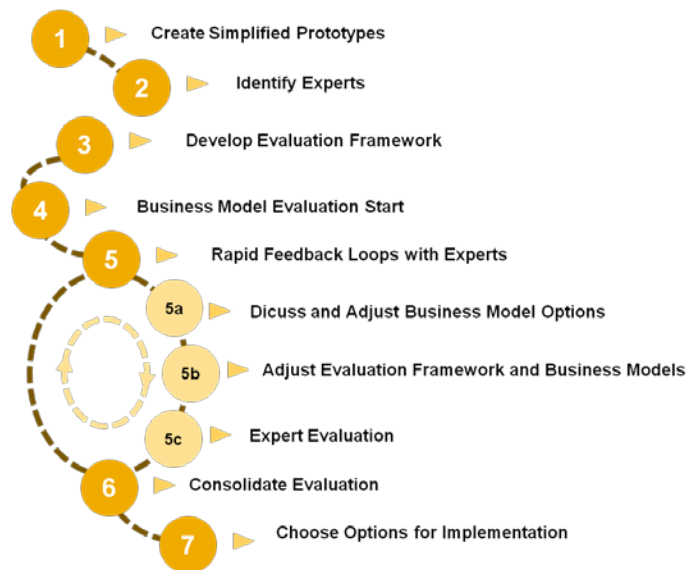


**Figure 17** The Cleaned-up Business Model Idea "Helix Nebula Brand & Franchising" as an Example

Eventually seven ideas were clustered, elaborated and cleaned up. They were condensed in SAP's canvas as figure 17 shows. To see the complete results of these methods we refer to chapter four. With the collection of BM ideas the validation phase can be started. It has the aim to provide the necessary information to finally choose options for implementation (cf. figure 18).



### 3.4 The Validation Phase

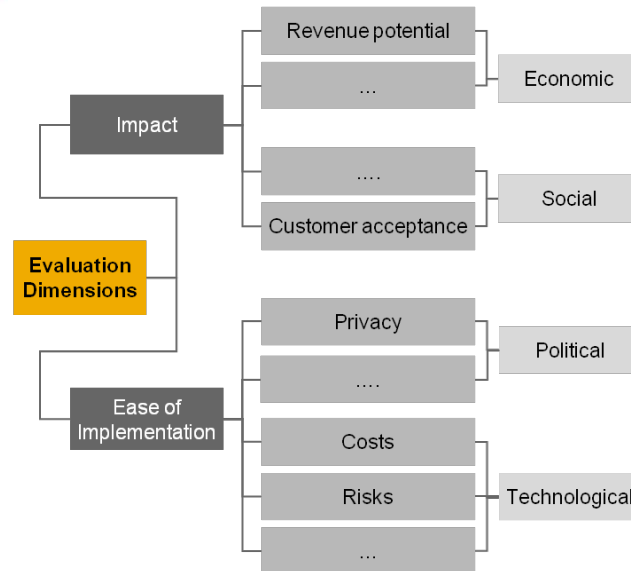


*Figure 18 The Helix Nebula validation phase*

The key element of this phase is the evaluation of the BM ideas by experts. But at first, these ideas needed to be extended to **prototypes** in further research work conducted by SAP. Our final prototype results are collected in a presentation containing eight potential BMs. Appendix figure 8 delivers an impression of what these prototypes look like. The finalized and evaluated versions of these prototypes will be presented in chapter four.

For the **identification of experts** each supplier was given the chance to nominate their cloud computing expert with business knowledge. With the requirement of the expert not working on Helix Nebula, we tried to ensure to get unbiased minds, not influenced by the projects history. Finally, experts from EGI, Cloud Sigma, Interoute, Dante, ATOS, and Sixsq participated. Further SAP chose six relevant external experts working at SAP.

We developed an **evaluation framework** that bases on two dimensions. The “impact” of the BM option on the market is described from the customers’ point of view, whereas the “ease of implementation” is seen from the suppliers’ point of view.



**Figure 19** The categorization of potential evaluation criteria

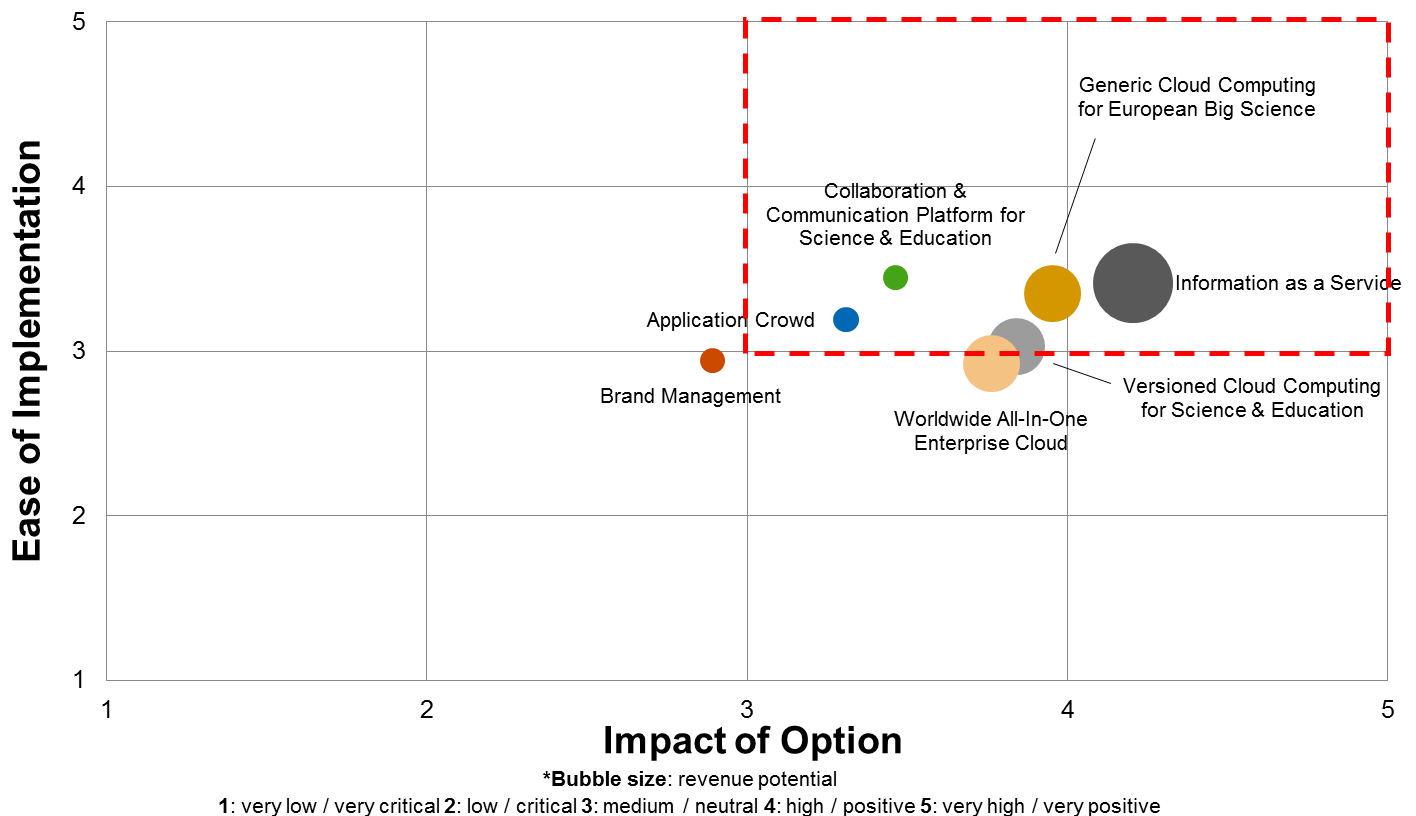
The approach allows combining qualitative and quantitative criteria in one framework (cf. figure 19). The criteria including financial aspects and risks were defined specifically for the project in collaboration with the HN suppliers. Further, for each criterion a weighting according to its importance was assigned. These weightings as well as the BM options were adjusted during the expert evaluations according to the experts' opinions. Each of the twelve experts evaluated each criterion for each BM on a scale with five options from "very low" resp. "very critical" to "very high" resp. "very positive". This methodology results in a score for each dimension and BM in the interval [1;5] with one as worst and five as best. The detailed evaluation framework and its methodology can be studied in the appendix (cf. appendix figure 9 & 10).

Having this framework, the **start of the BM evaluation** was possible. Therefore, one hour telephone meetings with the experts were set up. During the interviews the simplified BM prototypes were used to convey SAP's ideas (cf. appendix figure 8). We used a semi-structured interview approach to collect feedback and to discuss possible adjustments of the BM options. Improvements of the evaluation framework concerning criteria and weightings were also considered. For example, the former BM option „Blue Box Services for European Science“ is no longer seen as a BM, since experts graded it to be a "must-have". It will rather be a role that has to be fulfilled in each business model option. The reason for this step was persistent negative feedback by the experts. More details follow in chapter four. One **feedback loop** in step five of the validation phase was one expert interview.

In order to **consolidate** the single expert feedback we computed the expert scores' average for each BM concerning both dimensions (cf. appendix figure 11 & 12). The collection of these values allows a mapping onto a graph based on the two dimensions (cf. figure 20).

SAP's BMI also includes an "Implementation Planning Phase" and an "Implementation Phase". They remain unspecified since an implementation is not in the scope of this deliverable.

The analysis, design and validation phases generated reviewed BMs. They will be presented in detail in the following chapter. Therefore, a set of criteria to explain the BMs will be introduced. E.g., the BMs value creation and value capture (cf. figure 2) will be explained, as well as how the BMs meet derived challenges. Finally, the experts' opinion on the BMs will be processed, which resulted in figure 20. Further, overarching broker roles will be analysed and the BMs will be classified into *initial* and *future* BMs.



**Figure 20** The Business Model Portfolio of Helix Nebula

## 4 Business Model Options

In this chapter, the BMs that SAP's integrated BMI process synthesized will be presented. The description of each BM follows a consistent structure that systematically takes defined description criteria into account. The structure with all criteria is explained in the following chapter 4.1. After explaining this description foundation, we will introduce overarching broker roles that are required in each BM. E.g., the "Blue Box" as defined in deliverable 4.5 is a part of the overarching broker roles. Eventually, the evaluated initial and future BMs are explained.

### 4.1 Business Model Description Criteria

In this chapter we explain the catalogue of criteria that are relevant for the description of the HN BMs. The following four criteria constitute the first category that explains BM's functioning and its properties.

1. **Specifics:** In order to delimit a BM from others, we will explain in what way the basic BM is changed and/or extended in comparison to the initial BM "Generic Cloud Computing for European Science". Within the specifics the BMs' enterprise views are presented. For the first BM "Generic Cloud Computing for European Science" we show a network view and an enterprise view. Since further BMs provide only minor extensions to the initial network, no further network views are presented as this would unnecessarily extend the scope of this deliverable.
2. **Value Creation:** According to SAP's enterprise view (cf. figure 2), we will firstly explain the BM's partners, operations, value propositions and customers.
3. **Value Capture:** Secondly, we explain how the value is captured regarding costs and revenue.
4. **Risks:** Then we explain inherent risks of each BM. This happens in contrast to the next group of criteria five to seven which explain how imperfections found in D7.1 are influenced.

The following category explains the BMs influences on four additional factors on top of the criteria within SAP's enterprise and network view. HN deliverable 7.1 revealed the market imperfections investment cost, switching costs and non-transparencies in service comparison. Their manifestation in the current BM "Generic Cloud Computing for European Science" was already described in the document 7.1. Concerning the following BMs, we will analyse to what extent their manifestation changes. It might also be the case that the market imperfections remain the same or do not appear in the first place. Further, the fourth external criterion is in how far the BM meets at least one design challenge as defined in the analysis phase (cf. chapter 3.2).

5. **Investment Costs:** "In initial phases of markets investment costs to build up required resources play a major role and bear a risk of loss if they can't be balanced by profit over time. For the supply side this includes facets of uncertainty such as not knowing what commitment the demand side will be able or willing to make" (Neidecker-Lutz and Doll 2013).
6. **Switching Costs:** "Switching costs occurring between providers can hinder consumers to make rational decisions or moves at all times. On the one hand, they offer an entry barrier for providers outside of Helix Nebula. But on the other hand, they can prevent customers from switching from one Helix Nebula

provider to the other, even though their current offer might be more competitive. Hence, customers might not be able to reap the benefits of special offers” (Neidecker-Lutz and Doll 2013).

7. **Non-Transparencies:** “In order to make rational decisions, consumers have to be able to compare the offers provided at the market. However, pricing models and metrics utilized in cloud computing differ drastically from each other, which complicates their comparability. Further, different types of discounts applied increase the complexity of metrics implemented” (Neidecker-Lutz and Doll 2013).
8. **Design Challenges:** The last step of the analysis phase was the deduction of problems, objectives and challenges that need to be taken into account during the design phase (cf. chapter 3.3). Within criterion ten we will explain in how far a BM tackles one or more of these challenges.

The third criteria category explains the potential for optimisation realised by a specific broker role (to be assigned).

9. **Specific Broker Role:** Each BM occupies the possibility of a certain specific broker role that accomplishes so far unassigned tasks to get the BM to work. The role itself and its effects on the criteria one to six will be explained. Be careful not to mistake specific broker roles in each BM with the overarching broker roles (cf. chapter 4.2) that are required in all of the BMs.

The last criterion is geared towards the expert evaluation we conducted. This last category comes across as final synthesis of the BM. The detailed explanation of this evaluation can be found in chapter 3.4 on pages 32-33.

10. **Expert Evaluation:** We will present the experts’ average opinion of all the criteria and highlight relative peculiarities within each BM. Furthermore, important experts’ remarks are explained.

The list of description criteria allows a systematic approach to describe overarching broker roles (OBR) and BMs which will be done in the following. All concepts presented were developed in close collaboration with representatives of the HN supply side in two strategy workshops in Regensdorf, Switzerland on the 2<sup>nd</sup> and 15<sup>th</sup> May 2013. SAP Research elaborated the BMs without distorting the primal ideas.

## 4.2 Overarching Broker Roles

Before we dive into the BMs, we want to introduce the concept of OBRs. HN’s setting with various providers requires such broker roles that act as a middle man to address the customers appropriately (cf. figure 21). Operations that are necessary in all or many of HN’s BMs are centrally provided. E.g., a blue box system including a portal, a catalogue of services that enables provider selection based on cost, time, and capability, as well as unified billing are designated. Such a single interface funnels the access. This ensures a consistent on-boarding, log-in, and market presence. Moreover, it can be combined with an authentication service.

It has to be mentioned that these roles are not considered as HN BMs because experts evaluated them to be mandatory to create a marketplace and to ensure the success potential of chosen BMs. Thus, there is a significant difference between OBRs and BMs. OBRs are to be assigned to parties that act as shared service

centres. They are required for all BMs. This is why we chose the term “overarching”. Yet, we collected all OBRs in one BM enterprise view in order to understand them at one glance. This implies that ideally each OBR should be mapped to the best qualified party in order to cope with the requirements of a cloud computing partnership. E.g., the “up-/cross-selling”-role requires deep knowledge in databases, CRM, marketing, and data mining. Depending on these requirements, the role holder is to be chosen. We identified one conflict of interest that limits this additive function for the “Yellow Strom” role, i.e. that an organisation cannot manage more than one OBR without falling into interest conflicts. This can be read within its section.

As you can see in the footnote (cf. figure 21), the OBR remain to be assigned. OBR functions are additive and can be undertaken by the same organisation, if for example one HN partner will take responsibility for such a role, he will partner with all *HN providers* to address end customers as a middle man. Moreover, the *European Commission Directorate General for Communications Networks, Content and Technology* provides funding pots called “Framework Programmes” and is a partner therefore. Concerning OBRs’ customers, initially there will be the three initial flagships ESA, CERN, and EMBL. But as the HN’s customer base will spread, the OBR will get more customers as well, of course.

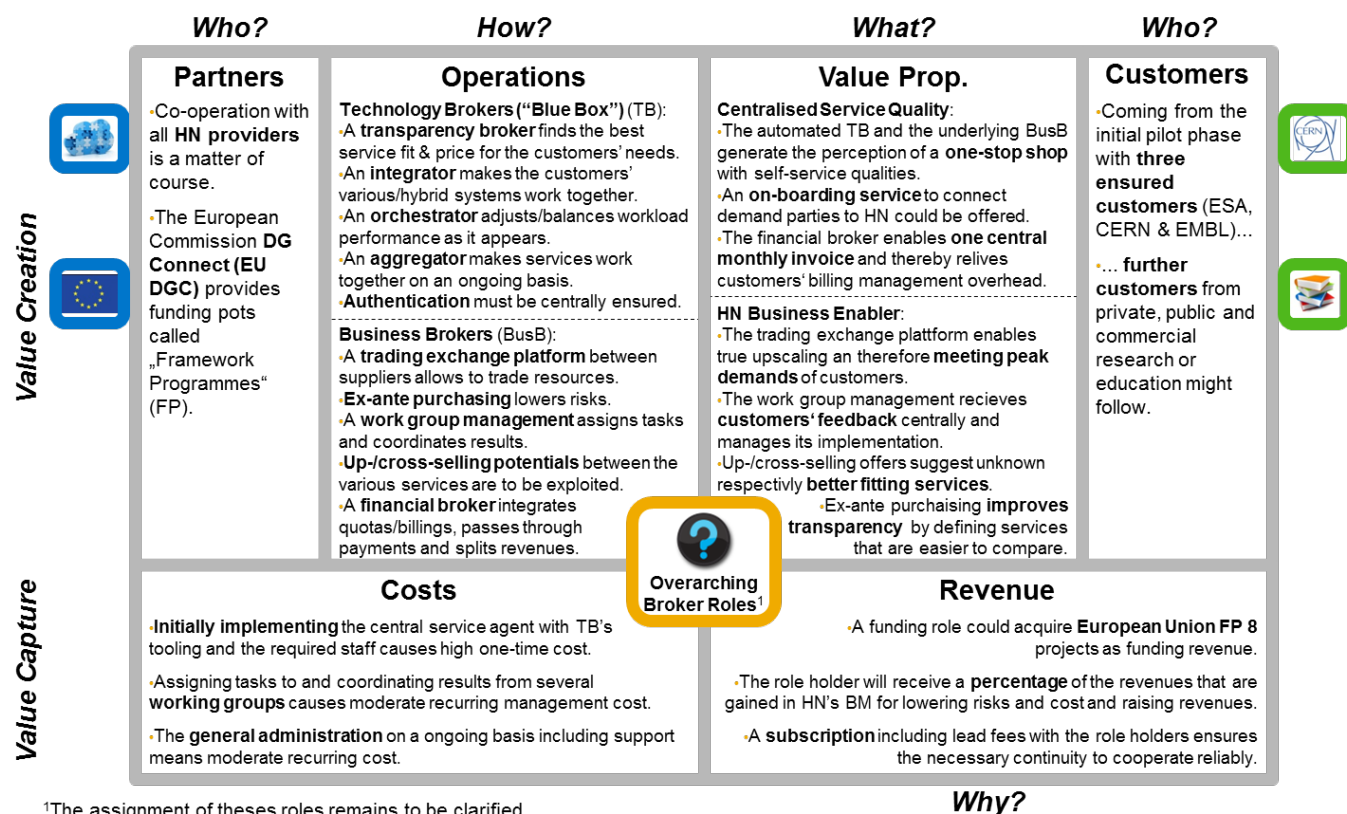


Figure 21 Overarching Broker Roles



### **The Technology Broker Category**

The operator of the technology broker (TB) is responsible for all technological tasks all pooled in one broker which is defined as the “Blue Box” in HN task 4.5. Since the “Blue Box” is discussed explicitly in task 4.5 its influences on HN are known and, therefore, not described in this document. Yet, in order to summarize and complement the “Blue Box”, we see five basic roles within it. The automated TB generates the perception of a *one-stop shop* with self-service qualities. The importance of this item is high since the EU has the vision to establish a *marketplace* that offers a resource to governments, businesses and citizens. The TB allows a “Layer Player”-BM that triggers *economies of scale*. This BM is implemented by “specialised companies that are limited to the provision of one value-added step for different value chains. They benefit from economies of scale and often produce more efficiently and at a higher quality” (Gassman et al. 2013). Thus, customers benefit from lower cost and higher quality compared to legacy information technology.

- **The Transparency Role:**

A *transparency broker* finds the best service fit and price for the customers’ needs. Therefore, a price/performance ratio is to be calculated for each offered product. This is difficult, as Neidecker-Lutz and Doll (2013) show in the HN task 7.1 in chapter seven by modelling a sample cloud application roughly patterned after the EMBL genome sequencing application in characteristics running on AWS’s EC2 instances. Even for only one provider, the result is a “(...) price variability of 1 to 1.7 on a single variation of provider infrastructure, without even starting to take into account variability due to different split of instance types or the substantial variability encountered on the same instance type over time or underlying physical infrastructure variation, which introduces a similar variation of actual resource consumption and hence price” (Neidecker-Lutz and Doll 2013). Concluding, “if there is a federated ecosystem of providers to be established, efforts to standardize some of the performance characterization of complex landscapes for comparison efforts as well as mechanisms to be able to tailor resource types more smoothly to more closely match offerings from another provider (...) would be helpful” (Neidecker-Lutz and Doll 2013). This could be the transparency broker’s task as it ensures price *transparency* and services’ *fitness of purpose*. We are very aware of the technical complexity to enable comparability. Yet, the standardization of some of the performance characterizations of services states a solution.

- **The Integrator Role:**

An *integrator* makes the customers’ various/hybrid systems work together. As the analysis of cloud computing trends (cf. chapter 3.2) has outlined, analysts predict that the iPaaS market will grow nearly 35% in 2013 (Biscotti et al. at Gartner 2012). A potential partner, yet non-European, or at least a role model is the award winning company MuleSoft that is an integration platform for connecting SaaS and enterprise applications in the cloud and on-premise.

In order to ensure centralised service quality a service to connect demand parties to HN could be offered within the integrator role. The expert evaluation includes a criterion that asks how high or low the customers’ subjective acceptance of the effort to migrate to this sourcing solution is. The overall result is a 3.2 on a scale from one to five meaning medium. Therefore, such a service could ease this adoption obstacle.

The integrator allows *multi-cloud capability* being open with low switching cost and a scaling possibility. “Multi-cloud strategy is the concomitant use of two or more cloud services to minimize the risk of widespread data loss or downtime due to a localized component failure in a cloud computing environment. Such a failure can occur in hardware, software, or infrastructure. A multi-cloud strategy can also improve overall enterprise performance by avoiding ‘vendor lock-in’ and using different infrastructures to meet the needs of diverse partners and customers” (Rouse 2012).

- **The Orchestrator Role:**

An *orchestrator* adjusts/balances workload performance as it appears automatically by distributing incoming application traffic across multiple infrastructure instances.

- **The Aggregator Role:**

An aggregator makes services work together on an ongoing basis. This task is similar to the integrator with the difference that the providers’ SaaS is integrated and standards for tool development are set. The aggregator in combination with the orchestrator assure a *high quality of service* enabling the supply side to follow “the practice of joining several products together for the purpose of selling them as a combined product” and selling “(...) a large variety of readily available products and accessories under one roof” combined with scalability (Gassman et al. 2013).

- **The Authentication Role:**

The TB states a central access point that funnels the access through a single interface. This could accompany with a central authentication for all BMs.

### **The Business Broker Category**

Leaving the TB, on the other hand, we identified business tasks that immediately suggest themselves to be centrally provided by a *business broker* (BB), which can also be split into several business broker roles. For the business brokers’ following description we apply a suitable subset of the foregoing criteria catalogue (cf. chapter 4.1) including **value creation** and **value capture**. Since they are new concepts and belong to our core competences, we analyse their influences on HN’s BMs’ criteria costs, revenues, risks, investment costs, switching costs, non-transparencies, and in how far they tackle design challenges.

The “Trading Role” and the “Yello Strom”-Role are presented first as they have major impacts on the imperfections found in deliverable 7.1. These comprise investment costs (including the problem of loss), switching costs (including the problem of a lock-in effect), and non-transparencies in service comparison. Lock-ins created by contract durations, intensified by relatively high switching costs make the comparability of current offers with potential future offers almost impossible. The two roles successfully provide a solution to the issues explained in deliverable 7.1.

### **The Trading Role:**

- **Value Creation:** A *trading exchange platform* between suppliers allows to trade infrastructure resources. Such a role could establish and manage a spot and future market, comparable to the energy spot and future market. This platform meets requirements that go beyond the orchestrator’s capability



which *automatically* distributes incoming application traffic across multiple infrastructure instances. The platform rather enables infrastructure providers to sell and buy computing capacity in order to better meet the customers' needs and to earn money with unused resources.

- **Value Capture:** The role holder will receive a percentage of the revenues that are gained in HN's BMs. Further, a fix subscription fee (lead fee) ensures the necessary continuity to cooperate reliably. Moreover, a percentage on each infrastructure trade is thinkable, just as it is the case in most e-commerce marketplaces. A potential role model is eBay. The costs for the role holder are the setup and deployment of a marketplace that enables ad-hoc trade of unused infrastructure resources.

#### The Trading Role's Influences:

- **Operational Costs:** If a supplier requires further infrastructure to satisfy his customers' scaling demands, the supplier will not face step-fixed investment cost, but he can buy the exact volume on the trading exchange platform. Further, the role holder will receive a percentage of the revenues that are gained in HN's BMs for offering this central service, lowering risks and cost based on economies of scale, and raising revenues which brings along a slight operational cost increase.
- **Revenue:** On the other hand, if a supplier has at-rest infrastructure, he can sell it on the trading exchange platform. The possibility of calling on further resources quickly allows fast scaling, which allows further use cases and, therefore, raises revenues.
- **Risk:** The lowering of financial risks concerning step-fixed investments and at-rest infrastructure was explained.
- **Investment Costs:** Compared to the initial BM "Generic Cloud Computing for European Science (Enterprise View)", further onetime costs appear to enable the inter-changeability and compatibility between all partners' resources. But once established, operational cost are lowered as explained.
- **Switching Costs:** Within HN, switching cost decrease for customers since the trading role has ensured a better interoperability beforehand. Yet, the suppliers have to defray the initial standardization cost. If new use cases appear that require standardisation the trading role should communicate the requirements to all suppliers that fit in.
- **Non-Transparency:** No influence was identified.
- **Design Challenges:** This role might tackle the design challenge 3 as explained in the analysis phase (cf. chapter 3.2).

(3) We recommend EGI as the role holder. EGI has confirmed a general interest in executing the role.

Yet, the upkeep of their current service offering and their non-commercial status must be ensured.

Based on HN task 6.1, we recommend this as integration from a policy point of view.

#### The "Yello Strom"- Role:

- **Value Creation:** A business intermediary can possibly adopt the BM of the German "Yello Strom GmbH" and transfer it to HN. In contrast to the transparency broker, this role does not make services compatible or prices transparent, but it buys the cheapest offerings to create frequently demanded bundles or single services ex ante and sells them to the end customer *without* making transparent from which provider the services come. Thus, this is a reseller model. We advise that the role holder is not

given a further role as all other roles act as shared service centres for the HN partnership. This role does not act as its own legal entity with its own market presence. Thus, if the role holder was assigned with further OBRs, interest conflicts could naturally develop.

- **Value Capture:** The role holder will frequently purchase a guaranteed amount of infrastructure and services from each HN provider. The reselling of the prior bought cloud service packages to higher prices, leads to profitability of this role. This step can be justified by the outsourcing of market risks to the role. The costs for the role holder are expected to be mainly costs for connecting, distributing and selling of resources. There is no investment needed in own or cloud infrastructure.

#### The “Yello Strom”- Role’s Influences:

- **Operational Costs:** Without the role, technological adaptations are required between all partners of the HN ecosystem to ensure service compatibility. If the role is approved and assigned, a decline in operational costs will be possible since a technological adaptation is only required to one central instance instead of implementing bilateral technological adaptations. Further, the role holder will receive a percentage of the revenues (slight cost increase for supplier side) that are gained in HN’s BMs for offering this central service, lowering risks and cost based on economies of scale.
- **Revenue:** A mechanism is required to integrate quotas/billings, pass through payments and split revenues. This is assigned to a financial broker role that follows. This OBR might lead to a boost of a price war between commoditised infrastructure offerings since the OBR promises its customers to choose the cheapest offering.
- **Risk:** The risks of the initial HN BM disappear since the business intermediary guarantees to purchase certain volumes. Yet, the supply side is taken the opportunity to manage its marketing according to its desire.
- **Investment Costs:** A central advantage is the improved calculability of cost caused by the ex-ante purchasing of cloud computing resources by the “Yello Strom”-role. The curve shape of demand turns more linear which eases the problem on investing in further infrastructure resources to meet peak demands. Thus, the risk of unprofitable investments is lowered.
- **Switching Costs:** They might be lowered since the realisation of this role requires the integration of all services into one offering provided to the customer by this role. The cost of central standardisation and reprogramming is lower than bilateral actions. The question remains if physical or virtual access for the role to conduct adjustments is possible and/or allowed by all HN partners.
- **Non-Transparency:** The subjective transparency improves a lot, since the role creates its own offerings after purchasing from HN partners (perceived as only one provider to the outside), which allows defining services that are easier to compare. The role will offer the single point of access for customers.
- **Design Challenges:** No influence was identified.

The following roles do not have major impacts on the description criteria category two encompassing changes of initial investment costs, switching costs, non-transparency changes, and design challenges (cg. chapter 4.1 and HN deliverable 7.1 chapter 1). Thus, we will only describe the respective criterion if there

is an impact. Yet, this does not mean these roles are of less relevance as they still improve costs, benefits, and risks.

### The Work Group Management:

- **Value Creation:** A central *work group management* assigns tasks and coordinates results between all HN partners' individual work groups. Further, this central project and communication management instance distributes technical standards that are required in other OBR and commands central governance rules. As you can read in more detail in the tackled design challenges, the role could centrally define customer segments, the service catalogue and a supply side expansion process for Europe and other continents, if approved.
- **Value Capture:** The role holder will receive a percentage of the revenues that are gained in HN's BMs. Further, a fix subscription fee (lead fee) ensures the necessary continuity to cooperate reliably. As the work in this OBR is primarily project based, appropriate incentive models for successful project finishing are required. E.g., for each successfully acquired partner that participates for a certain time in the partner network, the work group management receives a bonus. Further, depending on the success of chosen customer segments and products within the portfolio, bonuses state an incentive to do this job well. The costs are rather low, as only a small team is required. Yet, as business development is high-level strategic work with demanding requirements, high personal costs for highly talented staff are to be expected.

### The Work Group Management's Influences:

- **Operational Costs:** The role holder will receive a percentage of the revenues that are gained in HN's BMs for offering these central services and lowering risks and cost based on economies of scale which brings along a slight operational cost increase. Assigning tasks to and coordinating results from several working groups causes moderate recurring management cost. Actually this belongs to the category of general administration, but since HN's ecosystem is by far beyond classic organisations, we highlight it as a separate point.
  - **Revenue:** No influence was identified.
  - **Risk:** "Who do you call when you want to speak to Europe? The question, long attributed to Henry Kissinger, has yet to be answered convincingly by the 27 [today 28]-country European Union" (Heritage 2010). HN faces the same problem. By defining this role, the risk of appearing as a too bureaucratic business partner can be lowered. On the other hand, there is the danger of being easily seen as a cartel management. This needs to be tackled by the law broker as explained below.
  - **Design Challenges:** This role tackles the design challenges 6, 7, and 8 as explained in the analysis phase (cf. chapter 3.2).
- (6) **Customer segments to be addressed:** In SAP's derived BMs customer segments and appropriate versions are outlined. Yet, an exact definition and implementation through HN partners needs to follow. This could be anchored in a central work group management.

- (7) **Definition of the service portfolio:** As well, the BMs include IaaS, PaaS and SaaS offerings and further services like integration, support, and consulting. Yet, their detailed implementation could be managed by this role.
- (8) **Supply side expansion:** A defined core team of suppliers establishes HN. Yet, a governance structure to incorporate further suppliers needs to be found. This brings opportunities of new revenue streams. In a next step, data context enrichment and supply side expansion might turn more lucrative and enrich the service portfolio, if non-European partners like the NASA or the GNU operating system will be admitted. Both for European and Non-European partners, models for their incorporation are required in case of an approval for non-European partners. We suggest one solution for this issue in the BM “Brand Management”. *The on-boarding services could be a completely different business, e.g. done by some of the current SME’s.*

### The Up-/Cross-Seller

- **Value Creation:** *Up-/cross-selling potentials* between the various services are to be exploited. If a customer uses one service, other services might also fit his usage patterns. The customer’s data analysis can be conducted by this role in order to offer further fitting services. As well, if HN implements multiple BMs and one customer participates in one BM, other BMs might also be interesting to him. The task of calling the customer’s attention would lie in this role.
- **Value Capture:** The role holder will receive a percentage of the revenues that are gained in HN’s BMs. Further, a fix subscription fee (lead fee) ensures the necessary continuity to cooperate reliably. The most interesting revenue potential, yet, is (a) a percentage of each successful up- or cross-selling transaction and (b) a success fee in case a predefined, model-based revenue number (e.g. 500,000 €) is attained. The costs for the role holder are not to be underestimated as the efforts of customer relationship management are made in a partner network and not for one single organisation. Thus, gathering all transaction data from each HN partner, consolidating this data using a data warehousing approach to finally use analytics tools is costly. As well, required skills are at the utmost level of business analytics and cloud computing which is a rare combination on the employee market.

### The Up-/Cross-Seller’s Influences

- **Operational Costs:** The role holder will receive a percentage of the revenues that are gained in HN’s BMs for offering these central services and raising revenues which brings along a slight operational cost increase.
- **Revenue:** Through up- and cross-selling initiatives customers will be likely to purchase larger amounts and multiple services, which should lead to a revenue increase.
- **Risk:** The risk of not revealing new customer potentials is lowered by a central customer relationship management. Yet, up-/cross-selling might be perceived as intrusive. Thus, only well-chosen offers should be made.

### The Financial Broker

- **Value Creation:** A *financial broker* integrates quotas/billings, passes through payments and splits revenues. We put this role at last, because, in our opinion, the financial broker is the most important success factor for HN. We want it to stay in everyone's memory very well since it shoulders the business reliability of HN both in front of the supply and the demand side. If this role doesn't work, neither HN providers nor customers remain motivated to stay in the ecosystem. The financial broker is a classic shared service centre. "Shared service centers have become popular in recent times as companies look to centralize business functions and reduce costs. But a recent SunGard study shows corporations today are heading towards a centralized approach to services for other reasons besides just cost. Out of the 485 CFOs, treasurers and other senior executives surveyed globally in the first quarter of 2013, 21.2 percent said standardizing operations was a primary driver for implementing the shared service center, a sharp rise from the 11.8 percent who felt that way in 2010 when SunGard, a software and technology-services firm, did a similar study. To be sure, almost half of the respondents still selected cost reduction as the leading reason for the center." ([Hoffelder 2013](#)).
- **Value Capture:** The role holder will receive a percentage of the revenues that are gained in HN's BMs. Further, a fix subscription fee (lead fee) ensures the necessary continuity to cooperate reliably. Which revenues are gained beyond those two options depends on the pricing model. Choosing the right pricing model for a shared service centre "...is one of the most important elements of a shared service or outsourcing arrangement, dramatically influencing the relationship between a service provider and its customers. A great model aligns both 'buyers' and 'suppliers' to reach mutually-beneficial goals. Choosing the wrong one can create an adversarial relationship and drive inappropriate behaviours for both leaders and staff" ("[Choosing the Right Pricing Model for a Shared Service](#)" n.d.). In order to enable a sophisticated designing of a service pricing methodology, we recommend an initial lecture of Stratform's document addressing this topic. Several options are provided. We recommend a transaction-based model. Thus, the financial broker would receive a micropayment for each billing sent to a cloud end-customer or for each payment pass-through. Costs are the setup and deployment of processes that enable quotas/billings, pass through of payments and revenue splitting between providers. As these processes need to be computerized, IT costs will be most critical.

### The Financial Broker's Influences

- **Operational Costs:** The role holder will receive a percentage of the revenues that are gained in HN's BMs (slight operational cost increase on supplier side) for offering this central service, lowering risks and cost based on economies of scale, and raising revenues.
- **Revenue:** The expert evaluation unfolded that this role is an essential requirement for HN's success and a must-have to enable revenue streams. Since it increases customers' satisfaction it is also likely to increase revenues. The financial broker could acquire European Union FP 8 projects as funding. "The European Commission supports the implementation of the Digital Agenda through a number of funding programmes, which regularly publish competitive Calls for Proposals for projects. The Commission also publishes Calls for Tender to obtain services as diverse as policy analyses and communications (...)" (p 2013).



- **Risk:** The risk of losing both partners and customers because they are unsatisfied with complicated financial operations is lowered. A single point of finance also lowers the risk of non-transparencies concerning audits. Further, the risk of billing is outsourced to the financial broker.
- **Switching Costs:** Technical switching costs are not lowered. Yet, the fact that financial operations remain the same no matter which partner provides the service leads to a reduction of switching costs. E.g., if a customer decides to switch the IaaS provider there might appear switching costs concerning migration, service delivery, service introduction, and project management. But as financial data is kept consistently at the financial broker, there will be no changes in financial processes and, thus, no switching costs for financial topics.
- **Design Challenges:** This role tackles the design challenge 11 as explained in the analysis phase (cf. chapter 3.2).
  - (11) **Revenue model “broker”:** A role in each BM has to be defined and staffed to bear billing risks and ensure payments operations out of one hand. Further, a revenue split has to be managed.

### The Law Broker

- **Value Creation:** Legal operations concerning European and national antitrust policies, liability within the ecosystem, taxes and HN’s juridical status could be centrally managed for all providers by a central law broker.

Basically, antitrust policies aim to ensure competition. “Competition is a basic mechanism of the market economy which encourages companies to offer consumer goods and services at the most favourable terms. It encourages efficiency and innovation as well as reduces prices. In order to be effective, competition requires companies to act independently from each other, but subject to the competitive pressure exerted by the others” (“[Antitrust Overview](#)” n.d.). The European Commission is empowered to impose fines on undertakings which violate the EU antitrust rules. Basically, either (a) agreements between two or more independent market operators which restrict competition or (b) firms holding a dominant position on a determined market to abuse that position are indicators for the European Commission to start investigations. The “[Antitrust Overview](#)” (n.d.) by the European Commission is the best entry lecture to more details. The central law broker could ensure the compliance of national and European laws against antitrust.

Service definition and delivery in an ecosystem requires well-defined treaties both between a number of service providers as well as between the service providers and the customer as outages are a matter of fact in today’s cloud computing business. Attacks, outages, or interruptions happen on an erratic, yet continual basis. [Raphael](#) (2013) enlists the most critical cloud outages of 2013. The questions are how high the maximum liability will be and which HN partner carries which percentage. Further, “the MSPAlliance in partnership with Lockton Affinity, the world’s largest privately owned independent insurance broker announced the availability of a new [Cloud and Managed Services Insurance](#). The cyber insurance is aimed at service providers who require comprehensive protection. The MSPAlliance program includes limits of liability options, which range from \$1,000,000 to \$10,000,000 per claim and include deductibles from \$2,500 to \$10,000 per claim” ([Cohen](#) 2013). The decision upon



appropriateness of insurances is easier to be managed centrally as a better overview of risks is enabled. The matters of taxes and juridical statuses are of special interest as at first countries within the EU and later the entire planet might be addressed. Potentials for rate relief are to be exploited depending on national laws. E.g., in different countries different legal forms are more suitable for rate relief.

- **Value Capture:** The role holder will receive a percentage of the revenues that are gained in HN's BMs. Further, a fix subscription fee (lead fee) ensures the necessary continuity to cooperate reliably. Just as compared to the financial broker, a pricing model is required which defines whether revenues that go beyond usual legal service costs are allowed e.g. performance based. In order to enable a sophisticated designing of a service pricing methodology, we recommend an initial lecture of Stratform's document addressing this topic ("[Choosing the Right Pricing Model for a Shared Service](#)" n.d.). For the legal broker, we recommend an effort or headcount-based model which is one of the easiest to design, implement, adjust and benchmark. More important, such models work well when outputs are difficult to quantify, which is the case in legal work. High costs are personal costs. Highly skilled staff with specialised skills in cloud computing, cloud computing laws, business partnerships, antitrust laws, and languages is seldom and, thus, expensive.

#### The Law Broker's Influences

- **Operational Costs:** The role holder will receive a percentage of the revenues that are gained in HN's BMs for offering this central service and lowering risks and cost based on economies of scale which brings along a slight operational cost increase. As explained just before, the exploitation of rate relief potentials, defining and covering limits of liability both internally between partners and externally with customers, and ensuring the compliance of national and European laws against antitrust raises revenue indirectly as such costs are lowered
- **Revenue:** No influence was identified.
- **Risk:** Although it would be the explicit aim of this broker role to at least diminish liability and antitrust problems, outsourcing these tasks brings the risk of bad service quality and, thus, liability and antitrust might return as boomerang.
- **Investment Costs:** In case the role is established, it has to be defined completely at once from the beginning on in order to be able to outsource it and underlay it with contracts. Thus, initial investments costs would be higher.
- **Design Challenges:** This role tackles the design challenges 1, 9, and 11 as explained in the analysis phase (cf. chapter 3.2).
  - (1) **Antitrust guidelines:** The cooperation of many suppliers brings along the risk of being ranked as a cartel by competition authorities.
  - (9) **Limits of liability:** The co-operation of many suppliers brings along the necessity of liability. Yet, release clauses for risk reduction are to be considered.
  - (11) **Definition of HN's juridical status:** It is still unclear which status HN is supposed to have. Options are a separate legal entity, a joint venture or simply a brand with a logo.

Beside the costs and revenues within the OBRs, there are general aspects concerning the **costs** and revenues that count for all of them.

- Initially implementing the central service agent with TB's tooling and the required staff causes high onetime cost. They include salaries for team members, specific materials, supplies, and equipment, travel expenses to perform work, and subcontracts that provide support (Portny 2013).
- The general administration on an ongoing basis including support means moderate recurring cost. "Expenditures that keep your organization operational ... include salaries of your contracts department, finance department, and top management as well as fees for general accounting and legal services" (Portny 2013).
- The role holders will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. This aspect is the central motivation for role holders. The chance of outsourcing central tasks to OBRs lies in economies of scale and a more appropriate addressing of customers with one voice.
- A subscription including lead fees with the role holders ensures the necessary continuity to cooperate reliably.

Within this chapter we 4.2 introduced the concept of OBRs by using a suitable subset of the criteria catalogue including **specifics**, **value creation**, and **value capture**. We described the single OBRs which ensure a central management of overarching operations. This policy setting allows us to present the BMs. They are basically classified into *initial* and *future* models. The initial models are three in number. Their characteristic is that they can be started in the near future potentially at a maximum of two years.

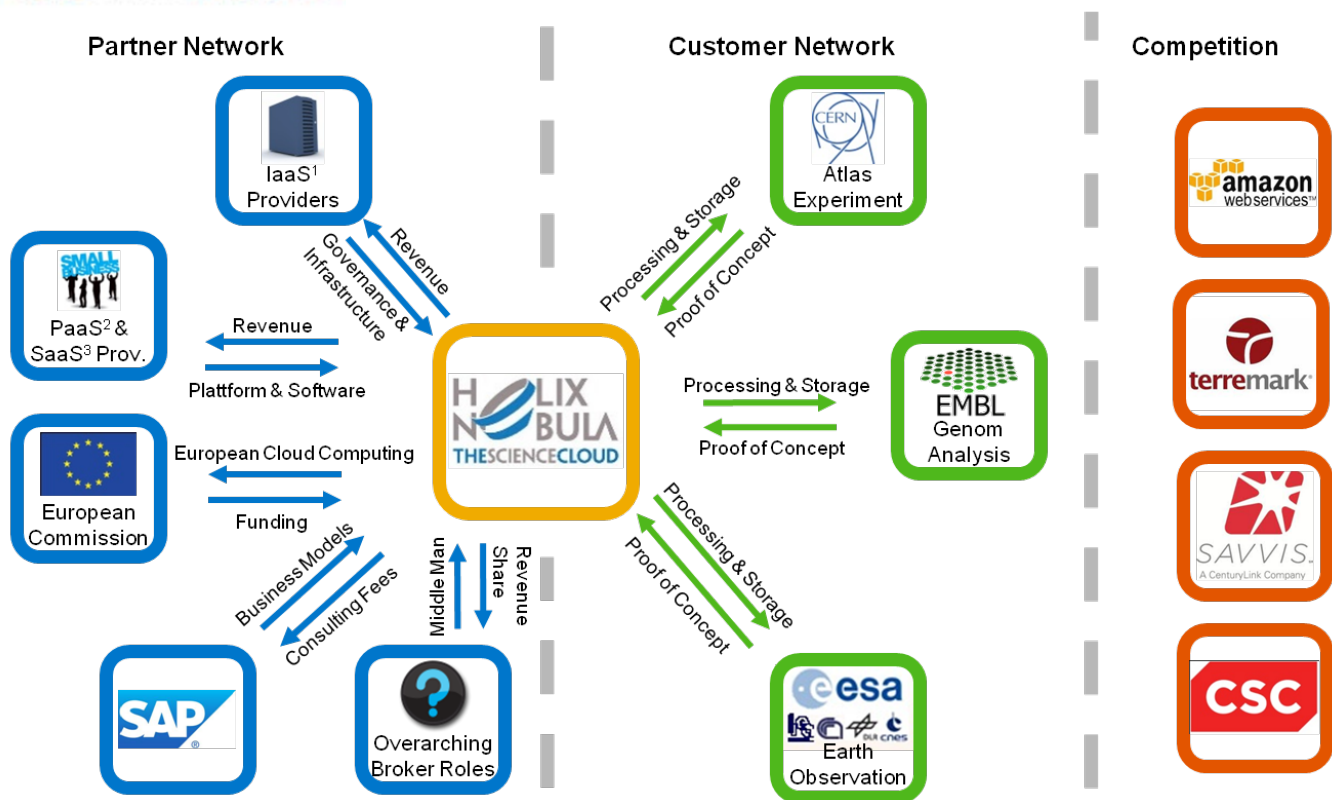
### 4.3 Initial Business Models

The BM named "Generic Cloud Computing for European Science" is presented first. It represents the current state of HN as a proof of concept. Therefore, we assume that the first BM is familiar to most HN partners in some measure because it covers the common understanding of HN. The BM description is based on the criteria catalogue to be found in chapter 4.1.

#### 4.3.1 Generic Cloud Computing for European Science

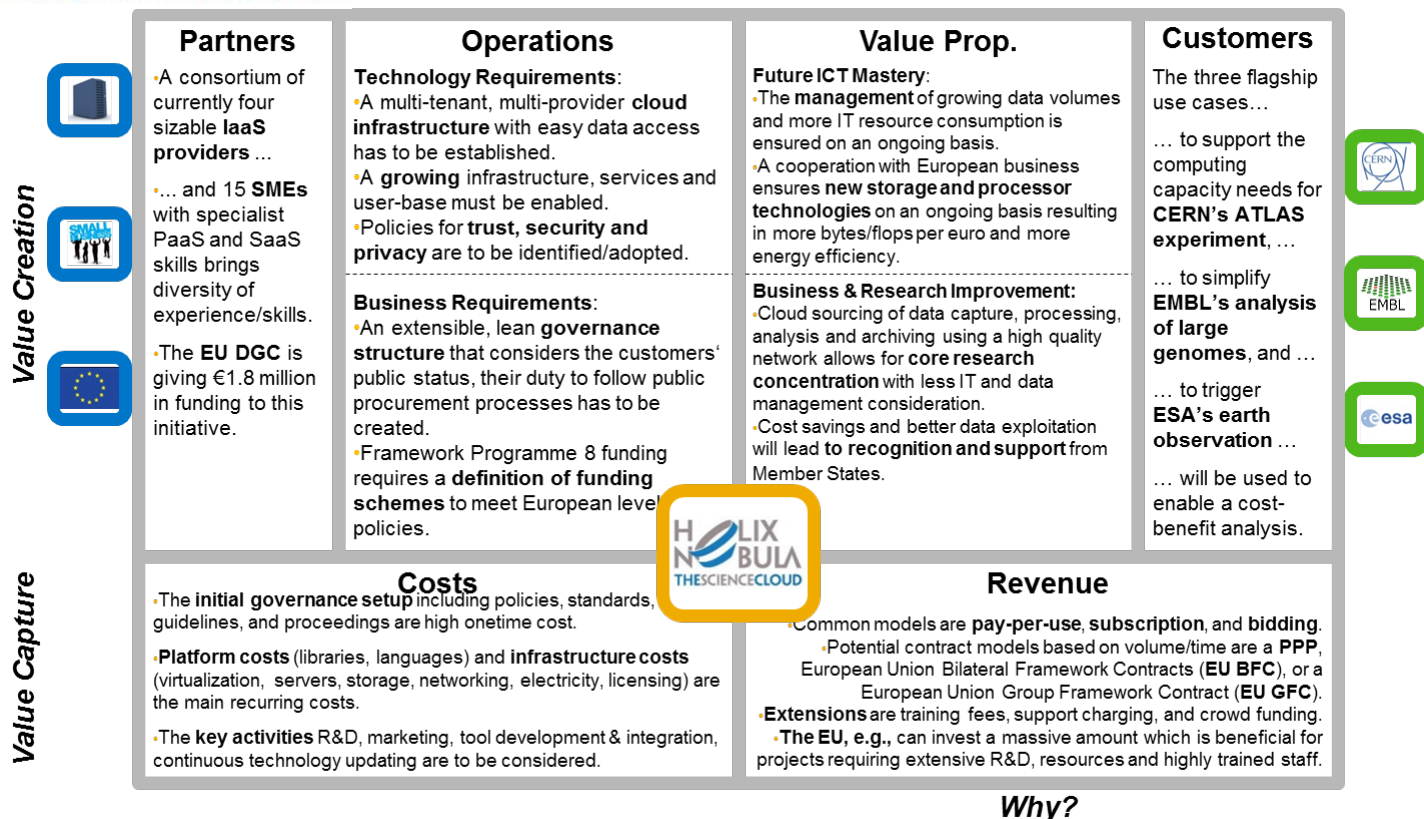
##### 1. Specifics:

This BM is the proof of concept on a long way to a worldwide wholesale cloud computing provider. It is based on the needs of European big-science and brings together leading IaaS providers and the three research centres CERN, EMBL, and ESA in order to provide data capture and processing that elastically meet big science's growing demand for computing power. This BM should be considered as a stepping-stone or basis on which we can build in order to get to BM "Information as a Service" (cf. figures 22 and 23).



<sup>1</sup>Infrastructure as a Service; <sup>2</sup>Platform as a Service; <sup>3</sup>Software as a Service

**Figure 22** Generic Cloud Computing for European Science (Network View)



**Figure 23** Generic Cloud Computing for European Science (Enterprise View)

## 2. Value Creation

The value is created by **partners** from three categories.

- A consortium of currently four sizable IaaS providers and 15 SMEs with specialist PaaS and SaaS skills partner to ensure diversity of experience and skills. Based on our information state, the provider of the HN initiative include ATOS, BT Global Services, CAP Gemini, CloudSigma, EGI.eu, ENEA, Logica, OpenNebula, Orange Business Services, SIENA, StratusLab, Server Labs, Six2, T-Systems International, Terradue srl, Thales and TrustIT.
- The EU DGC is giving €1.8 million in funding to this initiative.
- The roles holders of the OBRs are partners, too. They act as a middle man and outsourcer to address the customers more appropriately.

This BM's **operations** need to cover both technical and business requirements. Concerning *technical requirements* we identified the following.

- A multi-tenant, multi-provider cloud infrastructure with easy data access has to be established. Multi-tenancy is recommended since it "(...) can be economical because software development and maintenance costs are shared. It can be contrasted with single-tenancy, an architecture in which each

customer has [his] own software instance and may be given access to code. With a multi-tenancy architecture, the provider only has to make updates once. With a single-tenancy architecture, the provider has to touch multiple instances of the software in order to make updates” (Rouse 2011).

- A growing infrastructure, services and user-base must be enabled from the beginning on. HN is supposed to be based on the needs of European big science initially. Yet, eventually it is supposed to be a marketplace that offers resources to governments, businesses and citizens. In order to simplify this process, the enabling of expansion is recommended.
- Policies for trust, security and privacy are to be identified and adopted. Since 2006, when cloud computing as a sourcing concept for computing resources was introduced, cloud security is the most important factor for non-adoption of this sourcing technology caused by the three main problems data security, data storage security and hostile attacks (Amies et al. 2012).

Concerning *business requirements* we identified the following.

- An extensible, lean governance structure that considers the customers’ public status, their duty to follow public procurement processes has to be created. SAP Research’s gap analysis of existing procurement and budgeting processes has yielded the necessity for the three flagship use cases ESA, CERN and EMBL to follow public procurement rules including negotiations and tendering processes. But cloud computing use cases with on-demand access cannot follow repetitive procurement processes for the sake of avoiding disproportionate effort. Therefore, SAP Research is studying potential alternatives in order to provide a set of recommended changes and adaptations for collaborative procurement and operations. There are three potential procurement solutions we evaluated in a questionnaire. They are based on the EU’s procurement processes. Chapter 5 shows if they meet the procurement rules of the three flagships and European Research Area community that face national and internal rules as well.
- European Research Area FP8 and European Research Council funding require a definition of funding schemes to meet European level policies. ERC funding schemes are open to top researchers of any nationality or age who wish to carry out their frontier research in the 28 EU Member States or associated countries. There are three ERC core funding schemes and two additional schemes (“Funding Schemes” n.d.).
- The business requirement for geo-return (for inter-governmental institutes) and job creation in the EU for EU and national institutes are also of great importance. Member states that support a RI financially usually have the duty derived from their statutes to ensure that a certain proportion of the money flows back to same country in the form of contracts with industry or government contractor.

The **value propositions** are, on the one hand, to enable the demand side to master future ICT challenges and, on the other hand, to improve their business and research processes. Basically, these are the core cloud computing advantages. Yet, it is important for the customers to understand where exactly they benefit. Concerning *future ICT mastery* we identified the following.

- The management of growing data volumes and more IT resource consumption is ensured on an ongoing basis. The cloud computing advantages are well known to most readers of this document. Yet, we enlist the most important for those that are not familiar with the advantages.



- Lower capital costs
- Lower IT operating costs
- No hardware or software installation or maintenance
- Optimized IT infrastructure provides quick access to needed computing services
- Cooperation with European business ensures new storage and processor technologies on an ongoing basis resulting in more bytes/flops per euro and more energy efficiency. “Intel has a busy year of new processor product rollouts planned, as it continues to update its chips to take advantage of technology innovations. (...) Intel unveiled details of upcoming (...) products targeting the server, networking and storage requirements of the data center. The company will refresh its Intel Xeon and Atom processor lines with new generations of 22nm manufactured products. In coming months Intel will also begin production of new Intel Atom and Xeon processor E3, E5 and E7 families, featuring improved performance per watt and expanded feature sets” (Miller 2013).

Concerning *business & research improvement* we identified the following.

- Cloud sourcing of data capture, processing, analysis and archiving using a high quality network allows for core research concentration with less IT and data management consideration. In a customer side pre-survey conducted before the two BMI workshops, ESA explicitly highlighted one motivator to participate in HN. It is the internal opportunity to have a “new way of running projects (focusing on the core business without considering IT and detailed data management issues in the context of data exploitation & community building)” (Lengert at ESA 2013).
- Cost savings and better data exploitation will lead to recognition and support from Member States. Public organizations like the flagship customers have to prove that they spend the taxpayers’ money responsibly.
- Cross-domain research and cross-platform tools enable value co-creation. In our view, a generic platform can also provide cross-domain values, e.g. by shared by tools.

The **customer** side encompasses three flagship use cases that will be used to enable a cost-benefit analysis for both the supply and demand side.

- In its ATLAS use case, CERN evaluates the use of cloud technologies for ATLAS data processing, integrates cloud computing resources with the ATLAS Distributed Computing software and services, and implements the ATLAS cloud computing model within its Distributed Data Management, distributed production and analysis system as well as related tools and services (“CERN-ATLAS Use Case” 2013).
- EMBL wants to “open up new possibilities for scientists to perform large-scale genomic analysis without making large capital investments in computing infrastructure, (...) provide a leading bioinformatics pipeline to perform fast and on-demand genomic data analysis, and provide a basis for future extension of genomic research using cloud computing infrastructures” (“EMBL Use Case” 2013).
- Through its SuperSites Exploitation Platform use case, ESA wants to achieve an open source, unified e-infrastructure and improved data products for solid earth data research (volcano’s and earthquakes),



secure sharing of this data, and enabling international collaboration within a larger science user base to improve understanding of the phenomena (“ESA SSEP Use Case” 2013).

- It is not only CERN, ESA and EBML that can profit from this BM but also many other research organisations and small groups. Given the recent news and focus on security (cf. PRISM news articles) and the assessment made by the ECP Steering Committee we have a window of opportunity for Helix Nebula to offer a secure European generic cloud service.

### 3. Value Capture

On the **cost** side we identified the following.

- The initial governance setup including policies, standards, guidelines, and proceedings are high onetime cost. The requirements for HN’s governance model go beyond those of classic organisations. The structure has to be lightweight, as cloud computing may not be bureaucratic. It has to incorporate all stakeholders and should evolve over time as the infrastructure, services, and the user-base grow. In order to meet these requirements the costs are higher than in classic cases.
- Platform costs (libraries, languages) and infrastructure costs (virtualization, servers, storage, networking, electricity, licensing) are the main recurring cost. Research on cost-models for operating hyper-scale data centres shows significant percentages of approximately 90 per cent for data centre operating costs (Miller 2011). Hamilton (2011) reviews costs assumptions for an eight megawatt AWS data centre, which could include 46,000 servers, and outlines monthly operating costs for a facility. He estimated the costs at \$88 million (about \$11 million per megawatt), which is dominated by the cost for servers (57 per cent), followed by power and cooling (18 per cent) and electric power (13 per cent).
- The key activities research and development (R&D), marketing, tool development & integration, continuous technology updating are to be considered, as well. Knowing that circa 90 per cent are infrastructure cost without taking platform costs into account, we learn that these key activities are around five percentage at maximum.

On the **revenue** side we identified the following.

- Common models are pay-per-use, subscription, and bidding. With a subscription the customer gets access to the services by paying monthly or annual fees. The best example within cloud computing is Salesforce.com. It charges its customers a monthly fee rather than pay-per-use or rather than selling expensive up-front licenses. A pay-per-use model is offered for on demand use cases. It enables customers to pay only for the resources used, which results in lower costs, increased efficiencies, and faster time to market. An example could be 3€ per hour for a Microsoft Server instance with Oracle on it. Bidding has become famous through AWS’s spot pricing. Spot instances allow to name an own price for computing capacity. Customers simply bid on instances and run them whenever their bid exceeds the current spot price, which varies in real-time based on supply and demand. “The Spot Instance pricing model complements the On-Demand [Pay-as-you-go] and Reserved Instance [Subscription] pricing models, providing potentially the most cost-effective option for obtaining compute capacity, depending on ... [the] application. Spot Instances can significantly lower ... computing costs for time-flexible, inter-

ruption-tolerant tasks. Spot prices are often significantly less than On-Demand prices ..." ("Amazon EC2 Spot Instances" 2013). This model is very interesting for IaaS provider, as it allows filling unused capacity.

- Potential contract models based on volume/time are a PPP, European Union Bilateral Framework Contracts (EU BFC), or a European Union Group Framework Contract (EU GFC). Their feasibility and further potential options are examined in chapter five. Yet, we outline them already at this stage to get an overview.
  - A PPP is a cooperative venture between public authorities and private enterprises that can provide effective ways to offer services to the public.
  - After a single initial tendering process, the contractual relationship between the customer (e.g. a Research Institute) and the successful tenderer (e.g. Helix Nebula Consortium) will be governed by a special type of contract known as a EU BFC. It should be stressed that framework contracts involve no direct commitment and, in particular, do not constitute orders *per se*. Instead, they lay down the legal, financial, technical and administrative provisions governing the relationship between the customer and the contractor during their period of validity.
  - EU GFC is a variant of the EU BFC. One customer subscribes an EU GFC on behalf of all participating customers instead of multiple contracts having to be established.
- Extensions are training fees, support charging, and crowd funding.
  - Training is designated to solution architects, systems operators, and developers with the aim to teach them HN essentials, architecting, developing, advanced operations, and systems operations on HN.
  - Terremark Infrastructure & Cloud Services' priority support shows, that support is a considerable revenue stream. One enterprise-grade support ticket is the greater of \$500 or 20 per cent of your usage fees in a given month.
  - The idea of boosting new scientific innovation and bringing new discoveries through new services and products is a game-changing strategy and very visionary. This might attract "a crowd of investors who want to support the idea, typically over the internet" (Gassmann et al. 2012). If the proof of concept is successful and the critical mass is achieved, the idea will be realized. Investors will then receive special benefits. The social network Diaspora is a famous example. 6479 investors gave \$200642 within a few weeks (Gassmann et al. 2012).
- Governments can invest a massive amount which is beneficial for projects requiring extensive R&D, resources and highly trained staff. Government funding is available both for business and public organisations. Yet, top-class firms and researchers tend to be prioritised (Chang et al. 2010). Fortunately, the HN ecosystem meets this criterion with the cutting-edge demanders CERN, ESA, and EMBL that also attract investors for crowd funding.

SAP's deliverable 7.1 intensively analyses the criteria risk (4), investment costs (5), switching cost (6), and non-transparencies (7). Therefore, we reference to chapter one for criteria four to six and to chapter seven for criterion four.

## 8. Design Challenges

This BM might tackle the design challenges 2 (partly) and 12 as explained in the analysis phase (cf. chapter 3.2).

- (2) **Data storage and management:** The proof of concept phase allows the supply side to find or develop required staff qualifications, technology standards, and policies to master data storage and data management challenges.
- (12) **PPP as venue model:** Within this BM, e.g. the financial broker can initiate a PPP that allows a project to be completed sooner or make it a possibility in the first place.

## 9. Specific Broker Role

All further required tasks that have not been assigned to any HN partner are defined in the OBRs. Therefore, nor specific broker role is necessary in this BM.

## 10. Expert Evaluation

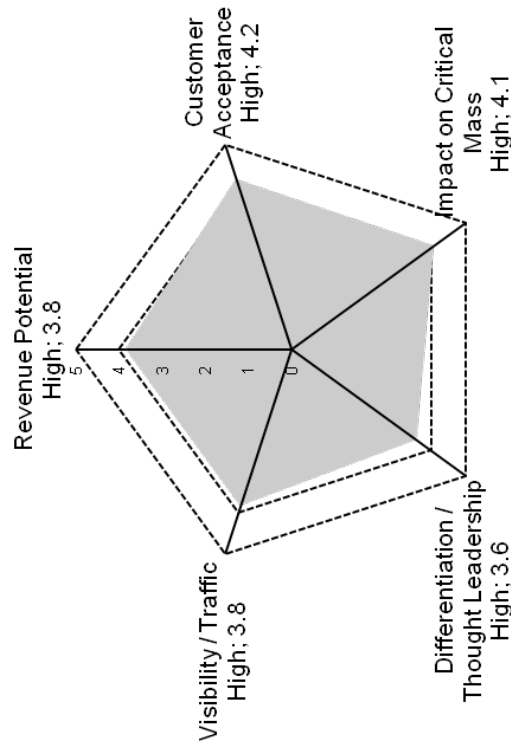
The **impact** of this BM was valued high with 4.0 (cf. figure 24). Actually, all criteria in the impact are consistently on a high level. The need as sub criterion of customer acceptance stands out, not even in this BM, but in all. With an average of 4.8, it is very high and its interpretation is, that big science struggles most with data volume management and therefore, has the highest need for cloud computing solutions of all customer segments. The fact that CERN, ESA, and EMBL participate in this BM as customers shows that even an only medium acceptance of efforts to migrate to the cloud and of security problems does not change the high level of the customer acceptance.

The **ease of implementation** was valued neutral with 3.4 which shows that there is a clear tendency to a positive ease of implementation. With a more inconsistent picture of values, the factors that are worst and prevented a positive value are the required time and investment costs. Even though this BM is already in preparation, experts still judge the time until the first service is sold rather neutral with a tendency to even critical because the unification of a double-digit number of partners still requires a lot of work to be done. This is also the reason why investment costs are neutral. But the feasibility and expertise as sub criteria of risk are high and the best values in the ease of implementation. Thus, experts still think this is objectively possible with today's knowledge that is, measured by the expertise criterion, positively available at HN's supplier organisations.

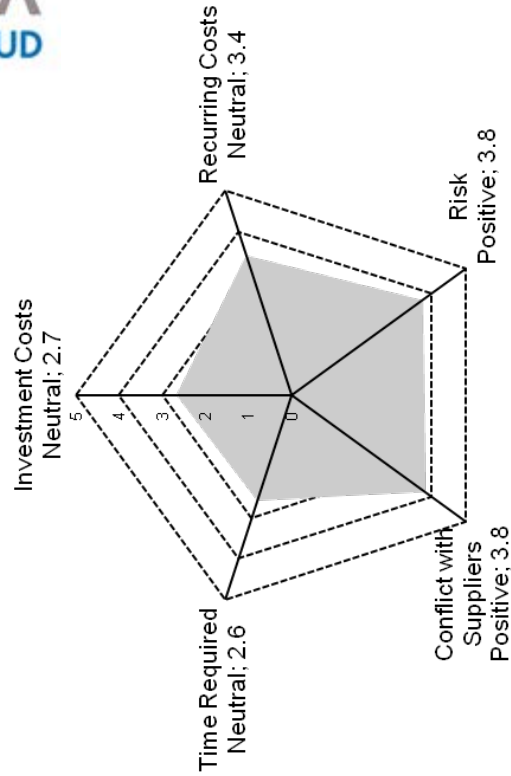
We clustered the experts' **remarks** on the BM with the following outcome. As this BM offers generic storage and processing services, the effort to migrate to HN must be very low because the competition is severe in generic markets with only the price and entry barriers as differentiators. Some experts had the opinion, that generic services require less time to be realized and allow lower security agreements. Further, experts said that it was good to include SaaS especially in the first BM as it had a high affiliation. If a customer outsourced his software deployment and was satisfied, he wouldn't put much effort on

comparing further competitors. Although experts were worried about the little number of customers, the data volume and setting as proof of concept convinced them. The sheer data volume and a market niche of European big science was reason enough for experts to value its customer need very high with the best value of all BMs. As it has solid evaluation results in all criteria and it allows a proof of concept, there is no reason why this BM shouldn't fly.

## Impact of Option



## Ease of Implementation



Impact		Revenue Potential		Customer Acceptance		Impact on Critical Mass		Differentiation / Leadership		Visibility / Traffic		Result	
Criterion	Weighting	Value	Need	Effort	Security	Mass	Leadership	0.1	0.1	0.1	0.1	1	
		0.3	0.2	0.05	0.05	0.2	0.1	0.1	0.1	0.1	0.1	1	
		high	very high	medium	medium	high	high	high	high	high	high	high	4.0
		3.8	4.8	3.0	2.9	4.1	3.6	3.6	3.8	3.8	3.8	4.0	↗

Ease		Costs		Risk		Conflict with Suppliers		Time Required		Result	
Criterion	Weighting	Value	Feasibility	Expertise	Legal	Suppliers	0.1	0.1	0.1	1	
		0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	1	
		neutral	positive	positive	neutral	positive	neutral	neutral	neutral	neutral	3.4
		2.7	4.0	3.9	3.1	3.8	2.6	2.6	2.6	3.4	↗

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 24 Expert Evaluation of "Generic Cloud Computing for European Science"

#### 4.3.2 Versioned Cloud Computing for Science & Education

##### 1. Specifics

Skipping the focus on the flagship use cases from ESA, CERN, and EMBL, this BM addresses the entire world of science and education with all its customer groups. The consequence of including research, development & education from consumer, business, and public markets and the differentiation between profit and non-profit is an explicit versioning of prices, revenue models, SLAs, and services (cf. figure 25).. Since further BMs provide only minor extensions to the initial network, no further network views are presented as this would unnecessarily extend the scope of this deliverable.

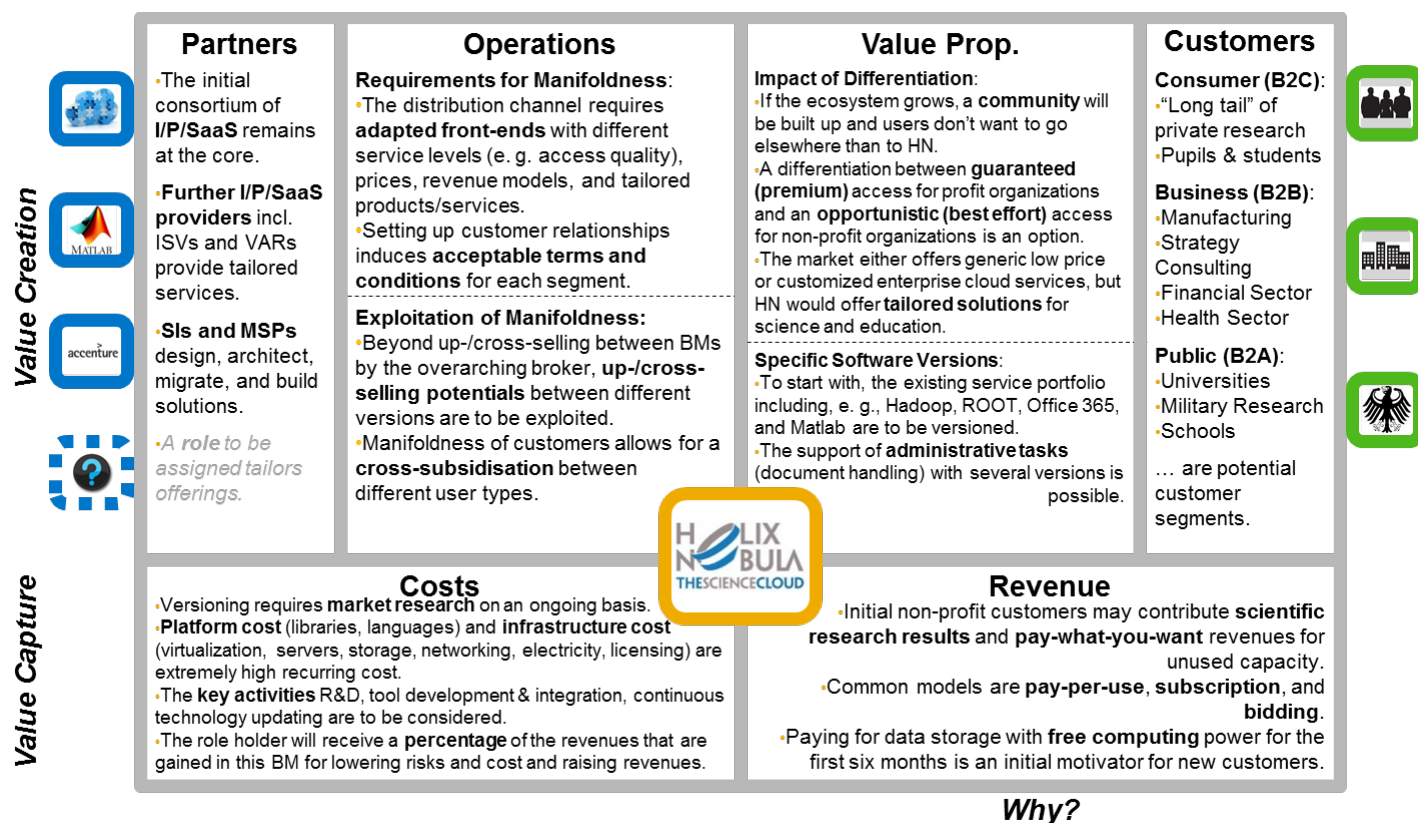


Figure 25 Versioned Cloud Computing for Science & Education

##### 2. Value creation

The value is created by **partners** from four categories.

- The initial consortium of I/P/SaaS as explained in the first BM remains at the core.
- Yet, the inclusion of larger numbers of further I/P/SaaS providers is possible from this point on and allows offering a possibly high number of tailored services.
- The cooperation with professional service companies encompassing service integrators, managed service providers, and strategy consultancies is a symbiotic relation. HN would benefit from professional



services firms helping customers of all sizes design, architect, migrate, or build new applications on HN, but also from potential partner fees and an increasing number of customers. The professional service companies benefit from a certification that also brings them more customers and they get access to a range of resources and training which allows to better serve their customers.

- As one explicit value proposition of this BM is the offering of specific software versions, a role (to be assigned) will research the market and implement this knowledge in tailored offerings. More information concerning the role is presented in description criterion eight.

The key principle of this BM is the increase of manifoldness which is a necessary step on the way to a wholesale provider. Thus, the **operations** need to cover both the requirements for manifoldness and the exploitation of manifoldness. Concerning the *requirements of manifoldness* we identified the following.

- The distribution channel requires adapted front-ends with different service levels (e.g. access quality), prices, revenue models, and tailored products/services. A pupil, e.g., needs a simple version of Office 365 with a low price and without a service level meaning a best-effort access. In contrast, businesses demand require very sophisticated versions that include all products within Office 365 with a well-defined SLA, which facilitates premium pricing.
- Setting up customer relationships induces acceptable terms and conditions for each segment. As seen in the previous example, a price differentiation between consumer and business markets is advisable.

Concerning the *exploitation of manifoldness* we identified the following.

- Beyond up-/cross-selling between BMs by the overarching broker, up-/cross-selling potentials between different versions are to be exploited. To remain in the example of Office 365, a user that already uses Word in Office 365 will be offered Excel. Further, if a user uses the basic version of any Office 365 product, a premium version is offered.
- Manifoldness of customers allows for a cross-subsidisation between different user types. Reducing prices for private consumers requires to raise prices in other customer segments to cross-finance and to keep profit up.

The **value propositions** are, on the one hand, the impacts that customer differentiation has and, on the other hand, the offering of specific software versions. Concerning the *impact of differentiation* we identified the following.

- If the ecosystem grows, a community will be built up that will bind customers to Helix Nebula. Taking the first mover advantage of a cloud computing marketplace explicitly for science has the benefit of customer loyalty. For this, a growing number of attractive cloud computing services for science and education have to be offered on the HN platform.
- A differentiation between guaranteed (premium) access for profit organizations and an opportunistic (best effort) access for non-profit organizations is an option. The example of AWS shows that best-effort clouds with narrowly defined SLAs (Leong et al. 2012) can be very successful even though the opposite is expected. Yet, enterprise class offerings require premium SLAs.

- The market either offers generic low price or customized enterprise cloud services, but HN would offer tailored solutions for science and education. So far, research and education are not explicitly covered by marketplaces. This gap is closed by HN and experts remarked that this is a good model to gain a foothold in the highly competitive market.

Concerning the *specific software versions* we identified the following.

- To start with, the existing service portfolio including, e.g., Hadoop, ROOT, Office 365, and Matlab are to be versioned. An example of Office 365 was explained previously.
- The support of administrative tasks (document handling) with several versions was explicitly pronounced by the HN demand side. For example, Cern asks for an Oracle based service to support its electronic document handling system that would supersede its own internal web-based e-business application for procurement and human resource management. Thus, versions of oracle with customization services are an option.

This BM states the first strategic move towards the last desirable BM “Worldwide All-In-One Enterprise Cloud” by extending the customer segments at least within science and education. We see potential **customers** in consumer, business, and administration markets. Potential consumers (B2C) are the “long tail” of private research, pupils, and students. But also businesses (B2B) have research departments of considerable volume, e.g. manufacturers, strategy consultancies, financial service providers, and health companies. The core customer segment remains the public sector (B2A) with universities, military research, and schools. The support of military research, of course, requires sophisticated compliance guidelines.

### 3. Value capture

On the **cost** side we identified the following.

- Versioning and mass customization requires market research on an ongoing basis. The tailoring of offers managed by a role to be assigned is a non-trivial effort. “Mass customization is a business strategy that aims to fulfil individual customer needs at a cost level that enables the firm to target a relatively large part of the market of a similar standard product” (Abdelkafi 2008). The definition of different versions per service and the assurance of interoperability between certain versions of different services are technically and financially sophisticated. “IT services – and in particular Cloud computing services – are currently not offered in a mass customization fashion. Consumers either are faced with the effort of building a service customized to their needs themselves or can select a more or less appropriate off-the-shelf Software-as-a-Service offer” (Haak 2013). After having gained experience in the scientific environment within the first BM, it is one option to enlarge the product portfolio through customization for science and education in this BM.
- As explained and quantified in the first BM “Generic Cloud Computing for European Science”, platform costs (libraries, languages) and infrastructure costs (virtualization, servers, storage, networking, electricity, licensing) are extremely high recurring costs.
- As explained and quantified in the first BM “Generic Cloud Computing for European Science”, the key activities R&D, tool development & integration, continuous technology updating are to be considered.

- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. The exact effects of this specific broker role are explained in criterion eight. We assess a percentage to be the right incentive for the role holder, because if he performs well, his revenues will grow, as well.

On the **revenue** side we identified the following.

- The core idea of this BM is that customized and industry-specific offerings allow higher prices and lead to more customers. This is in accord with the experts' opinion received off the record during the evaluation.
- Initial non-profit customers may contribute scientific research results and pay-what-you-want revenues for unused capacity. Especially research exclusively funded by governments should initially be enabled to consume on a non-profit basis. At some stage they gain commercial organisations' attention, which increases HN's customer base and increases profitability. In order to gain such customers from the beginning, they could work on unused capacity and pay what they want which is a pricing system where buyers pay any desired amount for a given commodity, sometimes including zero. Yet, it is advisable to set a minimum price, in some cases, and/or define a suggested price as guidance for the buyer (Gassmann 2012). In addition, researchers can contribute their research results.
- Common models are pay-per-use, subscription, and bidding as explained in the revenue section of the first BM "Generic Cloud Computing for European Science".
- Paying for data storage with free computing power for the first six months is an initial motivator for new customers. Of course, there has to be the constraints to filter out customers that intensively use compute capacities without storing their data on HN's infrastructure.

#### 4. Risks

Without a specific broker role that finds new partners and defines versions the HN marketplace faces the risk, that the process of defining different versions per service and the assurance of interoperability between certain versions of different services proceeds uncoordinated both from a business and a technology point of view. In this case, the danger of not covering initial investment costs is unnecessarily increased.

#### 5. Investment costs changes

On top of the investment costs that are necessary in the first BM "Generic Cloud Computing for European Science" as described in deliverable 7.1, the initial versioning and customization and the therefore required communication between suppliers increase investment costs.

#### 6. Switching costs changes

No influence of this BM was identified.

#### 7. Non-transparency changes

No influence of this BM was identified.

## 8. Design challenges

This BM does not address any specific challenge explained in the analysis phase (cf. chapter 3.2).

## 9. Specific broker role

This BM requires a specific broker role that finds new partners and defines versions. By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs are decreased for each supplier. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. Of course, savings through the role have to justify its costs.

As the definition and communication of interfaces for service bundles towards all marketplace partners is provided centrally, the participation in new bundles resp. the compatibility of services is increased which has positive effects on the revenue. In case the role is implemented, the partnership needs to justify and ensure that no cartel-like behaviour is applied. The law broker with specialised law personnel is the appropriate instrument. Bilateral arrangements are possible, yet, it is thoroughly more complicated. For the same reason, switching costs within HN are lowered for customers. As an example, we imagine a customer that runs an Oracle solution on Windows Server instance with 16 GB RAM Quad-Core infrastructure. If this customer decides to switch from Oracle to SAP, the interoperability with Windows Server and the underlying infrastructure must be ensured.

Initial investment costs are slightly increased as the role needs to be exactly defined and assigned. But once established the investment costs for the enablement of versioning and customization are lowered for each supplier because requirement definitions are communicated centrally instead of bilaterally.

## 10. Expert evaluation

The **impact** of this BM was valued high with 3.8 (cf. figure 26). Looking on the worst value in this dimension which is the customers' medium acceptance of the subjectively perceived effort to migrate to a cloud as sourcing solution, we have to acknowledge that customers are still worried about migration work and entrance barriers, yet not on a deal-breaking level, but it is a serious factor in decision making concerning cloud sourcing. Within the impact dimension, the customer need stands out positively, just as it does in the "Generic" BM. Its value 4.3 is high, yet not as high as the "Generic" BM's very high value. The reason is, that there is a shift in data volumes between truly big science organisations and ordinary university and business research.

The **ease of implementation** was valued neutral with 3.0. Actually all criteria values are at least satisfying if not positive, only the onetime costs are on a critical level. As promising versioning and customizing cloud services by enabling service bundles is, as difficult is its realization from a business and technology point of view. On the one hand, fitting service components and bundles that meet customer needs are to be defined; on the other hand, the technical interoperability is not easy to be assured. Yet, the positive value of

feasibility and conflict with suppliers tell, that it is objectively possible with today's knowledge and there are no major conflicts with suppliers' strategies, organizational structures or processes.

We clustered the experts' **remarks** on the BM with the following outcome. From an impact point of view, experts' evaluation of this BM was close to the "Generic" BM. Only the technical and financial efforts for establishing versions were experts' reason for lowering onetime costs to critical, which is the only worrying criterion. Yet, as HN is supposed to ultimately pave the way for a cloud computing platform for governments, businesses and citizens, experts acknowledged the inevitable requirement to broaden HN's offerings step by step. A first step is the inclusion of the entire world of science and education with all its customer groups.





### 4.3.3 Brand Management

#### 1. Specifics

With the first two BMs being successful, a brand may develop and be exploited. Above all, this is of great interest as the online advertising market for cloud computing is estimated to have a current volume of \$65-billion (Merrill Lynch 2013). Further, other cloud computing providers might raise interest to participate on the HN marketplace and donators might be attracted by new science paths (cf. figure 27).

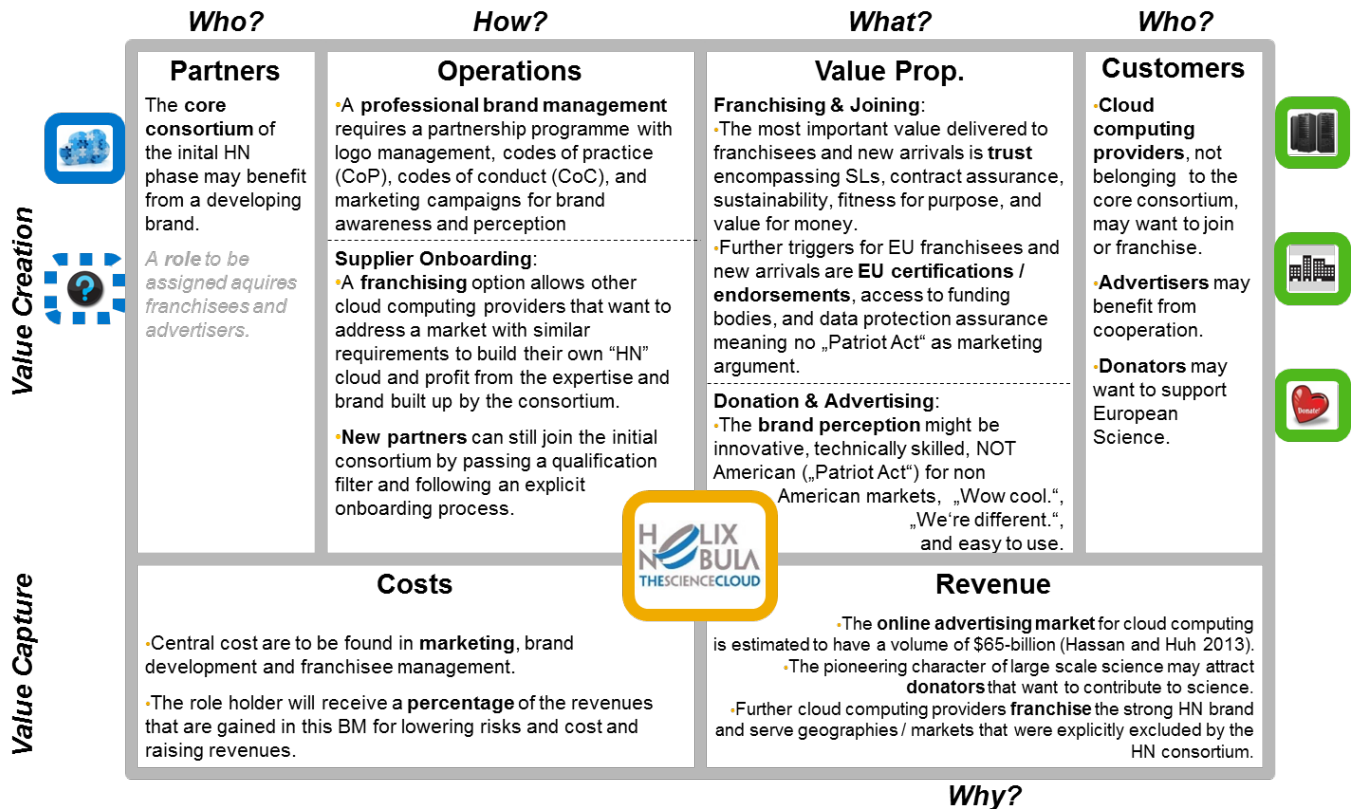


Figure 27 Brand Management

#### 2. Value creation

The value is created by **partners** from two categories.

- The initial consortium of I/P/SaaS as explained in the first BM remains at the core.
- A role to be assigned manages the acquisition, onboarding, and central technical administration of franchisees, advertisers, and donators. More information concerning the role is presented in description criterion eight.

The **operations** need to cover both a professional brand management and the onboarding of franchisees resp. new HN partners. Concerning the *professional brand management* we identified the following.

- A brand management requires a partnership programme with logo management, codes of practice, codes of conduct, and marketing campaigns for brand awareness and perception. Logos are interesting for marketplace partners to identify their participation in the HN programme on their website or in their own offline materials (e.g., in any printed material, mailing, or other document), as well as business cards, trade show booths, sales material, etc.

The brand perception of HN will lie in each partner's responsibility. In extreme cases one black sheep can be enough to damage an entire brand. In order to reduce this risk, a code of conduct provides a set of rules, principles, values, or standards of behaviour "... that guide the decisions, procedures and systems of an organization in a way that (a) contributes to the welfare of its key stakeholders, and (b) respects the rights of all constituents affected by its operations" ("[Defining and Developing an Effective Code of Conduct for Organizations](#)" 2007). As especially cloud security is a critical adoption factor, we advise that each marketplace partner should possess a code of practice that provides practical guidance for staff that ensures the cloud security how to achieve the standards required and about effective ways to identify and manage server farm and connection risks.

All of these achievements have to be extraverted to the market by lean and effective marketing campaigns.

Concerning the *supplier onboarding* we identified the following.

- A franchising option allows other cloud computing providers that want to address a market with similar requirements to build their own cloud consortiums or marketplaces and to profit from the expertise and brand built up by the HN consortium. It is important to understand that such consulting services are only offered to marketplace founders that want to serve geographies and markets that were explicitly excluded by the HN consortium. Otherwise own potential competitors would be supported. For example, the final step of offering enterprise class cloud services might not be realized. In this case, other cloud providers that want to address business markets can buy HN's knowledge.
- New partners can still join the initial consortium which is the basic idea of a marketplace. For this, they need to pass a qualification filter and follow an explicit onboarding process. The qualification filter encompasses a few selection criteria that are required to keep the level of quality high and to concentrate on science. Speaking for software services, it should be mature software that meets science and education needs and that has been publicly available for a certain time (AWS's minimum time is nine months). The service should fit in one of the predefined supported categories. A strong track record of customer satisfaction and customer support with a minimum number of reference-able customers is also advisable. Further criteria are strong and clear business operations and ethics, current and virus-free software on an ongoing basis and the enablement of hosting their services on HN infrastructure. The code of practice for security also has to be examined.

Within the onboarding process new partners will be made aware of the code of conduct and overarching broker roles providing services for HN as explained in chapter 4.2.

The **value propositions** are, on the one hand, the opportunity of franchising in geographies and markets of no interest to HN resp. joining HN itself and, on the other hand, a donation and advertising platform. Concerning *franchising and joining* we identified the following.

- “A thriving large franchisor corporation is able to offer its franchisees an extremely large reservoir of resources. Experience and expertise covering all facets of business acquired from years of successful operation are two of the most critical resources franchisees gain from their relationship with their franchising entity. The typical large franchising corporation is able to offer marketing clout from name recognition in the relevant market. This is a resource that a smaller business would not be able to access otherwise” (Gerhard et al. 2011).
- The most important value delivered to franchisees and new arrivals is trust encompassing SLs, contract assurance, sustainability, fitness for purpose, and value for money. This means that the core value *trust* - which is essential in cloud sourcing - is either bought in franchising models or generally accessible to all cloud providers that passed the qualification filter.
- Further triggers for EU franchisees and new partners are EU certifications and endorsements, access to funding bodies, and data protection assurance meaning no „Patriot Act” as a marketing argument. EU certifications and endorsements are desirable as they guarantee that a cloud service provider complies with legal, security, and data protection requirements. According to a study on likely non-adoption factors of cloud computing by the European Commission (EC) these three factors were identified to be the major obstacles. For this reason the EC establishes a list of voluntary certification schemes by 2014 (“EC Cloud Certification Expert Group” 2013). The complete study which we highly recommend reading researches on “Quantitative Estimates of the Demand for Cloud Computing in Europe and the Likely Barriers to Up-take” (2012).

As explained in the revenue section of the overarching broker roles, the EC and the European Research Council allocate funding bodies. The participation in HN or the expansion of the concept by franchising might raise the chances of an application for funding as HN is a project initiated by the EU itself.

The great trump of European cloud service providers is the non-applicability of the USA Patriot Act. The provisions of the Patriot Act allow U.S. authorities including the FBI, the NSA, or the CIA not only access to the servers of US companies without a warrant. Foreign subsidiaries are under U.S. law to grant access to their servers, even if local laws prohibit it. The HN partner network and marketplace might be connected strongly to this advantage which is one reason for other technology organisations to establish further marketplaces with this value proposition or to join the HN marketplace.

Concerning *donation and advertising* we identified the following.

- The brand perception might be innovative, technically skilled, *not* American (no Patriot Act) for non-American service providers, „Wow cool“, „We’re different“, and easy to use. Organisations that see similarities between their product resp. service perceptions and the HN brand could advertise on HN’s front-ends. As marketplaces are usually heavily frequented, actually anybody might be interested in advertising there. Donators might be motivated to give money in order to be associated with the explained brand perception and, more important, with the visionary way of changing science and developing cutting edge big data science approaches.

Three **customer** groups are addressed by this BM.

- Cloud computing providers, not belonging to the core consortium, may want to join or franchise. Joining means that new cloud service providers cooperate with all HN marketplace partners and broker roles to ensure the interoperability of all services and then offer their services on the marketplace. Franchising means that marketplace founders that want to serve geographies and markets that were explicitly excluded by the HN consortium can use the HN brand and profit from HN's partners' knowledge in founding marketplaces.
- Advertisers may benefit from cooperation as they can locate their advertisements on HN's front-ends. We talk about front-ends in plural as some of the suggested BMs have distinct front-ends. For example, the science cloud marketplace and the following BM "Information as a Service" that sells data and knowledge should be designed differently as they address different customers (in case both BMs are implemented by HN).
- Donators may want to support European Science attracted by the brand and/or the visionary way of improving science by applying large scale data processing in the cloud.

### 3. Value capture

On the **cost** side we identified the following.

- Central costs are to be found in marketing, brand development and franchisee management. Marketing is necessary to transport all the BM's value propositions to the potential customers. To oversimplify it, marketing is rather the tactical effort of actively promoting services, whereas brand development is the strategic effort to establish conscious or subconscious associations with the brand without explicitly saying "Buy our product!" Heaton (2011) found good words to differentiate marketing and branding: "Marketing may contribute to a brand, but the brand is bigger than any particular marketing effort. The brand is what remains after the marketing has swept through the room. It's what sticks in your mind associated with a product, service, or organization—whether or not, at that particular moment, you bought or did not buy." As cloud marketplaces are not known as sourcing solution to a great public, HN still has the chance to change this and build a first true cloud computing brand. The explained offering of an extremely large reservoir of resources, experience and expertise covering all facets of business requires the definition and assignment of processes to cope with franchising operations well which causes investment and recurring costs for the HN suppliers.
- Without an explicit broker role, each HN supplier has to establish and maintain his own marketing for HN which includes bilateral communication between all suppliers to coordinate marketing campaigns and the overall branding strategy.
- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. The exact effects of this specific broker role are explained in criterion eight. We assess a percentage to be the right incentive for the role holder, because if he performs well, his revenues will grow, as well.

On the **revenue** side we identified the following.

- Consumers increasingly use online media to find information, products, and services. Thus, firms are motivated to spend more of their marketing budget online (Kireyev et al. 2013). The online advertising market for cloud computing is estimated to have a volume of \$65 billion (Hassan and Huh 2013). Worldwide digital advertising spending passed the \$100-billion mark for the first time last year and will increase by a further 15.1% in 2013 to \$118.4 billion. In 2012, the actual value was \$103 billion, or about 20% of total money spent on advertising, and is expected to increase to \$163 billion, or 25% of total advertising spend, by the end of 2016. These and further important data were researched by eMarketer (2013). In 2012, almost half of all digital ad dollars worldwide were spent on paid search, and 38% were used for display ads (ZenithOptimedia 2012). If cloud computing marketplaces turn out to be as highly frequented as other marketplaces, this revenue stream alone justifies the realisation of this BM.
- The pioneering character of large scale science may attract donators that want to contribute to science. The key ideology of donations in the area of science is: “You donate to science. Science donates to you” (Science Donations 2013). This may sound idealistic, but as history shows, many important progresses of mankind wouldn’t have been possible without generous donators behind scientists. Many people understand this and want to contribute for exactly this reason. In four of the seven evaluated BMs the addressed customer is science and in the first BM specifically big European science. As science approaches are improved by large scale data capture, processing, analyses, and archiving the position that science donated back can be taken up confidently. In particular the BM “Information as a Service” will provide a game-changing way of knowledge gathering by enriching research data from different data providers in its context.
- Further cloud computing providers pay franchise fees in order to utilize the strong HN brand and serve geographies and / or markets that were explicitly excluded by the HN consortium. Three revenue streams are possible within franchising.
  - Purchasing costs: The franchisee must pay a franchise fee and a security fee initially.
  - Recurring costs: On a monthly basis, a rent fee (about 10 per cent) and a service fee (about 5 per cent) are given away based on monthly revenue.
  - Onetime service costs: The knowledge of establishing a marketplace is rare down to the present day. Thus, HN could offer consulting services in this area once a sufficient experience has been made.

#### 4. Risks

Yet, as the experience is low so far in franchising cloud computing marketplaces the risk of failure is high. This is a classic case of leadership risk.

#### 5. Investment costs changes

On top of the investment costs that are necessary in the first BM “Generic Cloud Computing for European Science” as described in deliverable 7.1, each HN supplier has to establish the markets for franchising, ad-



vertising, and donations himself in case there is no explicit broker role. Further, an onboarding process for new partners within the existing HN marketplace resp. consortium must be provided. The initial defining of business and technology requirements, as well as the process definition are further initial onetime costs. Again, if no explicit broker manages this centrally, each supplier has to define and implement an own onboarding process resp. the bilateral communication costs and risk of non-reliability and inconsistencies both in business and technology adaptations will be significant.

## 6. Switching costs changes

No influence of this BM was identified.

## 7. Non-transparency changes

No influence of this BM was identified.

## 8. Design challenges

This BM offers a solution from a BM and governance point of view for the design challenge 8 as explained in the analysis phase (cf. chapter 3.2).

- (8) **Supply side expansion:** A defined core team of suppliers establishes HN. Yet, a governance structure to incorporate further suppliers needs to be found. This brings opportunities of new revenue streams. In a next step, data context enrichment and supply side expansion might turn more lucrative and enrich the service portfolio, if non-European partners like the NASA or the GNU operating system will be admitted. Both for European and Non-European partners, models for their incorporation are required in case of an approval for non-European partners. The onboarding and franchising by a central broker role offers one possible solution.

## 9. Specific broker role

This BM requires a specific broker role that defines a central onboarding process for new partners both from a business and technology point of view including the operational execution of an onboarding of new partner. It further acquires franchisees in other markets/geographies, advertisers, and donators. The management of these business relations is also provided centrally by the role. We put special emphasis on consulting services for franchisees and onboarded partners.

By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs decrease for each supplier. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and costs. Of course, savings through the role have to justify its costs.

There are only slight positive effects on revenue as the central service provision for franchisees and new partners might attract more of them. Yet, the risks compared to having no broker role might be lowered significantly as the market creation and the onboarding process definition proceed consistently. Bilateral arrangements are possible, yet, it is thoroughly more complicated.



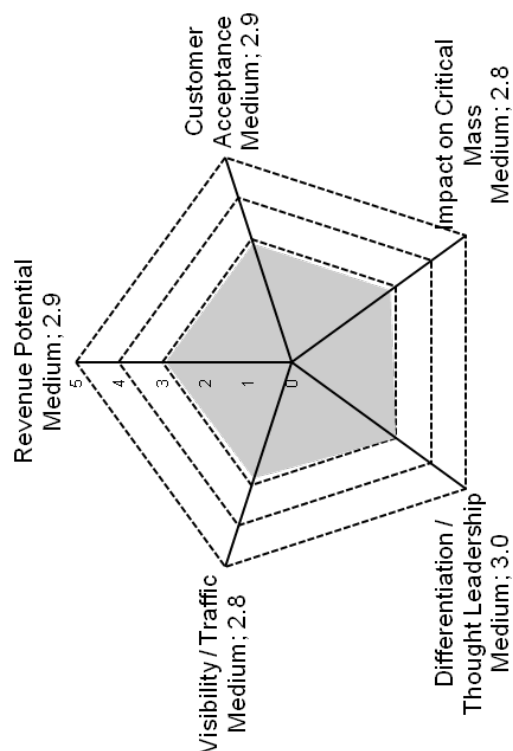
## 10. Expert evaluation

The **impact** of this BM was valued medium with 2.9 (cf. figure 28). The values of all impact criteria are in a medium range between 2.8 and 3.0, which as such is not alarming. The question is which effort is required to enable this medium impact.

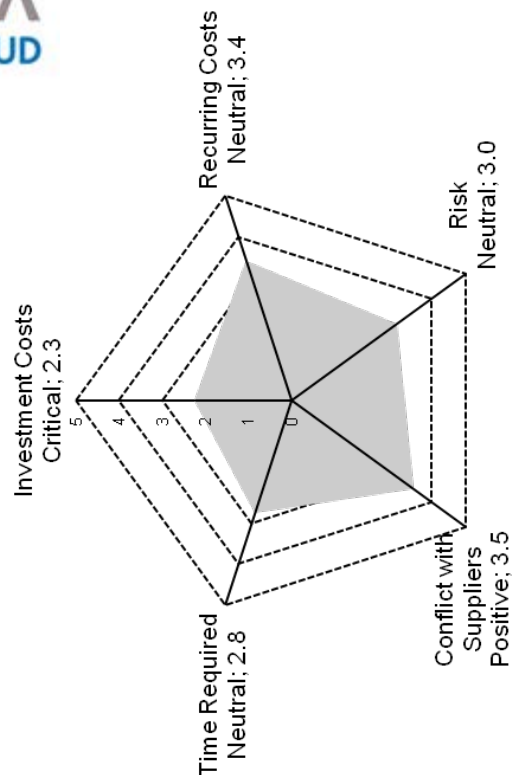
The **ease of implementation** was valued neutral with 3.0. The distribution of values within this dimension is slightly more unequal. Except for onetime costs and conflicts with suppliers all criteria are on a neutral level. The onetime costs are on a critical level with the value 2.3. The reasons are both a technically demanding onboarding process definition and the expenses for marketing and brand development. Displaying ads and collecting donations, naturally, were not evaluated to require high onetime costs. But once established the BM's recurring costs were evaluated to be neutral with a tendency to even positive. Relatively seen, the most positive value is the conflict with suppliers. They see no general conflicts with their strategies, organisational structures, and processes.

We clustered the experts' **remarks** on the BM with the following outcome. Compared to the other BMs, this model was judged to have the lowest impact especially caused by the lowest customer need. It might be interesting for other cloud computing providers, advertisers, and donators to participate in this BM, but experts estimate the critical mass of them to be medium. Further, the incorporation of further partners into HN causes critical onetime cost. The brand exploitation through advertising and donations is merely riskless and easily implemented. Most important – as described in the revenue section – the online display advertising market can be very profitable. Whereas, the implementation of franchising is rather difficult for technological, geographical, and juridical issues and will be tedious. All in all, the exploitation of advertising potentials and the selling of cloud brokerage knowledge via consulting services should be considered seriously.

## Impact of Option



## Ease of Implementation



Impact	Criterion		Revenue Potential		Customer Acceptance			Impact on Critical Mass		Differentiation / Leadership		Visibility / Traffic		Result	
	Weighting	Value		Need	Effort		Security								
			0.3	0.2	0.05		0.05		0.2	0.1		0.1		1	
			medium	2.9	medium	3.3	medium	3.1	medium	3.0	medium	2.8	medium	2.9	medium
Ease	Criterion		Costs		Risk			Conflict with Suppliers		Time Required		Result			
	Weighting	Value	Onetime	Recurring	Feasibility		Expertise								
			0.2	0.2	0.2		0.1		Legal	0.1	0.1	0.1	1		
			critical	2.3	neutral	3.4	neutral	2.7	neutral	2.6	positive	3.5	neutral	2.8	neutral

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 28 Expert Evaluation of "Brand Management"

## 4.4 Future Business Models

So far we explained initial BMs that are based on the needs of European big-science and open to a broader customer base in science and education including the management of a developing brand. Now we move to BMs that ultimately pave the way for a cloud computing platform for governments, businesses and citizens which is a defined vision (*"Helix Nebula Vision" 2013*).

### 4.4.1 Information as a Service

#### 1. Specifics

Capturing, processing, analysing, and archiving of highly attractive data from ESA and EMBL provides the opportunity to cooperate with further data providers in order to enrich the data in its context. The selling of resulting data sets and knowledge is evaluated as the most promising BM in terms of market need, impact on critical mass, differentiation, and thought leadership. Yet, the required time for implementation is long (cf. figure 29).



Figure 29 Information as a Service

#### 2. Value creation

The value is created by **partners** from the following categories.

- The confirmed data of the three flagships (CERN, ESA, and EMBL) is the basis for context enrichment. ESA already offers free and restrained datasets free of charge and explicitly pointed out its wish to offer their data to an even greater public. Within its earth observation activities the Earth's environment is monitored which enables a reliable assessment of the global impact of human activity and the likely future extent of climate change (cf. appendix figure 13). Data concerning the Earth topics agriculture, atmosphere, solid Earth, water, land, oceans and coasts, snow and ice, and natural disasters is available (["ESA Earthnet Online" 2013](#)).  
"EMBL has joined the Global Alliance, a large-scale, international effort to enable the secure sharing of genomic and clinical data. The Global Alliance invites commercial and not-for-profit organisations to join forces with other leading data, health care, research, and disease advocacy organisations to establish an evidence base for genomic research and medicine ..." ([EMBL Internet presence 2013](#)). David Altshuler, Deputy Director of the Broad Institute of Harvard and MIT in the US, explained that "the ability to collect and analyse large amounts of genomic and clinical data [presented] a tremendous opportunity to learn about the underlying causes of cancer, inherited and infectious diseases, and responses to drugs" ([EMBL Internet presence 2013](#)).  
Alone the combination of geographical and medical data might turn out to be of high need and revenue.
- Yet, in order to make the BM even more interesting further providers' data sets should be acquired and incorporated. Examples are the UNESCO Institute for Statistics (UIS), the World Bank, or the OECD. The UIS, e.g., is a source for cross-nationally comparable statistics on education, science and technology, culture, and communication for more than 200 countries and territories ([UIS Internet presence 2013](#)). Beyond public available data, commercial data providers are also to be considered.
- The technology is provided by the HN partners. The actions of capturing, processing, analysing, and archiving data are conducted on HN's I/P/SaaS. The initial consortium of I/P/SaaS was explained in the first BM.
- A data broker role to be assigned acquires, standardizes, and combines the data coming from diverse data partners. More information concerning the role is presented in description criterion eight.

This BM's **operations** need to cover both the expansion of further data partners resp. data customers and data processing requirements. Concerning *partner and customer expansion* we identified the following.

- The finding and binding of further valuable data providers of e.g. financial data is a key success factor. In a first step statistic institutions like the World Bank or Eurostat that offer publicly available, high quality and broad range data could be new partners. Prospectively, a distinction of those data providers will only be possible upon the following conditions. (a) Commercial organisations must contribute their data exclusively to HN and (b) the offerings should not simply be sold in parallel, but rather in a context enriched way.

For point (a) we think of research departments of global concerns. Deutsch Bank Research for example focuses on macroeconomic analysis, economic policy issues in Germany and Europe, global research on the financial sector and its regulation, and natural resources - risks and opportunities, ensuring future supply ([DB Research 2013](#)). McKinsey Global Institute is a further example of data that might be im-

portant to complete the comprehensiveness of data services. Data on financial markets, labour markets, natural resources, productivity, competitiveness, growth, technology, innovation, and urbanisation are collected (McKinsey Global Institute 2013). Yet, cooperation with such high-end partners requires incentives that go beyond money as those organisations will not simply sell their most important strategic weapons which are their data and knowledge. “Ingredient branding” as explained in the following bullet might offer a solution.

Coming to point (b), the great strength of this approach is the recombination of data which reveals and contributes completely new causalities to the knowledge base. Therefore, persons that know to ask the right questions are required. Their questions will show which data should be combined. These are extensive product and service management efforts.

- According to the expert evaluation extensive marketing is necessary and worthwhile as the “ingredient brands” ESA and EMBL are expected to raise high interest and attention. The risk of losing leadership advantages by not advertising on this kind of service is too high. Ingredient branding is an appropriate BM pattern and marketing technique in order to create sustainable partnerships as well as establishing and maintaining unique selling propositions. It describes the branding of a product that will no longer be available on its own but only as an ingredient of another product (Gassmann et al. 2013). If, for example, the data of Deutsche Bank Research is only exclusively available through the HN channel, a win-win-situation emerges. On the one hand, Deutsche Bank Research data reaches the level of an ingredient brand as its data can only be sold as an “ingredient” of context enriched data. On the other hand, HN attracts more customer as it exclusively sells high quality data. However, in case a data partner insists of selling his data in parallel in its original form, there should not be a negation.

Concerning *data processing* we identified the following.

- Selling enriched structured data sets requires a data warehousing approach integrating data from one or more disparate sources encompassing structured, semi-structured, and unstructured data. The data stored in the warehouse are uploaded from various virtual storage areas of customers that host their data centres on HN. The efforts of continuously extracting data from outside sources, transforming it to the used data model, and loading the data to the data warehouse are considerable. Yet, the following benefits and the associated business opportunities might be worth the efforts.
  - The data quality is improved by providing consistent codes and descriptions, flagging or even fixing bad data.
  - A single common data model for all data of interest regardless of the data's source is enabled.
  - The data can be restructured so that it makes sense to the business users and so that it delivers excellent query performance, even for complex analytic queries (Ponniah 2010).
- The more profitable option is selling knowledge. This induces analytics using data mining methods. Common used methods are at the intersection of artificial intelligence, machine learning, statistics, and database systems. Knowledge is a broad term. The required operations to synthesise knowledge depend on the desired outcome, the amount of data, and the data quality.



- Data with high quality are structured data sets with high information density as generated and explained in the above data warehousing-section. As it requires huge efforts to reach such a data quality, the quantity remains manageable. Business intelligence solutions using descriptive statistics are used to measure the data and to detect trends.
- If data sets' volume and complexity exceed the abilities of commonly used tools big data approaches are required. The term big data is still very vague in its definition, yet the characteristics volume, variety, and velocity are used to define it (Zikopoulos et al. 2012).

The **value propositions** are, on the one hand, double-sided improvements both for data partners and data buyers and, on the other hand, the unique strengths of this BM. Regarding the *double-sided improvements* we identified the following.

- As data is accessible to a greater public, researchers' problems of identifying missing research instrumentation and research questions can be mitigated. As researcher and data provider you are always confronted with the question what is the right thing to research and gather data of. The more people can use the data, commercially or non-commercially, the more feedback will come back and the easier the task of asking the right questions will become.
- Core business improvement is achieved by new data sets and knowledge concerning issues like urban development, disaster reduction research, teaching material, military movements, soil moisture etc. Generally, this value proposition bases on the fact that the more you know the more you can change. Siemens, e.g., has the business unit "Infrastructure & Cities" whose success heavily depends on strategic knowledge about city development. ESA's data is predestined for this scenario because if high resolutions pictures are taken over a time line on an ongoing basis, new insights will be possible.

Concerning the *business model strengths* we identified the following.

- Being evaluated with highest "impact on the market" among all BMs, the opportunity for a differentiated, thought-leading platform for data and knowledge sale truly exists. This is a value proposition as a central data and information point provides easier access and better knowledge quality. E.g., if a customer researches a correlation between weather and congestion, he would have to ask (a) one data provider that offers weather data for the required locations and times (b) one data provider that offers congestion data for the same locations and times. On such a platform, the effort of searching at several suppliers and standardising the data in order to combine it is obsolete.
- Easy data and tool access yields in community growth. As explained above, the obsolescence of efforts to find and combine data might become obsolete or will at least be lowered as a central access point gathers many required data. E.g. if a researcher is attracted by the improved simplicity, word-of-mouth-advertising will be the consequence which might cause a swap to consumer markets.

The following **customer** groups are addressed by this BM.

The businesses sector including manufacturing, strategy consulting, financial sector, health sector, or the oil industry etc. and the public sector including universities, military, governments, or schools etc. are cus-



tomers expected to have a very high need. The explanation of this statement and an example is to be found in the second bullet point within value propositions.

### 3. Value capture

On the **cost** side we identified the following.

- Infrastructure cost (virtualization, servers, storage, networking, electricity, licensing) are extremely high recurring cost which was explained and quantified in the first BM “Generic Cloud Computing for European Science”.
- Staff costs for data standardization, context enrichment, and mining also appear recurrently. Both the approach of consolidating data with warehouses and the approach of analytics running on those data sets require considerable efforts. E.g., let us take a look on setting up an Oracle data warehouse system. One needs to prepare the hardware environment by sizing and configuring his hardware. Then the oracle database software must be installed and optimized for using a data warehouse. Next, you need a data integration product, which is in Oracle’s case the Warehouse Builder software. Those costs were solely the investment costs for software.
- Especially the exploitation of a first mover advantage causes high initial onetime costs for marketing campaigns. This BM has achieved high and very high values within the impact dimension. But in order to make the market aware of new value propositions, marketing and branding is required. As explained in the BM “Brand Management”, marketing and branding are phenomena partly based on psychology and hard to structure as well as expensive to place. E.g., the core value proposition of core business improvements through better data quality deserves highly frequented advertising spaces.
- Without an explicit broker role, each HN supplier has to establish and maintain the knowledge and technologies for data warehousing and analytics including big data itself. Further, the data provider acquisition costs are higher than provided centrally.
- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost as well as raising revenues. The exact effects of this specific broker role are explained in criterion eight. We asses a percentage to be the right incentive for the role holder, because if he works well, his revenues will grow, as well.

On the **revenue** side we identified the following.

- Transaction-based services are of interest for onetime needs. Some customers have onetime data, information, or knowledge demands and do only want to pay onetime for this specific demand. E.g., an academic research project that requires data to test a newly developed model would not be interested in updates on an on-going basis over months or even years.
- Premium subscription ensures updates to follow latest data. Other customers especially within the business environment require updates concerning their data, information, or knowledge demands as they want to ensure competitive advantages by improving products and services continuously. E.g., Siemens’ business unit “Infrastructure & Cities” wants to follow urban development on an on-going monthly basis.

- Crowd sourcing allows for data provisioning by anybody. Any data collection provided by individuals may contribute to the information pool. On the one hand, this includes structured data that was purposefully built and is given to the platform actively. On the other hand, anonymised unstructured data sets gathered from each individual's footprint contribute to knowledge increase. E.g., potential sources for such data may be social networks like Facebook or digital marketplaces like Amazon.
- Data enrichment could be triggered by free or low price cloud access if data is made available to be aggregated and sold. This represents a win-win-situation again. Customers from business, consumer, or administration markets can even more lower their IT sourcing costs, on the one hand. HN benefits from even more data, on the other hand. Additionally, this might state an access to data that would not be accessible otherwise. E.g., if a consumer consents to unveil parts of his purchase history at Amazon, he gets decent deductibles on cloud costs.

#### 4. Risks

- As well as franchising cloud computing marketplaces as explained in the BM "Brand Management" (cf. chapter 4.3.3), this BM holds leadership risks. Providing data sets and knowledge on this scale is an issue that was discussed a lot, but no one actually ever tried to start doing it commercially. Intelligence agencies, e.g. the American National Security Agency with its "PRISM" project, indeed have technological experience, but as it was financed with tax money, business model experience is missing.
- It is also problematic that the final commitment of ESA, CERN, and EMBL to make their data available to be aggregated and sold is still missing. As the realisation of this BM takes long and can only be started when such a commitment is legally confirmed, the leader opportunity decreases day by day. E.g., if AWS works on similar plans and is ready to market sooner, first mover advantages are lower or even obsolete.
- The most crucial point in the adoption of this BM are data security and privacy (Miller 2013). As the success of this BM depends on the willingness of data providers to host their data on HN's infrastructure, those two most critical factors of non-adoption need to be dispelled. E.g., as cloud computing is an internet technology, inaccessibility to the cloud is a very common fear.

#### 5. Investment costs changes

On top of the investment costs that are necessary in the first BM "Generic Cloud Computing for European Science" as described in deliverable 7.1, the following investment costs appear.

- Business development of leader BMs is expensive. One simple question which is hard to answer explains the required investment costs. Which customer is willing to pay how much for which kind of data, information, or knowledge? E.g., an initial market analysis to answer this question raises the investment costs.
- But also the technical development influences the investment costs. As explained above, the setup of data warehousing technologies and cohering processes for extraction, transformation, and loading of data from diverse sources is not trivial and might even include consulting services. One example is the

task of developing routines for data mapping which requires highly trained staff especially when integrating unstructured data.

## 6. Switching costs changes

Even if no central data broker will be assigned, a central data model can be defined which lowers switching costs within HN. If a customer obtains data from one HN supplier and decides to change to another supplier or add a further supplier, the switching costs are lower, as the new supplier is familiar with the data model the first supplier uses.

## 7. Non-transparency changes

No influence of this BM was identified.

## 8. Design challenges

This BM offers a solution from a BM and governance point of view for the design challenges 2, 4, and 5 as explained in the analysis phase (cf. chapter 3.2).

**(2) Data storage, management, and exploitation:** The outsourcing of those three tasks to a central data broker role offers a solution to these challenges and has a positive impact on costs, revenue and risks.

**(4) The “long tail” of science:** This customer segment is especially addressed within this BM as data sets are rare and very precious in science. During the evaluation experts remarked off the record that high prices are achievable for data sets even at public science.

**(5) Information to be published:** The required security process that ensures reliability of a potential data purchaser is established within this BM. It is necessary, as the data can be misused for military, intelligence, or terrorist actions. E.g., if the data supports countries that are ostracised by the United Nations Security Council a trade will be denied.

## 9. Specific broker role

This BM requires a specific broker role that acquires, standardises, and combines new structured, semi-structured, and unstructured data which is considered to be beneficial to the existing offerings. Key activities of this role are (a) central data warehousing to generate enriched structured data sets and (b) analytics to synthesise knowledge out of the data sets. Further, the role could manage the security filter as explained above on this page in design challenge five.

By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs decrease for each supplier. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and costs. Of course, savings or revenues through the role have to justify its costs.

Indeed, we see high revenue potential in assigning a role, because it enables the greatest strength of this BM which is the content/context enrichment of existing data. If there is no central broker role, data warehousing will not be possible and analytical methods are only possible for the isolated data sets hosted at

each HN cloud provider.

Risks of a leader BM, data commitment by data partners, and data security/privacy are lessened as central management enables a lean and fast management of those issues.

As the data broker role acts as an outsourcer, the HN partners will no longer be responsible for the out-sourced tasks which results in dropped investment costs.

The effects that this BM has on switching costs are intensified by setting up and assigning a role. The reason is the central data warehousing that offers data predicted to be interesting for customers from one consistent data model.

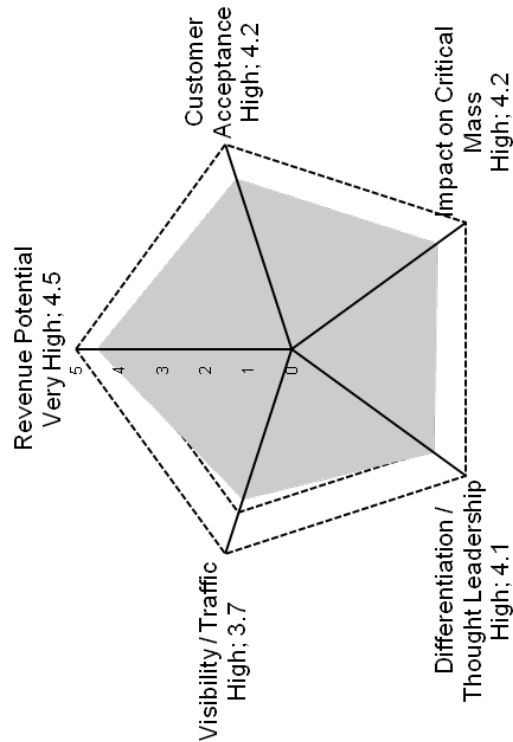
## 10. Expert evaluation

The **impact** of this BM was valued with 4.2 which is the highest value of all BMs. (cf. figure 30). The reason why this value is not even higher is the sub criteria effort and security within customer acceptance with the lowest values. The customers' subjective acceptance of the migration effort to new data sources is actually high with a value of 3.5. But there is a tendency to be medium. We interpret this to be a potential non-adoption factor for some customers. The same counts for the customers' subjective acceptance of security issues which is medium with a tendency to high. We derive that potential customers see the responsibility that some data sets bring along. As explained above the data can be misused for military, intelligence, or terrorist actions. HN's security process precludes this risk. But to keep that level of security, customers who buy data or knowledge must ensure the same security level of course, in case the data is downloaded to on-premise infrastructure. The best value in the impact dimension is the revenue potential. It was judged to be very high with a value of 4.5 which is the highest revenue potential of all BMs. The same counts for the customers' need of fast access to high quality data or knowledge. The revenue potential is that high, because there is no commercial offer on the market on this scale so far, even a lot has been talked about big data products and even the US National Security Agency with its "PRISM" project has proven that steps in this direction are possible.

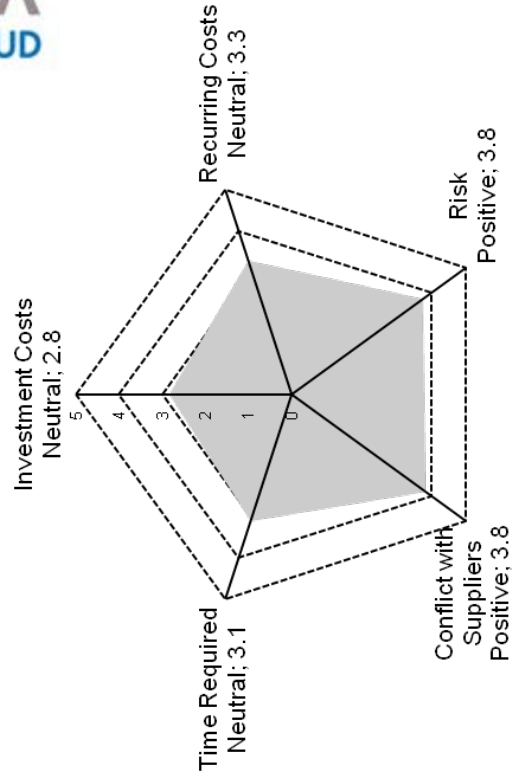
The **ease of implementation** was valued neutral with 3.4. The lowest values are (a) the neutral onetime costs with a result of 2.8 and (b) the neutral legal risk with a result of 2.8. These values aren't problematic by far, but relatively seen experts highlighted them to be potential obstacles on a neutral level. Concerning point (a) infrastructure investments to cope with the data volumes and the logic set up to deal with the data is expensive. Concerning point (b) the great responsibility of enriching data in its' context/content with all its risks shall be pointed out.

We clustered the experts' **remarks** on the BM with the following outcome. Both HN supplier experts and SAP experts were quite enthusiastic about this BM which is depicted in its very high revenue potential and its very high customer need. Selling enriched data sets and derived knowledge on this scale is a thought leading BM with a high differentiation and a very high revenue potential. Taking into account that experts are positive on objective feasibility and the required suppliers' expertise, we clearly advise to bear the critical onetime costs.

## Impact of Option



## Ease of Implementation



Impact	Criterion	Weighting	Value	Revenue Potential	Need	Effort	Security	Impact on Critical Mass	Differentiation / Leadership	Visibility / Traffic	Result
				0.3	0.2	0.05	0.05	0.2	0.1	0.1	1
			very high	4.5	4.5	high	3.5	high	4.2	high	high
			4.5	4.5	4.5	3.5	3.4	4.2	4.1	3.7	4.2
			4.5	4.5	4.5	3.5	3.4	4.2	4.1	3.7	4.2

Ease	Criterion	Weighting	Value	Costs	Feasibility	Risk	Conflict with Suppliers	Time Required	Result
				0.2	0.2	0.1	0.1	0.1	1
			critical	2.8	4.0	neutral	positive	neutral	neutral
			2.8	4.0	4.2	2.8	3.8	3.1	3.4
			2.8	4.0	4.2	2.8	3.8	3.1	3.4

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 30 Expert Evaluation of "Information as a Service"



#### 4.4.2 Application Crowd

##### 1. Specifics

The basic idea of this BM is to establish a marketplace where application users can outsource and “crowdsource” domain-specific development projects to thousands of developers from around the world (cf. figure). Application Crowd fixes the problems with the traditional development process including a slow turnaround, expensive rates, limited application options, uncertain results, and high risk.

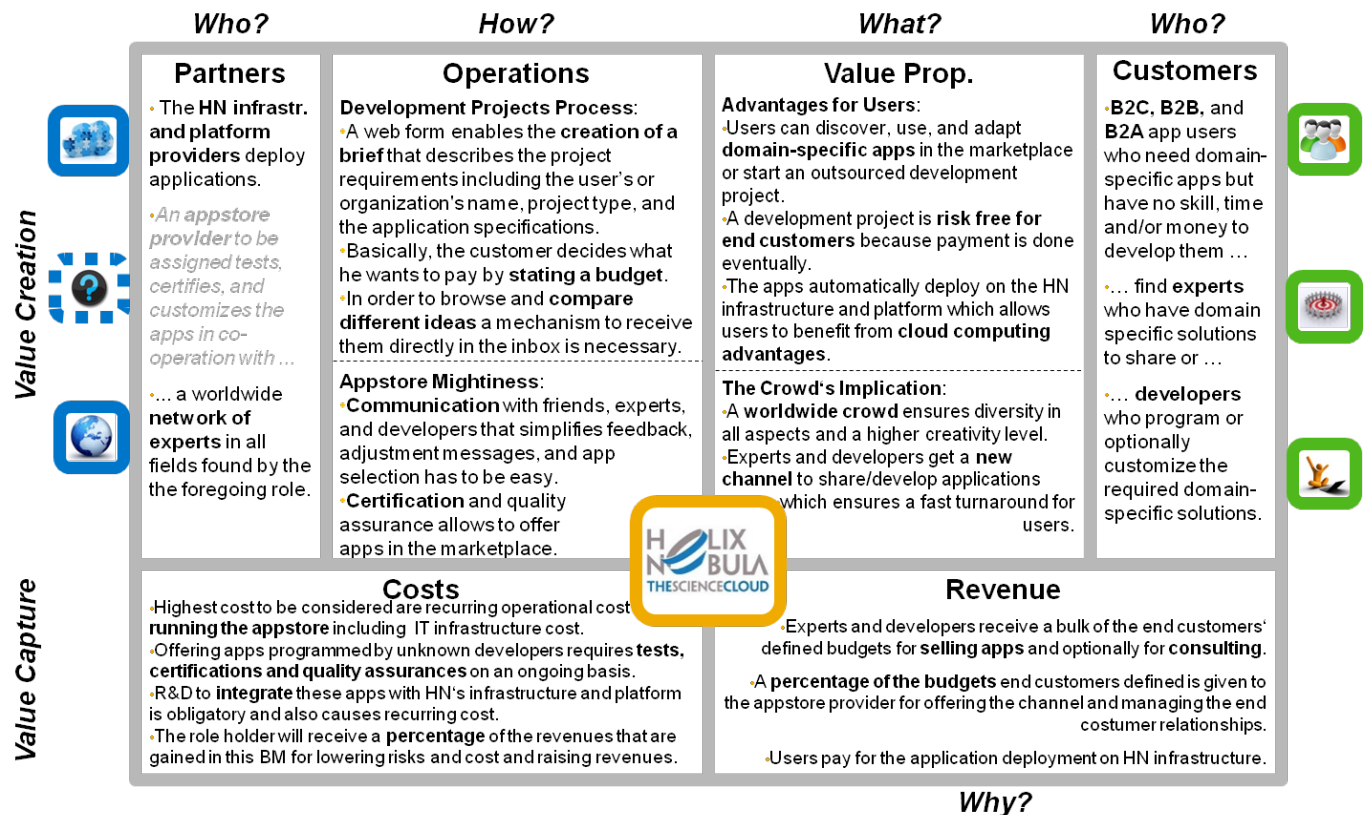


Figure 31 Application Crowd

##### 2. Value creation

The value is created by **partners** from the following categories.

- The initial consortium of I/PaaS as explained in the first BM remains at the core. Those HN infrastructure and platform providers deploy the applications in the cloud.
- A role to be assigned tests, certifies, and customizes existing or newly developed applications. More information concerning the role is presented in description criterion eight.
- In order to accomplish its task, the role holder requires a worldwide network of experts in all fields that provides subject-specific and professionally qualified support in testing, certifying and customizing the existing or newly developed applications.



The **operations** need to cover both the development project process and the enabling of a certain app store mightiness. Concerning the *development project process* we identified the following.

- A web form enables the creation of a brief that describes the project requirements including the user's or organization's name, project type, and the application specifications. In application development, the user requirements specification is a crucial step. "The specification of requirements is one of the most important stages in the development of [software applications]. The correct description is one of the principle goals in preparation of specification of requirements. Well-done specification ... is a significant support to create software with high functionality, low maintenance and adaptation costs" (Butkiene and Butleris n.d.) The importance has to be made clear to customers that publish their brief.
- Basically, the customer decides what he wants to pay by stating a budget. Both the customer's brief with the user requirement specifications and the defined budget enable potential developers to decide if they submit a functional specification document. This document again (a) enables the end customer to decide which developer is chosen and (b) serves as contract.
- In order to browse and compare different ideas a mechanism to receive them directly in the inbox is necessary. The adoption of this out of the box development process relies on the simplicity of comparing different ideas. Therefore, we suggest an easy to implement mechanism that sends the functional specification documents directly to the end customer's inbox.

Concerning the *app store mightiness* we identified the following.

- Communication with friends, experts, and developers that simplifies feedback, adjustment messages, and app selection has to be easy. Application development requires consultations especially between end customers and developers. In a sequel design process like the waterfall model consultations are ideally needless after the initial requirement phase. Yet, even in waterfall models often consultations are necessary. Rapid development heavily depends on communication between several stakeholders.
- Certification and quality assurance allows offering apps in the marketplace. After an end customer's need for an application was successfully answered (a) by an expert who already has a solution or (b) by a developer who creates the solution, the application shall not only be used by the end customer who initiated the process, but it shall also be offered in the marketplace. Therefore, the role holder tests and certifies potential applications in cooperation with a worldwide network of experts that contributes subject-related insights.
- A potential future enhancement is the value proposition of a C2C platform that offers anything as a service (XaaS). "XaaS is a collective term said to stand for a number of things [like workforce or application exchange] ... The acronym refers to an increasing number of services that are delivered over the Internet rather than provided locally or on-site. XaaS is the essence of cloud computing. ... Other examples of XaaS include storage as a service, communications as a service, network as a service, and monitoring as a service" (Rouse 2010).

The **value propositions** are, on the one hand, advantages for users in comparison to the classic development process and, on the other hand, implications for the crowd. Concerning *advantages for users* we identified the following.

- Users can discover, use, and adapt domain-specific apps in the marketplace or start an outsourced development project. Ideally, an application in the marketplace already fits the requirements of a customer and only has to be customized by either a developer or the app store provider in cooperation with its expert network. This brings the opportunity of reusing and reselling niche software applications to a broad public. We suggest that the ownership of the software will remain (a) with the expert in case a solution already exists or (b) with the developer in case a developer from the crowd newly creates a solution. Point (b) is of importance as it enables developers to resell their apps which is the incentive for developers to participate.
- A development project is risk free for end customers because payment is done performance based. After a successful implementation of the functional specification document the application is measured against this document. If all specifications are met, the customer will pay the money. Other models are possible, as well. E.g., the customer pays 25 per cent upfront and the rest is paid at the end.
- The apps automatically deploy on the HN infrastructure and platform which allows users to benefit from cloud computing advantages. This value proposition was evaluated to be very thought leading because customers are not only proposed a new way of realizing their software development projects, but they can further combine it with the advantages of cloud sourcing. Such advantages can be found in the following.
  - Capital expenses are traded for variable expenses. Ideally, customers pay nothing to get started enabled by a “freemium”-strategy and only pay transaction based.
  - Even the variable expenses for deploying apps in HN’s cloud are lower than doing it by self-hosting.
  - Self-hosting requires predicting the resource demand, but prediction leads to either waste or undersupply which ends up in user or even customer dissatisfaction. A cloud solution is much more elastic and always meets the actual need.
  - The classic monolithic or client/server sourcing models have the problem of time delays in meeting server requests. But if application users host their apps in the cloud, they can dramatically increase their speed and agility.

Concerning the *crowd’s implication* we identified the following.

- A worldwide crowd ensures diversity in all aspects and a higher creativity level. Potentially each expert that can offer a niche application or each developer that creates new solutions can inspect the user requirements and offer his applications resp. development services. Thus, the end user might be given suggestions with different approaches for the realisation of the project. This will overcome the challenges of the traditional development process including a slow turnaround, expensive rates, limited application options, uncertain results, and high risk.
- Experts and developers get a new channel to share resp. develop applications which ensures a fast turnaround for users, as well. A marketplace where demand and offer meet is something that is rather

new to software development and lowers many of the market imperfections that were valid so far. E.g., the problem with project acquisitions for software developer is lowered as the marketplace enlists many projects transparently.

The following **customer** groups are addressed by this BM.

- B2C, B2B, and B2A app users who need domain-specific apps but have no skill, time and/or money to develop can either find (a) existing solutions offered by experts within the required niche or (b) upload web forms in which they define their problem in an user requirement specification document.
- Experts who have domain specific solutions to share can create value by making their software public and open to customisation on the marketplace.
- Developers program or optionally customize the required domain-specific solutions. This step is necessary if no solution was found on the marketplace by the end user.

### 3. Value capture

On the **costs** side we identified the following.

- Highest costs to be considered are recurring operational cost for running the app store including IT infrastructure costs. Serving the content (traffic and payment processing) with a content management system, duration, support, and infrastructure resources for web hosting are to be considered. Running the app store website in the HN cloud might lower costs, improve the availability, and improve the time-to market. The actual hosting of applications could be conducted by HN suppliers.
- Offering apps programmed by unknown developers requires tests, certifications and quality assurances on an on-going basis. As the app store offers solutions within possibly any niche for very sophisticated use cases, the HN supplier do not have the required expertise to test and certify the applications by themselves. This is why we suggest establishing a worldwide network of experts within their fields. The incentives for experts to participate as partners may be monetary and therefore costs.
- R&D to integrate these apps with HN's infrastructure and platform is obligatory and also causes recurring costs. Both from a technological and subject point of view the applications offered on and developed for the marketplace are very inhomogeneous in their required infrastructures and platforms.
- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. The exact effects of this specific broker role are explained in criterion eight. We asses a percentage to be the right incentive for the role holder, because if he performs well, his revenues will grow, as well.

On the **revenue** side we identified the following.

- Experts and developers receive a bulk of the end customers' defined budgets for selling apps and optionally for consulting. As the success of this platform based BM depends on the number of participating experts and developers, the incentive for them to take part has to be high enough. E.g., if a customer defines his budget for a software that automatically sorts pictures in folders depending on their dates to be 300€, the customer can chose the best of many developers' functional specification

documents and this developer might receive 270€, whereas the app store provider role gets 30€. The price for hosting the software on HN is billed separately.

- A percentage of the budget that the end customer defined is given to the app store provider for offering the channel and managing the end customer and developer relationships. Serving the content (traffic and payment processing) with a content management system, curation, support, and infrastructure resources for web hosting are costs that need to be defrayed. Moreover, profit is desired as well. In the above given example we assumed a rate of 10%.
- Users pay for the application deployment on HN infrastructure. This point explains how the HN supplier can generate revenue in this BM. It remains to be clarified whether the end customers that seek for an application are to be forced to host the data on HN infrastructure or rather have the option to do so and are convinced with cloud advantages as enlisted above. Proceeding with the example: after the price of 270€ was paid to the developer and the app store provider received 30€, the customer can or has to run the application on one of the HN partners' cloud services including the necessity to upload the pictures in order to run the application. As mentioned, the *can* or *must* have yet to be decided.

#### 4. Risks

- The risk of not finding or incentivising the required experts for the worldwide expert network that helps to test, certify, and customize the software is critical. The problem is that neither the HN suppliers nor the app store provider have the capabilities to understand all of the applications from a functional point of view. If, e. g., one end customer seeks an application within the field of genome analysis, the testing and certification cannot be conducted by the app store provider solely, but rather an expert that can decide if the software functions as required. Such an expert may not be found or not convinced to participate.
- The diversity of required infrastructure and platform bundles may exceed the service portfolio and the economics of the HN supplier that are responsible for hosting the software in case the customer desires a cloud hosting. To explain this more in-depth, we want to tell that cloud computing is a "Layer Player" BM. These models are realised by "specialised companies that are limited to the provision of one value-added step for different value chains. They benefit from economies of scale and often produce more efficiently and at a higher quality" (Gassmann et al. 2013). But to reach that economy of scale moment, each offered service has to reach the critical mass. If only one application in the app store requires, e.g., a 32 GB RAM central processing unit or multi-tenancy, why should it be offered. Thus, a critical mass barrier should be defined in order to actually benefit from economies of scale.

#### 5. Investment costs changes

On top of the investment costs that are necessary in the first BM "Generic Cloud Computing for European Science" as described in deliverable 7.1, the costs for the worldwide expert network, the app store set up itself, and the marketing have to be added. Explanations and examples for the worldwide expert network were given above. The marketing is necessary as this BM, same as the BM "Information as a Service", has a high differentiation and thought leadership evaluation. E.g., a customer that starts a new development pro-

ject does not even know about the sourcing solution “Application Crowd” which means that he will not even search for such a kind of marketplace. Thus, the value propositions need to be explained by marketing.

## 6. Switching costs changes

No influence of this BM was identified.

## 7. Non-transparency changes

No influence of this BM was identified.

## 8. Design challenges

This BM does not address a specific challenge mentioned in the analysis phase (cf. chapter 3.2).

## 9. Specific broker role

This BM requires a specific broker role to be assigned that provides the app store as well as tests, certifies, and customizes the apps. Further, it manages the finding and incentivising of field experts over the entire planet. This should be done by *one* role as an app store provided by representatives of each HN supplier may lead to slow governance processes and increased communication costs. By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs decrease for each supplier. E.g., the costs for communication and the setup of all required app store processes at least decrease as they are outsourced to the broker role. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and costs as well as raising revenues. Of course, savings through the role have to justify its costs.

As this app store provider role can or even must host its webpage on HN cloud services, there will be advantages for the costumers. In case the role is implemented, the partnership needs to justify and ensure that no cartel-like behaviour is applied. The law broker with specialised law personnel is the appropriate instrument. A cloud hosted website may be more reliable than alternatives since other computers in the cloud can compensate when a single piece of hardware goes down. Also, local power disruptions or even natural disasters are less problematic for cloud hosted sites, as cloud hosting is decentralized. These and more advantages can be found at [Pollock \(2013\)](#).

One further advantage of a central broker is lowering the risk of not achieving the critical mass. The broker can define responsibilities for each HN partner so that each partner focuses on specific service areas. In case the role is implemented, the partnership needs to justify and ensure that no cartel-like behaviour is applied. The law broker with specialised law personnel is the appropriate instrument. If, for example, one HN supplier is explicitly responsible for batch computing applications, the effect of economies of scale is achieved earlier.

## 10. Expert evaluation

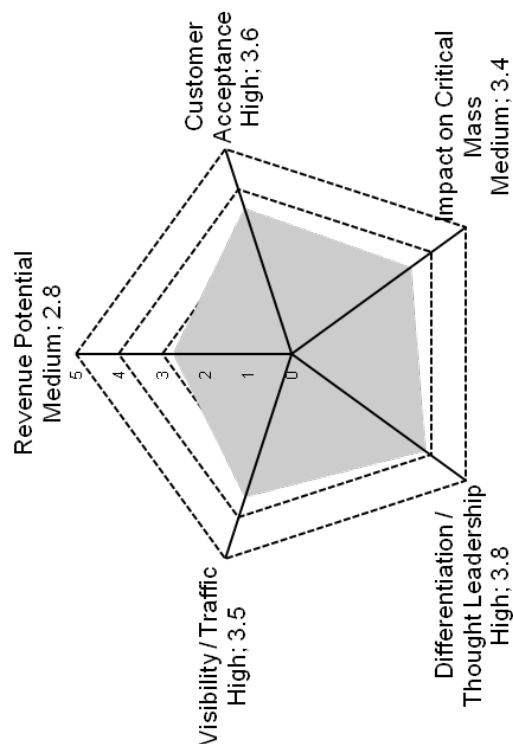
The **impact** of this BM was valued medium with 3.3 (cf. figure 32). The lowest value, yet still on a medium level, unfortunately is the revenue potential with a value of 2.8. The experts were cautious in seeing high revenue potentials in (a) hosting the app store provider's *one* web page, (b) high development budgets, or (c) hosting individual applications on HN cloud services. Yet, the chance lies in the visibility and traffic, which was valued high. Thus, the revenues may be small, but the mass effect may make it interesting. In contrast, customer needs and differentiation resp. thought leadership are the highest valued criteria. The background of those high values is the acceleration and diversification of the classic project awarding process. E.g., projects of little size could never reach such a diverse public in classic competitive procedures.

The **ease of implementation** was valued neutral with 3.2. The investment costs were valued neutral with a tendency to critical, as the value is 2.6. But once the BM is set up, recurring cost are seen as neutral. An example would be development efforts for the app store and underlying back office processes. But once this work is done, organising the content (traffic and payment processing) with a content management system, curation, or support on an ongoing basis is rather neutral. Fortunately, exactly the app store development's objective feasibility was judged with the highest value 3.9 which is positive. Coming together with positive expertise within the HN partners' organisations, the risks are rather positive in this BM.

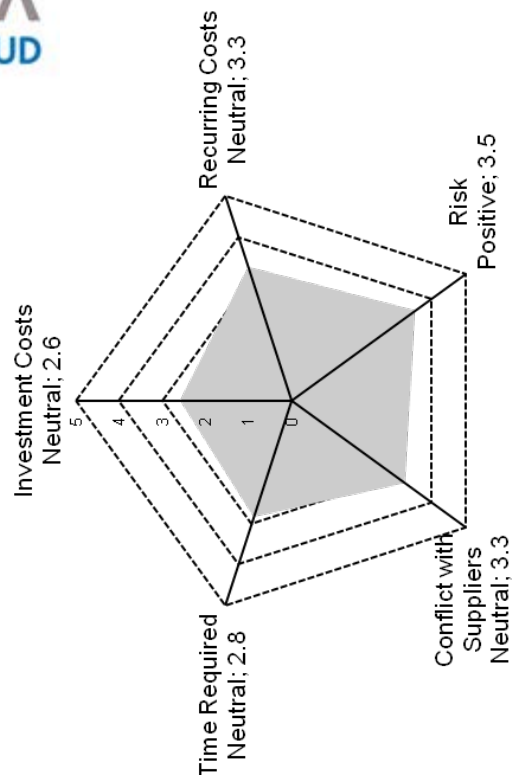
We clustered the experts' **remarks** on the BM with the following outcome. Just as "Information as a Service", experts highlighted the game changing and out of the box character of this BM off the record and in their evaluation of the differentiation and thought leadership criterion which is high in average and second best of all. The possibility for end customers to outsource their application development process on a marketplace is expected to have only a medium revenue potential, but the visibility and traffic caused is high. As crowdsourcing in the area of software development is completely new, the combination with cloud deployment and leader advantages make an realisation very interesting.



## Impact of Option



## Ease of Implementation



Impact	Criterion		Revenue Potential		Customer Acceptance				Impact on Critical Mass		Differentiation / Leadership		Visibility / Traffic		Result	
	Weighting	Value	Need	Effort	Security	Mass	Leadership	high	0.1	high	3.8	high	3.5	1		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8<td>2.9<td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td></td></td>	3.8 <td>2.9<td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td></td>	2.9 <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2	0.05	0.05	0.2	0.1	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>1</td><td></td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>1</td><td></td></td>	high	3.5 <td>1</td> <td></td>	1		
		medium	high	medium	medium	medium	high	medium	3.4 <td>medium</td> <td>3.8<td>high</td><td>3.5<td>medium</td><td>3.3</td></td></td>	medium	3.8 <td>high</td> <td>3.5<td>medium</td><td>3.3</td></td>	high	3.5 <td>medium</td> <td>3.3</td>	medium	3.3	
		2.8 <td>3.8</td> <td>2.9</td> <td>3.1<td>3.4</td><td>3.8</td><td>3.4</td><td>3.8</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.5</td><td>3.3</td><td></td></td>	3.8	2.9	3.1 <td>3.4</td> <td>3.8</td> <td>3.4</td> <td>3.8</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.5</td> <td>3.3</td> <td></td>	3.4	3.8	3.4	3.8	3.5	3.5	3.5	3.5	3.3		
		0.3	0.2													

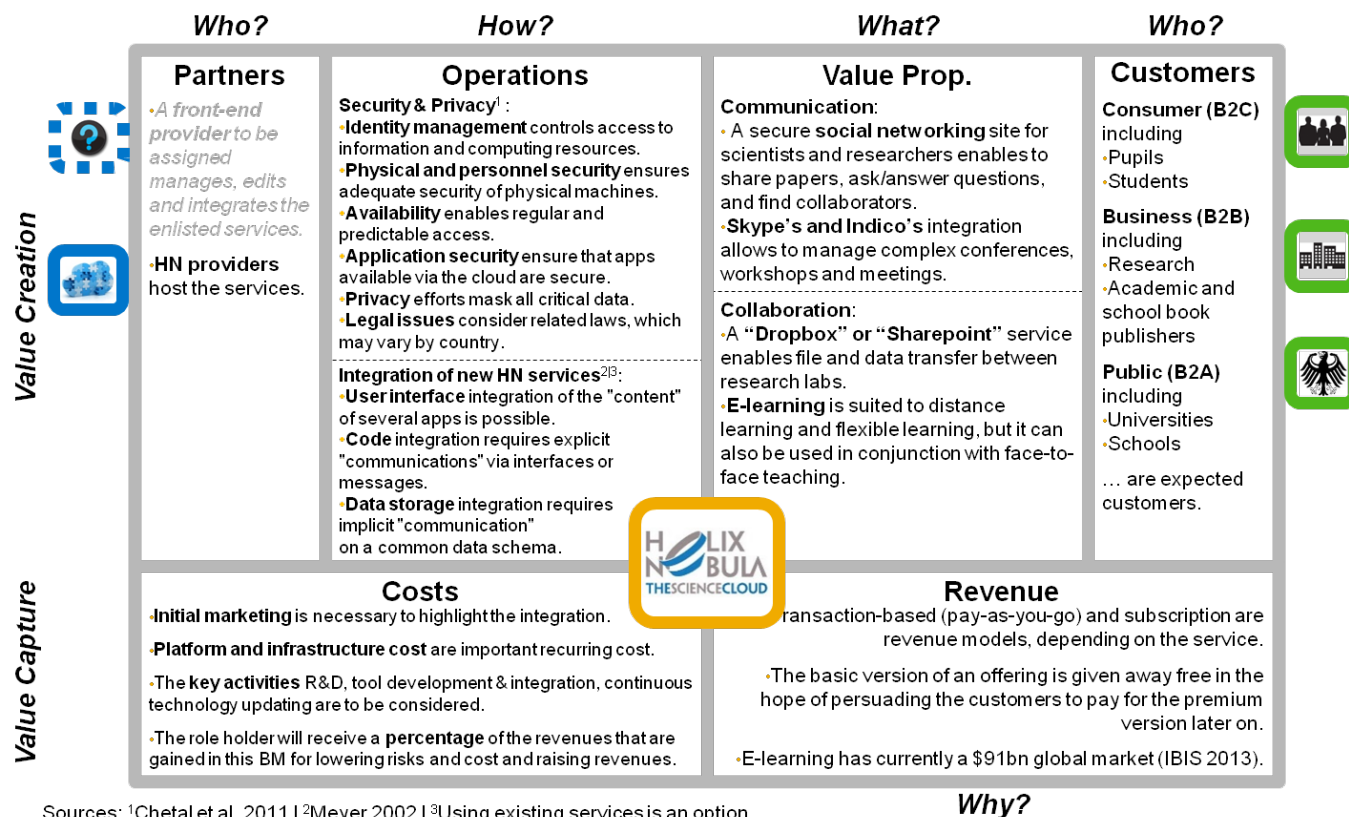
1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 32 Expert Evaluation of "Application Crowd"

#### 4.4.3 Collaboration and Communication Platform for Science and Education

##### 1. Specifics

This BM combines social networking, scheduling, data interchange, and secure communication integrated in one web frontend. Scientists and researchers can share papers, ask and answer questions, find collaborators, and schedule and organize events, from simple lectures to complex meetings, workshops and conferences with sessions and contributions. E-learning is offered to students, pupils, and teachers.



Sources: <sup>1</sup>Chetal et al. 2011 | <sup>2</sup>Meyer 2002 | <sup>3</sup>Using existing services is an option

**Figure 33** Collaboration and Communication Platform for Science and Education

##### 2. Value creation

The value is created by **partners** from two categories.

- The initial consortium of I/P/SaaS as explained in the first BM remains at the core to host the services and front-ends provided by the broker role as explained in the following.
- A role to be assigned manages, edits, and integrates collaboration and communication services. More information concerning the role is presented in description criterion eight.

The **operations** need to cover both security/privacy as well as the integration of new HN services and existing services.

Concerning the *security and privacy* we identified the following.

- Identity management controls access to information and computing resources. “A typical ID management system today comprises four basic elements: a directory of the personal data the system uses to define individual users (think of it as an ID repository); a set of tools for adding, modifying and deleting that data (the access lifecycle management stuff); a system that regulates user access (enforcement of security policies and access privileges); and an auditing and reporting system (so you'll have a way to verify what's actually been happening on your system)” (Waters n.d.).
- Physical and personnel security ensures adequate security of physical machines. “Physical security is the protection of personnel, hardware, programs, networks, and data from physical circumstances and events that could cause serious losses or damage to an enterprise, agency, or institution. This includes protection from fire, natural disasters, burglary, theft, vandalism, and terrorism” (Rouse 2005).
- Availability enables regular and predictable access. When people, especially scientists, decide for a communication solution, they expect it to be available all the time. Therefore, you can even find tables on the Internet that enlist the current uptime of social networks (“Uptime status Social Networks” 2013). Facebook’s uptime, for example, was 100% at the time of researching this source.
- Application security ensures that apps available via the cloud are secure. The BM’s services should be “secure by implementing testing and acceptance procedures for outsourced or packaged application code. They also require that application-security measures (application-level firewall and database auditing) be in place in the production environment” (Griffin and Jones 2010)
- Privacy efforts mask all critical data. It is also important that all critical data is masked and that only authorized users have access to data in its entirety. Just like any data that is gathered in cloud computing services or social networks, digital identities and credentials have to be protected (Griffin and Jones 2010). The misuse of credit card numbers is one example.
- Legal issues consider related laws, which may vary by country. An adaption of data privacy operations to each nationality’s law is inevitable. The related key word concerning communication and collaboration networks is internet censorship which needs to be carried out at the behest of governments. If one government commands the censorship of certain research traffic, a denial may lead to a market ban.

Concerning the *integration of newly developed/existing services* we identified the following operational options (Meyer 2002).

- User interface integration of the "content" of several application systems in the front-end is one option. The connection of functions and data from multiple systems into new components/portals/web parts with an integrated navigation between these components is the characteristic of this integration style. Common examples are enterprise portals that combine desired services like Facebook chat, news streams and Skype communication at will.
  - The advantages are easy feasibility, personalisation, and no required change to existing application systems which especially enables the integration of existing services like Skype calls.

- Cons are that only "superficial integration" of communication and collaboration services is possible as well as data and functional redundancies are retained. This may result in two different user names and contact addresses for one person in the same communication network.
- A further possibility is code integration of parallel running services. This option is only applicable to newly developed services as there is no code access to existing services like Skype, Facebook, or SharePoint. A realisation requires explicit "communication" via interfaces or messages that can be synchronous or asynchronous. E.g., if user data is changed within the chat service, the telephone conference service is informed by a machine-to-machine message so that data can be updated.
  - The advantages are that the interface is seemingly made in one piece, but functional redundancy is still enabled.
  - Yet, this approach is rather disadvantageous as (a) data redundancy remains, (b) interfaces need to be provisioned and maintained, and (c) high communication overhead resulting in typical network problems is caused.
- The third option is data storage integration. It requires implicit communication on a common data scheme. One example of this solution is SAP's Enterprise Resource Planning product SAP ERP® that combines different services based on one common data schema. This option is only possible for existing services if data access is granted. Otherwise, it is only applicable to newly developed services.
  - Avoiding data redundancy and bringing consistency in the foreground are advantages. A common data basis is also good for data analysis using business analytics.
  - Typical database problems (e. g. concurrent writing or lost update) appear.

The **value propositions** are to be found both in communication and collaboration services.

Concerning *communication services* we identified the following.

- A *secure* social networking site for scientists and researchers enables to share papers, ask/answer questions, and find collaborators. As highlighted, security is the key value proposition and a unique characteristic in this social network use case.
- Skype's and Indico's integration enables managing complex conferences, workshops and meetings. Firstly, the event is organized with Indico. Secondly, Skype allows users to communicate with peers by voice using a microphone, video by using a webcam, and instant messaging over the Internet.

Concerning *collaboration services* we identified the following.

- A "Dropbox" or "Sharepoint" service enables file and data transfer *between* research labs. This value proposition is rather new in comparison to data transmission and exchange *within* research labs. Internal collaboration is widespread as content management improves efficiency and for internal solutions it is easy to define and maintain the standards and the governance. One core value proposition of this BM is that basically each researcher could be enabled to use, share, or work with data provided by other researchers in different research labs, countries, or organisations. The difficulty of changing standards and diverse governance rules for collaboration and data transmission within

different research organisations is lessened as one central instance manages the governance and standards for all participating research organisations. In the following we enlist the value proposition of world-wide research collaboration enabled by this platform as researched by [Loan-Clarke and Preston](#) (2002).

- Ensurance of a more effective use of individual talents
- Transfer of knowledge or skills
- Source of stimulation and creativity
- Provisioning of intellectual companionship
- Extension of the individual researcher's networks
- Enhancement of project dissemination

We concentrate on the first bullet which contributes to an increasing research quality the most, in our opinion. "Modern research is increasingly complex and demands an ever widening range of skills. Often, no single individual possesses all the knowledge, skills, and techniques required. In principle, an individual might be able to learn or acquire all the techniques needed to solve a particular problem, but this can be very time consuming. If two or more researchers collaborate, there is a greater probability that among them they will possess the necessary range of skills" ([Loan-Clarke and Preston](#) 2002). We recommend following the link as a complete explanation of all value propositions can be found there.

- E-learning is suited to distance learning and flexible learning, but it can also be used in conjunction with face-to-face teaching. The [IBIS Capital e-Learning Report](#) (2013) provides latest insights into this market which are provided in an overview as follows.
  - *Industry Overview:* The e-Learning market broadly splits between the educational market and the market for corporate training. ...
  - *Key Market Factors:* The e-Learning market is driven by a range of factors from both the supply and demand side. Technology and infrastructure are key factors for the supply side whilst the relationship between consumer, government and corporate are driving demand.
  - *Market Trends:* The pace of change will dictate the emerging structure of the e-Learning landscape. The underlying trends affecting government spending, technology and consumer behaviour are all important factors that we review.
  - *Insights into e-Learning Innovation:* The education market is now ripe for innovation. There are a whole range of new technologies and business models. ...
  - *M&A and Valuations:* The market has a healthy ecosystem of large strategic players, expectant capital markets and venture capital investors. ...
  - *IBIS View of the Future:* We believe there is a paradigm shift occurring in the e-Learning market which will radically change the future of how education is resourced, taught and consumed."

The following **customer** groups are addressed by this BM.

As the e-Learning market broadly splits between the educational market and the market for corporate training, there are potential customers in consumer, business, and public markets.



- Within the *educational market*, (a) consumers including pupils and students, (b) businesses including research departments and academic or school book publishers, and (c) public customers including universities and schools are expected customers.
- Within the *corporate and public market*, employers and employees, as well as clerks are customers that need e-Learning platforms for continued education and advanced trainings.

### 3. Value capture

On the **cost** side we identified the following.

- Without an explicit broker role, each HN supplier has to ensure the quality and integration testing by communicating bilaterally. This governance model for quality assurance raises operational costs.
- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. The exact effects of this specific broker role are explained in criterion eight. We assess a percentage to be the right incentive for the role holder, because if he performs well, his revenues will grow, as well.
- Initial marketing is necessary to highlight the value proposition of integrated services which was explained in the BM “Information as a Service” (cf. chapter 4.4.2).
- Platform and infrastructure costs are important recurring costs which was explained and quantified in the first BM “Generic Cloud Computing for European Science” (cf. chapter 4.3.1).
- As explained and quantified in the first BM “Generic Cloud Computing for European Science” (cf. chapter 4.3.1), the key activities R&D, tool development & integration, continuous technology updating are to be considered.

On the **revenue** side we identified the following.

- Experts remarked off the record that this BM attracts and attains a high number of people at once and, thus, is well suited to raise revenue in other HN BMs (if multiple BMs are implemented), as the overarching up-/cross-selling broker role can make these customers familiar to the other BMs.
- Transaction-based (pay-as-you-go) and subscription are revenue models, depending on the service. The use of communications tools comparable to Skype is well suited for transaction-based revenue streams, whereas the use of e-Learning and online social networks should be based on subscriptions with a “freemium”-strategy as follows.
- The basic version of an offering is given away free in the hope of persuading the customers to pay for the premium version later on. For example Flickr is a free image hosting and video hosting website that charges fees to its customers for extra storage (Gassmann et al. 2013).
- E-learning is a great growth opportunity and has currently a \$91bn global market (IBIS Capital e-Learning Report 2013). There is a number of even more promising numbers concerning the healthy ecosystem of e-Learning (IBIS Capital e-Learning Report 2013):
  - 1.4bn students out of 7.1bn world population
  - \$4,435bn global education expenditure
  - 7.4% p.a. growth in overall education spend through to 2017



- 23.0% p.a. growth in e-Learning over same period

A short version of this market report can be found [here](#).

#### 4. Risks

Addressing a high number of customers is boon and bane at the same time. If no central broker role is established, the bane lies in a risk to destroy the brand by offering badly integrated services to a large audience.

#### 5. Investment costs changes

On top of the investment costs that are necessary in the first BM “Generic Cloud Computing for European Science” as described in deliverable 7.1, each HN supplier has to spend on marketing, tool integration, and platform development.

#### 6. Switching costs changes

No influence of this BM was identified.

#### 7. Non-transparency changes

No influence of this BM was identified.

#### 8. Design challenges

This BM does not address any specific challenge explained in the analysis phase (cf. chapter 3.2).

#### 9. Specific broker role

This BM requires a specific broker role that centrally ensures marketing, front-end deployment, tool integration, and quality assurance. Thus, such the assigned front-end provider manages edits and integrates the enlisted services. Basically, the complete operations are in the hand of the front-end provider. The HN partnership hosts the services on its cloud. There is a variety of communication and collaboration technologies that the role can choose from to achieve the explained value propositions.

- **Wikis** - A wiki is a collaborative website which can be directly edited by anyone with access to it. Wikis use a simplified language to allow collaborators to easily create and edit static web pages. Wikipedia, for example, is an online encyclopedia where individuals from around the world collaborate to create entries and keep them accurate ([Ebersbach and Glaser 2005](#)).
- **Blogs** - A blog is an easy way to create an online journal with chronological postings. Many blogs also allow for comments and means to connect to other blogs. Blogs can be individually authored, but often are the collaborative efforts of multiple authors ([Kaiser 2008](#)).
- **Social Networking** - Social networking sites offer users a closed web page on which to post personal information like interests and "favorites," and frequently center on personal connections with "friends." Two popular sites are Facebook and MySpace, while Scholar and ELGG are more academically focused ([Boyd and Ellison 2007](#)).

- **Web 2.0** - Web 2.0 is a term credited to Tim O'Reilly that refers to recent movements in website design including greater interactivity, simplicity of design, extensibility, and greater use of and connections between data and people. Two technologies that embrace "Web 2.0" are wikis and blogs. Popular "Web 2.0" websites include Netvibes (news reading), Flickr (photo sharing), Digg (story rating), and Last.fm (music sharing) (Stanoevska-Slabeva 2008).
- **Discussion Boards** - Discussion boards operate much like e-mail, but in a localized place where everyone can see all messages and who replied to whom (threads). Conversation on discussion boards happens asynchronously, or over time (Horstmanshofa and Brownie 2013).
- **Chat or Instant Messaging** - Chat and instant messaging are synchronous technologies, meaning that conversation happens in real-time. Typically, conversation happens quickly and informally: short phrases and typos are the norm (Blyth 2012).
- **Teleconferencing and Videoconferencing** - Conferencing systems are another means of real-time communication where participants can hear and sometimes see each other (Lawson 2010).
- **Web Course Management Systems** - Course or content management systems offer easy ways to create a website to share information-largely without requiring users to know any html code. Many also have means to add a number of tools to a site, such as discussion boards and frequently asked question (FAQ) lists (Boiko 2005).

By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs decrease for each supplier. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and costs. Of course, savings through the role have to justify its costs.

The disadvantage of the role is a loss of control concerning the market image as the relationships to stakeholders are managed by the broker role. We mention this risk especially in this BM as the visibility and traffic are high and, thus, the risk that the role holder puts customers off is higher simply because of the higher quantity.

One advantage is that the initial investments as explained in description criterion five become pointless for the HN partners as the broker role bears the costs and, thus, the business risk. This advantage is a classic strength of outsourcing which we think is appropriate within this BM as communication and collaboration platforms are not the core activities and competences of all HN partners. Thus, if the role is outsourced to one partner, the HN partnership can benefit from the following outsourcing advantages (Bucki n.d.).

- **Focus on core activities:** The HN partnership can concentrate on deploying all the services, instead of managing the market presence and product portfolio.
- **Costs and efficiency savings:** If market presence and tool portfolio were managed in bilateral communications, it would cause higher costs and less efficiency compared to a management by a central role. The role, thus, leads to reduced overhead at each HN partner.
- **Reduced risk:** In case the BM will not "fly", the risk of having established resources that are not required anymore is not carried by the HN partners.

Another advantage is an improved integration of communication and collaboration tools. As explained in the operations section, the strength of this BM lies in an integrated offering of many thinkable services. It is

easier to reach a sophisticated integration strategy and operations within one organisation instead of many in a partner network.

## 10. Expert evaluation

The **impact** of this BM valued high with 3.5 (cf. figure 34). A critical and ambivalent criterion is the differentiation and thought leadership. It was valued medium with 2.7 and shows a slight tendency to even critical. The differentiation and thought leadership was actually described to be critical as online social networks like Facebook, communication tools like Skype, and file hosting services with or without version management like Dropbox or SharePoint already exist. The only new thing would be the combination and integration of these services. The reason why the differentiation and thought leadership is still medium is the higher differentiation of an e-learning platform. Even though such platforms exist as well, e.g. YouTube is used for e-learning, a mighty platform has not yet established to be market standard yet. YouTube is used a lot, but it is very restricted in its capabilities especially concerning the communication between teacher and student. Considering that experts were conservatively evaluating and cautious especially concerning this BM, it is very interesting that they nevertheless think, that the need for integrated communication and collaboration services, especially for e-learning, is high. Indeed, all described services exist. Yet, parallel usage is exhausting for customers as it diverts from the actual contents. This is why the need was evaluated high.

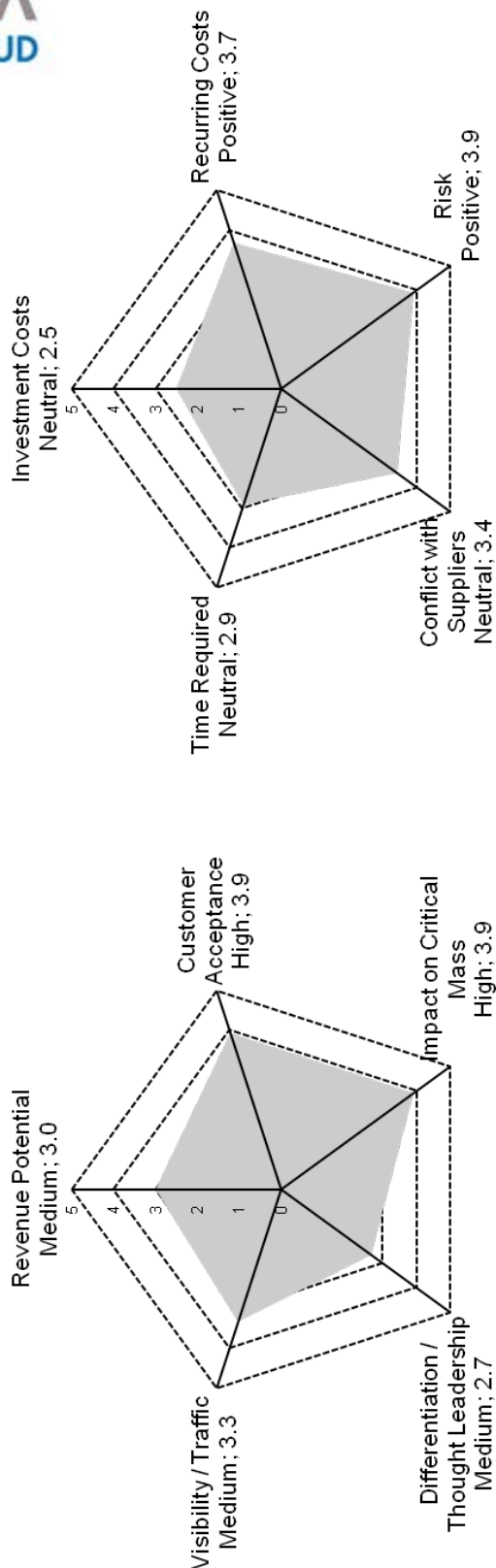
The **ease of implementation** was valued neutral with 3.4. There is a tendency to a high evaluation. Just as in other BMs, especially the onetime costs are neutral with a strong tendency to critical. Whereas marketing and platform development are onetime cost factors in each model, this BM requires moreover efforts to integrate newly developed and/or existing services. But once the BM is set up, the recurring costs are on a positive level. Turning to the most positive outlier, the feasibility is on a very positive level and has the highest feasibility value of all BMs with 4.6. As outlined in the operations segment, there are three possible options of application integration which are interface, source code, or data scheme integration. Depending on the chosen integration style, the feasibility varies. Experts outlined that interface integration is the easiest and fastest way with redundancies for customers, whereas data scheme integration implies higher onetime costs but the service level is higher as machine-to-machine communication works faster if based on a common data scheme. Both data and source code integration of existing services were judged to be very difficult as negotiations with service providers like Facebook or Microsoft for SharePoint are required. Yet, there is a clear green light for objective technological feasibility.

We clustered the experts' **remarks** on the BM with the following outcome. Compared to the most potential BMs, experts were worried about this BM's impact as the market for e-collaboration is mature. But if the integration of so far parallel used solutions and their adaption to science is successfully implemented, there will be a chance for this BM to be worth the effort. Also the revenue potential is only medium and compared to other BMs the second worst, experts think that its neutral to positive ease of implementation combined with the effects on awareness caused by online social networks and e-learning justify a realisa-

tion. Yet, the market for e-learning is of high revenue potential ([IBIS Capital e-Learning Report 2013](#)) and could be a reason for a limited approval of an e-learning platform.

## Ease of Implementation

## Impact of Option



Impact		Revenue Potential		Customer Acceptance		Impact on Critical Mass		Differentiation / Leadership		Visibility / Traffic		Result	
Criterion	Weighting	Value	Need	Effort	Security	Mass	Leadership	medium	0.1	0.1	0.1	1	
		medium 3.0	high 4.2	medium 3.4	high 3.5	high 3.9	medium 2.7	medium 3.3	high 3.5	high 3.9	high 3.5	1	high 3.5
		medium 3.0	high 4.2	medium 3.4	high 3.5	high 3.9	medium 2.7	medium 3.3	high 3.5	high 3.9	high 3.5	1	high 3.5

Ease		Costs		Risk		Conflict with Suppliers		Time Required		Result	
Criterion	Weighting	Value	Feasibility	Expertise	Legal	Suppliers	0.1	0.1	0.1	1	
		neutral 2.5	very positive 4.6	positive 3.6	neutral 2.8	neutral 3.4	neutral 3.4	neutral 2.9	neutral 2.9	neutral 3.4	neutral 3.4
		neutral 2.5	very positive 4.6	positive 3.6	neutral 2.8	neutral 3.4	neutral 3.4	neutral 2.9	neutral 2.9	neutral 3.4	neutral 3.4

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 34 Expert Evaluation of "Collaboration & Communication Platform for Science & Education"

#### 4.4.4 Worldwide All-In-One Enterprise Cloud

##### 1. Specifics

The “Worldwide All-In-One Enterprise Cloud” eventually paves the way for a cloud computing platform that offers a unique resource to governments, businesses and citizens. This is a defined aim by the European Union. It can be the ultimate BM for big players consolidating different business activities and strategies, including an ecosystem approach or comprehensive SaaS (cf. figure 35).

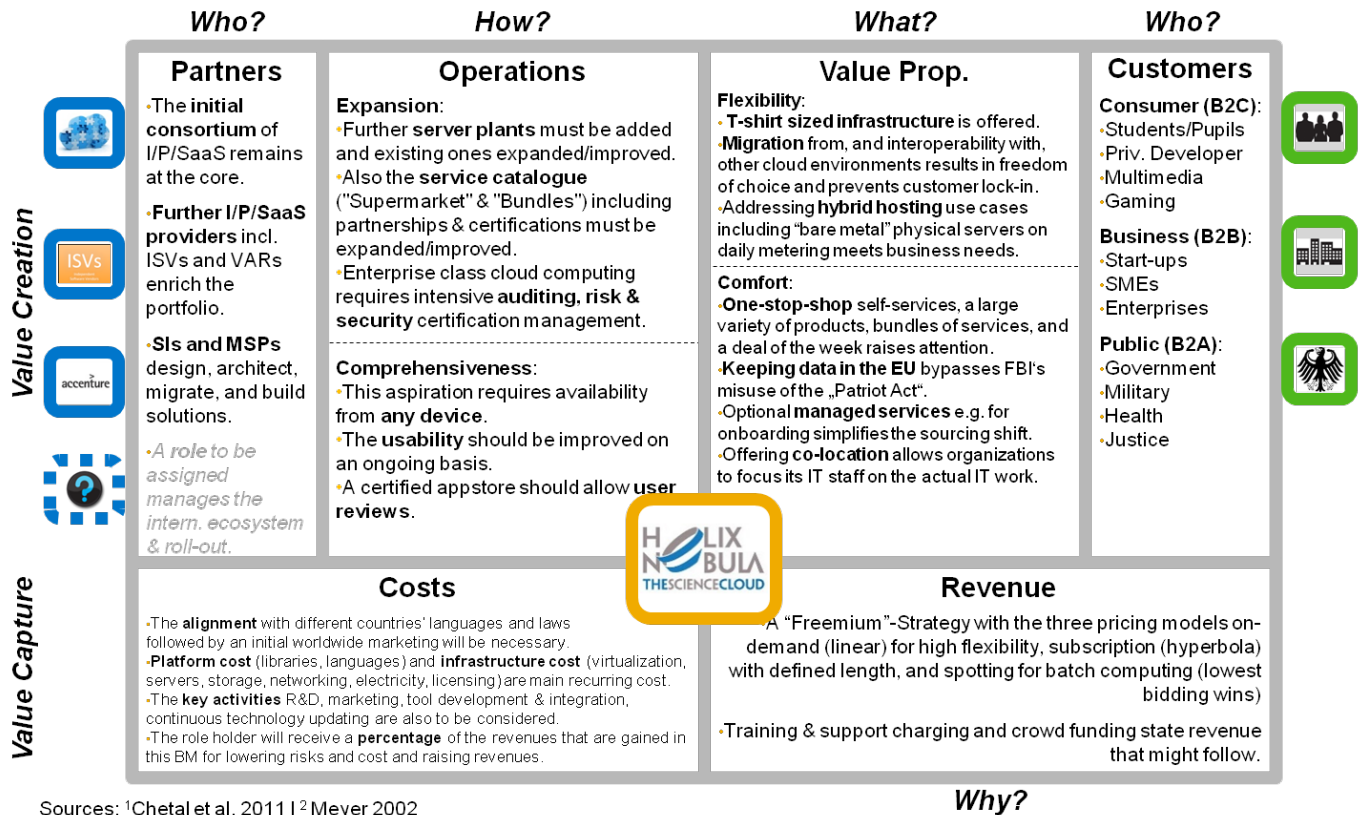


Figure 35 Worldwide All-In-One Enterprise Cloud

##### 2. Value creation

The value is created by **partners** from the following categories.

- The initial consortium of I/P/SaaS as explained in the first BM “Generic Cloud Computing for European Science” (cf. chapter 4.3.1) remains at the core. Especially there are no IaaS partners added to raise revenue of the existing IaaS providers.
- Technology partners enrich the service portfolio by participating in the marketplace. The wording “Technology Partner” comes from AWS which is known to have a very large technology partner ecosystem. “Many software vendors have specially licensed and packaged their software to run on EC2, either independently or via the AWS Marketplace, easing deployment and eliminating some of the challenges associated with licensing software to run in the cloud. Its API is supported by many third



parties that provide associate management tools ...“(Gartner 2012). Technology partners are commercial software and internet service companies that build solutions that run on, or are complementary to, HN’s infrastructure. Independent Software Vendors (ISVs), SaaS, PaaS, developer tools, management and security vendors can be included (AWS n.d.). The advantages for the initial HN consortium are potential participation fees, more customers, and more complementary software and platform products. Yet, as HN is supposed to be an open marketplace, participation fees are a critical decision point. The advantages for the technology partners are IaaS, PaaS, support, certification, and new marketplace channels.

- Consulting partners are professional services firms that help customers of all sizes design, architect, migrate, or build new applications on HN. Consulting partners include System Integrators (SI), strategic consultancies, resellers, agencies, and value added resellers (VAR).

SIs are third party providers – usually the larger IT services firms – that run multi-sourcing models by marshalling and managing a network of IT providers on the customer’s behalf. “[SIs] share governance with their clients, set and run the mechanisms and interfaces between providers and guarantee end-to-end service delivery to make multi-sourcing work. They do this by offering best-in-class service management tooling, contractual mechanisms to yoke providers together and the feedback loops that shape and set the strategic direction of service delivery” (Davis 2011).

“In the computer and other industries, a VAR ... is a company that takes an existing product, adds its own ‘value’ usually in the form of a specific application for the product (for example, a special computer application), and resells it as a new product or ‘package’. For example, a VAR might take an operating system such as IBM’s OS/390 with UNIX services and, adding its own proprietary UNIX application designed for architects, resell the package to architectural firms. Depending on sales and installation requirements, the VAR could choose whether or not to identify OS/390 as part of the package” (Rouse 2007). HN consulting partners should gain access to a range of resources and training that will enable them to better help their customers deploy, run and manage applications in the HN cloud.

- A role to be assigned manages the international ecosystem and the international roll-out. More information concerning the role is presented in description criterion eight.

As the BM aims to offer enterprise class services worldwide, the **operations** need to cover both intensive expansion efforts and improvements of the comprehensiveness.

Concerning the *expansion* we identified the following.

- Further server plants must be added and existing ones expanded and improved. The adding of server plants worldwide is important to enable risk reduction for the customers by spreading the data to many data centres and to be present on each continent which is an important adoption factor. The expansion of existing data centers is necessary to meet the higher demand that is caused by (a) addressing customers worldwide and (b) addressing enterprises with enterprise level cloud services. Further, the expansion is required to enable batch computing, as the strategy of AWS shows. AWS is the cloud competitor that “has by far the largest pool of capacity, which makes it one of the few infrastructures suitable for batch computing, especially those workloads that require short-term provisioning of hun-

dreds of servers at a time” (Leong et al. 2012). We are aware that the capacities built for the first BM already meet batch computing demands, yet only for few customers on one continent. Moving to world-wide batch computing use cases is an important decision point with immense growth potential. At last, the improvement is required to actually reach the level of enterprise-class public cloud IaaS. Looking back to the analysis phase (cf. chapter 3.2), we learnt that Terremark has the best and longest track record in the market for enterprise-class public cloud IaaS including the best feature sets. We use Terremark to find out what makes a cloud provider successful in enterprise use cases. “Terremark, via the standard Enterprise Cloud service, is the market share leader in VMware-virtualized cloud IaaS ... [and] can address hybrid hosting use cases via the Enterprise Cloud Managed Edition, which can offer ‘bare metal’ physical servers on daily metering. ... Terremark’s CloudSwitch acquisition gives it a tool that can be used to facilitate migration from, and interoperability with, other cloud environments, including AWS” (Leong et al. 2012).

- Also the service catalogue (“Supermarket” & “Bundles”) including partnerships and certifications must be expanded and improved. The keyword “Supermarket” indicates the actual aim of a cloud computing marketplace to “sell a large variety of readily available products and accessories under one roof” (Gassmann et al. 2013). “Bundling” even goes beyond supermarket offer by “joining several products together for the purpose of selling them as a combined product” (Gassmann et al. 2013). Just as, for example, McDonald’s value meals combine main courses, side orders, and drinks, a cloud computing marketplace provider should enable bundles of I/P/SaaS products.
- Enterprise class cloud computing requires intensive auditing, risk & security certification management. AWS has so far lacked the service level that is required for enterprise-class cloud computing. But “AWS has been aggressively expanding its targeting of enterprises. It has been doing so by both broadening its technical capabilities and increasing its go-to-market partnerships with system integrators. It has obtained many security and compliance-related certifications and audits. Customers may be able to access these audits under a nondisclosure agreement, but cannot conduct their own independent audits” (Leong et al. 2012). Terremark already has a long track record of achieving compliance with highly regarded industry standards such as the Payment Card Industry Data Security Standard (PCI DSS) version 2.0. Thus, Terremark continues to be a key differentiator for Verizon in the enterprise and federal markets because of its rich portfolio of certifications (McNevin 2012).

Concerning the *comprehensiveness* we identified the following.

- Enterprise and federal markets aspiration requires availability from any device. This is because cloud mobility gives companies help in handling the bring-your-own device (BYOD) environment as devices are inhomogeneous, but data and applications on the cloud are not. We recommend that mobile support services encompass Android, Apple iOS and Windows devices of every kind, including tablets, smartphones and laptops. Citrix’s “Enterprise Mobility Cloud Report” answers in detail, amongst others, which vertical industry prefers which mobile operating system. The key finding is that “iOS continued to dominate the enterprise [in 2012] as the mobile platform of choice with 58% of global devices enrolled. Android was the fastest growing platform in Europe, the Middle East, and Africa with an 11

percentage gain from the prior quarter [Q3 2013]" (Citrix 2012). Looking on HP's mobile cloud strategy, there are services that "[a] can ensure that mobile data is encrypted both in transit and at rest and [b] can provide a secure file-sharing service so that mobile device users aren't resorting to online services that may later prove to have been a security exposure" (Babcock 2013).

- The usability should be improved on an on-going basis as it is a critical factor both in mobile cloud application adoption and cloud adoption in general. Simplifying and effectively compressing the user interface enable users to focus on key functionality with a minimum of keystrokes and navigation. Streamlining mobile application design on the backend can improve speed at the user end, adding utility to the application and improving user satisfaction (Akamai n.d.).
- A certified appstore should allow user reviews. The very essence of a marketplace is to find many products and services – separated or bundled – in one place and to compare them. Finding and deploying software can be hard. HN should enable customers to compare options, read reviews, and quickly find the software they want. Thus, user reviews can contribute to the comparison process if they are trustworthy. While setting up a review mechanism it needs to be ensured that (a) reviews can only be uploaded by people that actually used the service, (b) the language is appropriate, and (c) that reviewers were not paid to write positive reviews. E.g., "Amazon.com recently deleted a lot of reviews for a particular brand of protective case designed to fit the Kindle Fire tablet computer. [It turned] out the makers of the case were paying people to write positive reviews. That's illegal according to the Federal Trade Commission" (Moe 2012).

The **value propositions** are (a) enterprise- resp. federal-class flexibility and (b) service comfort that goes beyond competitors with cost driven business models and best-effort clouds with no managed services.

Concerning *enterprise- resp. federal-class flexibility* we identified the following.

- T-shirt sized infrastructure is offered. "In earlier days the pricing model for virtual machines in the cloud was fairly simple. The variables in pricing were the amount of CPUs and the storage provided. This has now evolved into a more fine-grain model, and depending on the provider you can compose your own menu: T-shirt-size-based CPU (small, medium, large), storage input and output operations per second, and size in GB or TB, network bandwidth and optional clustering capabilities" (Waanders 2013). A further value proposition and most out-of-the-box pricing model could be "Pay per tick" that uses the amount of CPU instruction cycles used during a certain timeframe. An instruction cycle is the basic operation cycle of a computer. This is the most transparent way of doing business in the cloud. Further, it might have implications as users would also start thinking about resource consumption of an application and developers would be persuaded to make more lean applications (Waanders 2013).
- Migration from, and interoperability with, other cloud environments results in freedom of choice and prevents customer lock-in. This value proposition is that important as many business or federal organisations decide for a multi-cloud strategy which focuses on "the concomitant use of two or more cloud services to minimize the risk of widespread data loss or downtime due to a localized component failure in a cloud computing environment. Such a failure can occur in hardware, software, or

infrastructure. A multi-cloud strategy can also improve overall enterprise performance by avoiding ‘vendor lock-in’ and using different infrastructures to meet the needs of diverse partners and customers” (Rouse 2012).

- Addressing hybrid hosting use cases including “bare metal” physical servers on daily metering meets business needs. “A hybrid cloud is a cloud computing environment in which an organization provides and manages some resources in-house and has others provided externally” (Rouse 2010). This approach allows organisations to maintain a centralized approach to IT governance for business critical processes, yet the advantages of cloud computing can be tested and exploited to some degree.

Concerning *service comfort* we identified the following.

- One-stop-shop self-services, a large variety of products (“Supermarket”), bundles of services (“Bundling”), and a deal of the week raises attention. The principles of supermarket and bundle offerings were described profoundly. The value proposition is not solely the supermarket and bundling topic, but moreover self-services allow customers to access and work with cloud resources without the cloud provider’s involvement. This is important for customers that work in rather simple use cases and, thus, want to realize a cloud sourcing shift fast without major communication efforts. A deal of the week is simply a classic marketing instrument to raise attention and to tempt new customers.
- Keeping data in the EU bypasses FBI’s misuse of the „Patriot Act“. This value proposition is communicated to the market within the BM “Brand Management”. Thus, compare the value proposition section of chapter 4.3.3 for an in-depth description of this value proposition.
- Optional managed services, e.g. for on-boarding, simplify the sourcing shift. Citrix (2010) has published a well written white paper about solutions for cloud on-boarding. Basically, it says that “moving applications to the cloud can be complex, and depending upon the application the target cloud environment may require re-architecting the application and network stack. Many factors must be considered when moving an application to the cloud: application components, network stack, management, security and orchestration. ... In short, the desire to move application workloads to the cloud should be seamless and with minimal manual effort making cloud computing a reality giving system administrators a solution to move to the cloud with ease” (Citrix 2010).
- Offering co-location allows organisations to focus its IT staff on the actual IT work. Co-location is especially an interesting value proposition for organisations that want to adhere to their IT department, yet choose a co-location over building an own data centre. “A co-location is a facility in which businesses can rent space for servers and other computing hardware. [It] typically provides the building, cooling, power, bandwidth and physical security while the customer provides compatible servers, storage and networking equipment. Besides basic space rental, many [co-locations] extend their services to include leasing for equipment, network and server monitoring tools, power, redundancy and backup systems. In general, collocation is moving or placing things together, sometimes implying a proper order” (Rouse et al. 2010) there might be the following reasons why a business or federal organisations chooses co-location.
  - Disaster recovery and redundancy

- Hosting a customer-facing website or for a testing environment for new projects
- Web site owners could place the site's own computer servers on the premises of the Internet service provider.

The following **customer** groups are addressed by this BM.

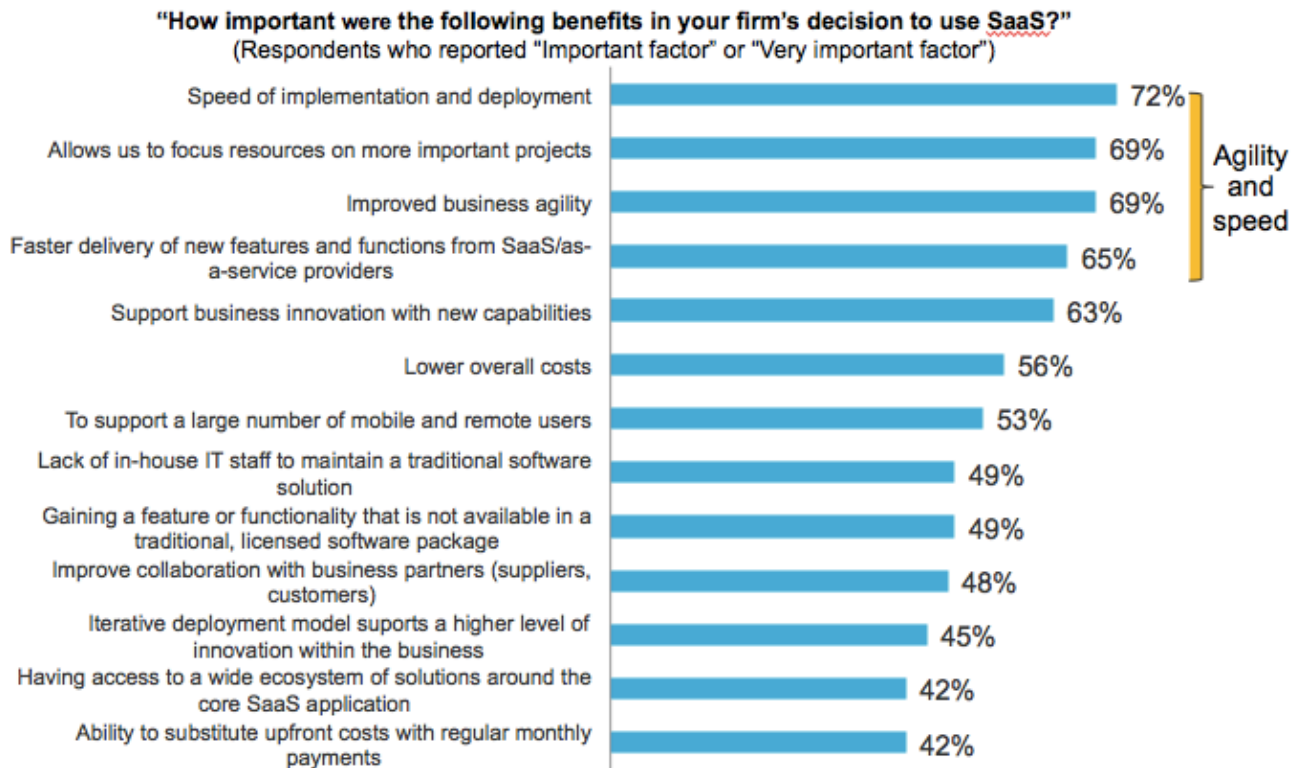
- **Consumer markets (B2C):**

- Cloud storage: "The number of global consumers using cloud services after the first six months hit more than 375 million, or about three-quarters of the estimated total of 500 million by year-end. While no firm numbers exist to show the extent of the cloud in 2011 because it was relatively new and untested, best estimates put global subscribers then at approximately 150 million. Subscriptions to either free or paid cloud services will continue to climb in the years ahead, jumping to an estimated 625 million next year, and then doubling over the course of four years to reach 1.3 billion by 2017 ..." ([Rebello](#) 2012).
- Private developers: We assume that private developers have similar reasons for leveraging the cloud as occupational developers (cf. figure 36).
- Multimedia and gaming users benefit from (a) eliminating the installation of software which alleviates software maintenance and upgrading and (b) cheaper infrastructure with power usage as the computing capacity – which is very high in today's multimedia and gaming – is provided by the cloud provider ([Zhu et al.](#) 2011).

- **Business markets (B2B):**

- Occupational developers: 71% of cloud developers have at least six years of programming experience, and some 11% have been writing code for over 20 years. These aren't novices trying the cloud because it is a hype ([Asay](#) 2013). The primary reasons why developers turn to cloud is speed of development (cf. figure 36).





Source: [Forrsights Software Survey, Q4 2012](#)

**Figure 36** Developers' Reasons for Cloud Leveraging

- All kinds of business organisations encompassing start-ups, small and medium enterprises, and large concerns benefit from cloud computing by saving money, increasing competitiveness, and finding exciting possibilities for businesses of all sizes. These qualitative findings are well-known and trivial. The interesting question is which kind of organisation benefits to which degree from which effect. The Manchester Business School and Rackspace researched this question empirically. They surveyed 1,300 organisations split between the UK and US. 1,000 of these were SMEs and the remaining 300 were enterprises with in excess of 1,000 employees. The quantitative findings, confirming the qualitative statements, can be found at [Nicholson et. al \(2013\)](#).
- **Public markets (B2A):** In order to get an idea of the importance of this customer segment, we choose the example of the Canadian public sector. Having 262,902 civil servants located in more than 180 countries working for 34,880,491 Canadian citizens ([Wouters 2013](#)), it is proven that within public sector there are the world's largest and most complex organisations and employers. This size and scope makes, for example, governments, military, health systems, or justice systems well-suited candidates for cloud computing ([Young 2013](#)). An in-depth white paper about the implications of cloud computing for the public sector can be found at [Young \(2013\)](#).



### 3. Value capture

On the **costs** side we identified the following.

- The alignment with different countries' languages and laws followed by an initial worldwide marketing will be necessary. This pool of costs depends on the establishment of a broker role that manages the international roll-out and ecosystem as explained in the analysis unit 8. If the role is established, the costs will be outsourced. Especially the analysis of and adaption to different national laws requires intensive efforts. The knowledge base has grown immensely concerning cloud computing both from technology and business points of view. The slow improvement of national laws over the planet to support global cloud computing has not been researched in-depth. Yet, the "[2013 BSA Global Cloud Computing Scorecard](#)" shows that "a small number of countries have quickly advanced by embracing the legal and regulatory changes needed to take full advantage of the digital economy. They have adopted new laws that will improve user confidence in the cloud and allow the countries to exploit the great productivity and expanded economic growth that cloud computing enables." Therefore, the white paper helps in deciding which countries should be addressed and where new server plants can be built from a legal point of view.
- Platform costs (libraries, languages) and infrastructure costs (virtualization, servers, storage, networking, electricity, licensing) are main recurring cost. These costs were explained and quantified in the first BM "Generic Cloud Computing for European Science" (cf. chapter 4.3.1).
- As explained and quantified in the first BM "Generic Cloud Computing for European Science" (cf. chapter 4.3.1), the key activities R&D, marketing, tool development & integration, continuous technology updating are also to be considered.
- The role holder will receive a percentage of the revenues that are gained in this BM for lowering risks and cost and raising revenues. The exact effects of this specific broker role are explained in criterion eight. We assess a percentage to be the right incentive for the role holder, because if he performs well, his revenues will grow, as well.

On the **revenue** side we identified the following.

- Fundamentally, the enlargement on business and federal markets and an internationalisation brings high revenue potential with it which was confirmed in the expert evaluation.
- A "Freemium"-Strategy with the three pricing models on-demand (linear) for high flexibility, subscription (hyperbola) with defined length, and spotting for batch computing (lowest bidding wins). A "Freemium"-strategy for market entrance and the three pricing models were described in-depth and can be found within the revenue section of the first business model (cf. chapter 4.3.1).
- Training, support charging, and crowd funding state revenue that might follow. Same counts for these revenue drivers. They were explained in chapter 4.3.1.

### 4. Risks

Supplying business and federal organisations brings along very high risks as violations of SLAs lead to liability for potentially immense profit losses. If a researcher has no access to data for one week, the consequences are not dramatic, whereas an outage in the financial services sector can lead to bankruptcy within weeks. To develop a practically oriented understanding of how high outage costs are and how liability is calculated, we recommend a Vision Solution paper ("[Assessing the Financial Impact of Downtime](#)" 2008). Further, market presence in many nations brings the risks of (a) not abiding by national law or (b) being forced to grant access to data by federal organisations like intelligence agencies or governments.

## 5. Investment costs changes

The investment costs, that are necessary in the first BM "Generic Cloud Computing for European Science" as described in deliverable 7.1, appear in a much more extreme way as potentially any business or public customer in potentially any country can be supplied. Therefore, intensive infrastructure investments in different countries are required. Moreover, the choice of geographies and adaption to national laws and languages are to be added.

## 6. Switching costs changes

No influence of this BM was identified. Yet, we want to indicate that it is of high importance to especially overcome the problem "... known as customer lock-in (sometimes also known as vendor lock-in) where switching costs, or the additional time, money, and effort it takes to switch to competing technology platform, make it very difficult" (Jakki et al. 2010) as this is an even more critical adoption factor for businesses and federal organisations. The challenge is that "... technology lock-in concerns the cost of moving a business service from one cloud platform to another. Once a company is on a particular platform, it is often more cost-effective to purchase additional services compatible with existing ones – and thus increasing lock-in" (Willcocks et al. 2011). A potential solution to this challenge is the adaption to compatibility standards which may increase standard-based competition and thus help avoid consumer lock-in (Egyedi 2010). The definition of standards in cooperation with competitors and the adaption to the standards causes costs.

## 7. Non-transparency changes

As the service portfolio might be enriched by co-location, hybrid cloud computing, onboarding services, and many more marketplace partners in general the problem of intransparencies turns even more critical. Yet, if a solution is found, e.g. by communicating standards to the technology partners, a true distinction to the competition will be achieved.

## 8. Design challenges

This BM does not address any specific challenge explained in the analysis phase (cf. chapter 3.2).

## 9. Specific broker role

Having the ambition to establish a world-wide all-in-one enterprise cloud brings the impact of cloud computing partner networks to its full potential. Large, powerful companies at the core of ecosystems act as or-

chestrators and assemble the partner network. The very basic idea is that the scale and complexity of a network is far beyond what can be provided by any single company. The incentive for partners to participate in network programs can be the access to technical, sales, and marketing support. The orchestrator might benefit from a better service quality and market penetration. The concept of partner networks as such was researched in-depth (e.g. [Iansiti and Levien 2004](#); [Street and Cameron 2007](#); [Larson 1991](#)). It is a concept that goes beyond companies' isolated strategizing on product-market segments as introduced by [Porter \(1985\)](#).

Exactly such a specific broker role would act as an orchestrator that manages the choice of worldwide geographies where data centres are to be installed and customers addressed. Further, the international roll-out requires national law and language adaptations of the services. As the central orchestrator would be the strategic core of the partnership, he would also be responsible for the portfolio management and, thus, the selection of further partners especially in the area of SaaS, as well as business development, definition of new services for the global market (innovation management and market research), and the reduction of transparency and switching costs for end-customers. This would be a great strategic advantage as the following source shows. "In spite of the availability of a variety of cloud computing services by different technology vendors, one of the biggest challenges that has been hindering the widespread acceptance of cloud computing solutions by enterprises has been the lack of specific, global standards that could enable CIOs to evaluate various vendors on certain specific parameters and choose the one that suits their needs" ([Premrajan 2013](#)).

By managing these tasks centrally instead of having each supplier working on these issues in bilateral communication, the economies of scale effect grasps and, thus, operative costs decrease for each supplier. Yet, the role holder could receive a percentage of the revenues that are gained in this BM for lowering risks and costs. Of course, savings through the role have to justify its costs.

Although we do not see how this role could raise revenues, a role set-up and assignment might definitely be worth the effort, in our opinion, as (a) costs are lowered as explained above and (b) risks are lowered through a central management team. The point is that decision making in an international environment requires intensive efforts for information gathering (laws, market requirements, languages, and cloud computing policies), information analysis, preparation and presentations to decision makers. If these tasks are split up and distributed to all technology partners that participate in the marketplace, there will be the risk that no one actually sees the big picture and different analysis units (e.g. geographic risks of a certain country) are used for decision making or the same decision criteria are interpreted differently. The same counts for law analysis of each potential nation to be addressed. Specialists for each nation's laws are required. If they need to cooperate bilaterally with each technology partner of HN, both costs and risks raise, whereas one contact, which would be the specific broker role, remedies this problem.

Further, the required initial investment costs would be outsourced to the specific broker role except investments in technology expansion (e.g. further infrastructure with a different virtualization technology) and adaptations (e.g. further languages and law adaptations for SaaS).

The role does not have implications on switching costs and non-transparency problems within the HN

marketplace.

## 10. Expert evaluation

The **impact** of this BM was valued high with (cf. figure 37). Amongst top level values, there is no outlier. The revenue potential, customers' need, impact on critical mass, as well as the visibility and traffic are on high levels with values from 3.8 to 4.0. Thus, most relevant key criteria are ranked positively. Yet, the customers' subjective acceptance of the migration effort to and security problems with cloud services; and the differentiation resp. thought leadership are "only" on a medium level with evaluation values from 3.0 to 3.3.

Concerning effort and security, these evaluations were to be expected as they are no inherent problem of this very BM, but actually of all kinds of cloud services. Customers simply are still cautious and worried about cloud computing scenarios, even if SLAs are defined in detail and from an objective point of view these risks might be lower than perceived. Actually, comparing the medium values of effort and security to other empiric research, this evaluation brought up rather positive values, at least relatively.

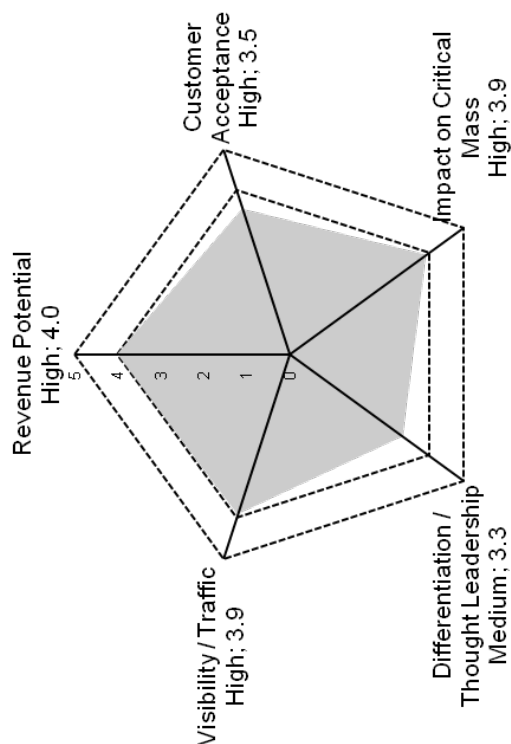
Concerning differentiation resp. thought leadership there is only a little number of competitors that meet enterprise and federal class application demands. "These [demands] are general-purpose workloads that are mission-critical, and may be complex, performance-sensitive or contain highly sensitive data; they are typical of a modest percentage of the workloads found in the internal data centers of most traditional businesses. They are usually not designed to scale out, and the workloads may demand large VM sizes. They are architected with the assumption that the underlying infrastructure is reliable and high-performance" (Leong et al. 2012). Bluelock, Savvis, and Virtustream are the only recommended suppliers for enterprise applications. The reason why the evaluation value for differentiation resp. thought leadership is medium is the number of suppliers that fit for general business applications which experts included in the idea of enterprise-class cloud computing. Thus, true differentiation can be reached by supporting enterprise and federal class application demands. Depending on the source, there are about 196 countries in the world. The decisions (a) in which country data centers are to be set-up, (b) customers from which countries are supported, (c) which level of business use cases is to be achieved (general business or even enterprise-class services) etc. take their time to be met.

The **ease of implementation** was valued neutral with 2.9 which shows that there is no tendency to other evaluations. This value is the worst and, thus, this BM is, as expected, the most difficult to implement. The most critical criteria are the onetime costs and the required time until the first service is sold. Costs and time for language, law, and especially infrastructure volume adaption, as explained above, are immense. Yet, in one point, experts were positive about the ease of implementation, which is the expertise of the current HN consortium's partners to master the challenge. Even though there is a tendency with the value of 3.5 to a neutral expertise, it is good to know that the talents to master this ultimate BM for big players are available within HN.

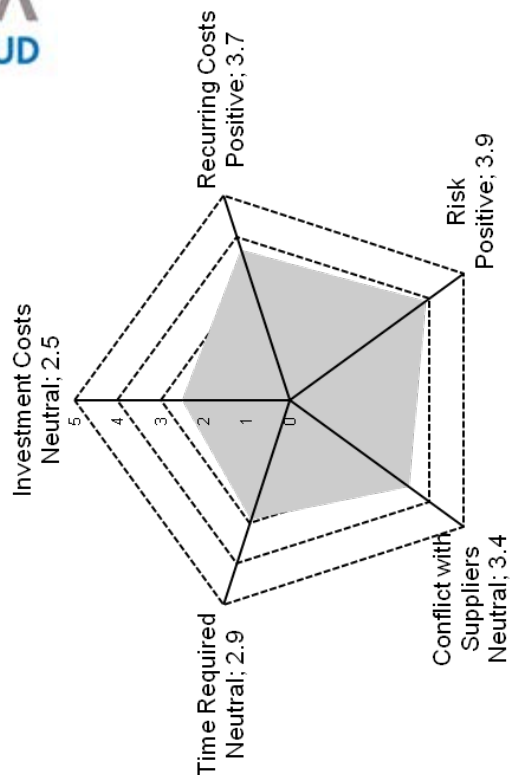
We clustered the experts' **remarks** on the BM with the following outcome. As the EU has the vision of eventually paving the way for a cloud computing platform that offers a unique resource to governments, businesses and citizens worldwide, this BM has to be included, of course. The expert evaluation revealed a two-sided perception of this BM. HN supplier experts are attracted by its revenue potential which lead to a high value being the second best of all BMs. SAP experts were more reserved because the expansion to enterprise level cloud services worldwide causes high onetime costs and takes very long which is depicted in critical values. Yet, the potentials of such an ultimate BM for big players and the chance to consolidate different marketplace partners' business activities and strategies in one BM including the ecosystem approach should certainly not be overlooked.

After the overarching broker roles and all BMs including their specific broker roles were described and evaluated in-depth according to defined analysis units, the questions arise (a) how they can be compared, (b) what the *overall* evaluation results are, and (c) how the BMs could be brought to life initially. Therefore, the following conclusion for the BM options shows and explains a variety of tables, radars, and matrices that enable a profound decision making. Thus, questions (a) and (b) are answered in the following chapter. Question (c) is answered in chapter 4.6 that outlines appropriate steps to generate network effects, which we define as the increasing value of a product or service for each user as the number of users grows. These steps might be required to reach a critical mass of users.

## Impact of Option



## Ease of Implementation



Impact		Customer Acceptance		Impact on Critical Mass		Differentiation / Leadership		Visibility / Traffic		Result	
Criterion	Weighting	Need	Effort	Security	Mass	0.1	0.1	0.1	0.1		
	Value	0.2	0.05	0.05	0.2	0.1	0.1	0.1	0.1	high	1
		high	3.8	medium	3.9	medium	3.3	high	3.9	high	3.8
		high	4.0	medium	3.0	medium	3.3	high	3.9	high	3.8
Ease		Costs		Risk		Conflict with Suppliers		Time Required		Result	
Criterion	Weighting	One-time	Recurring	Feasibility	Expertise	0.1	0.1	0.1	0.1		
	Value	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	neutral	1
		critical	3.3	neutral	3.5	neutral	2.8	critical	2.4	neutral	2.9
		critical	2.3	neutral	3.5	neutral	2.8	critical	2.4	neutral	2.9

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

Figure 37 Expert Evaluation of "Worldwide All-In-One Enterprise Cloud"



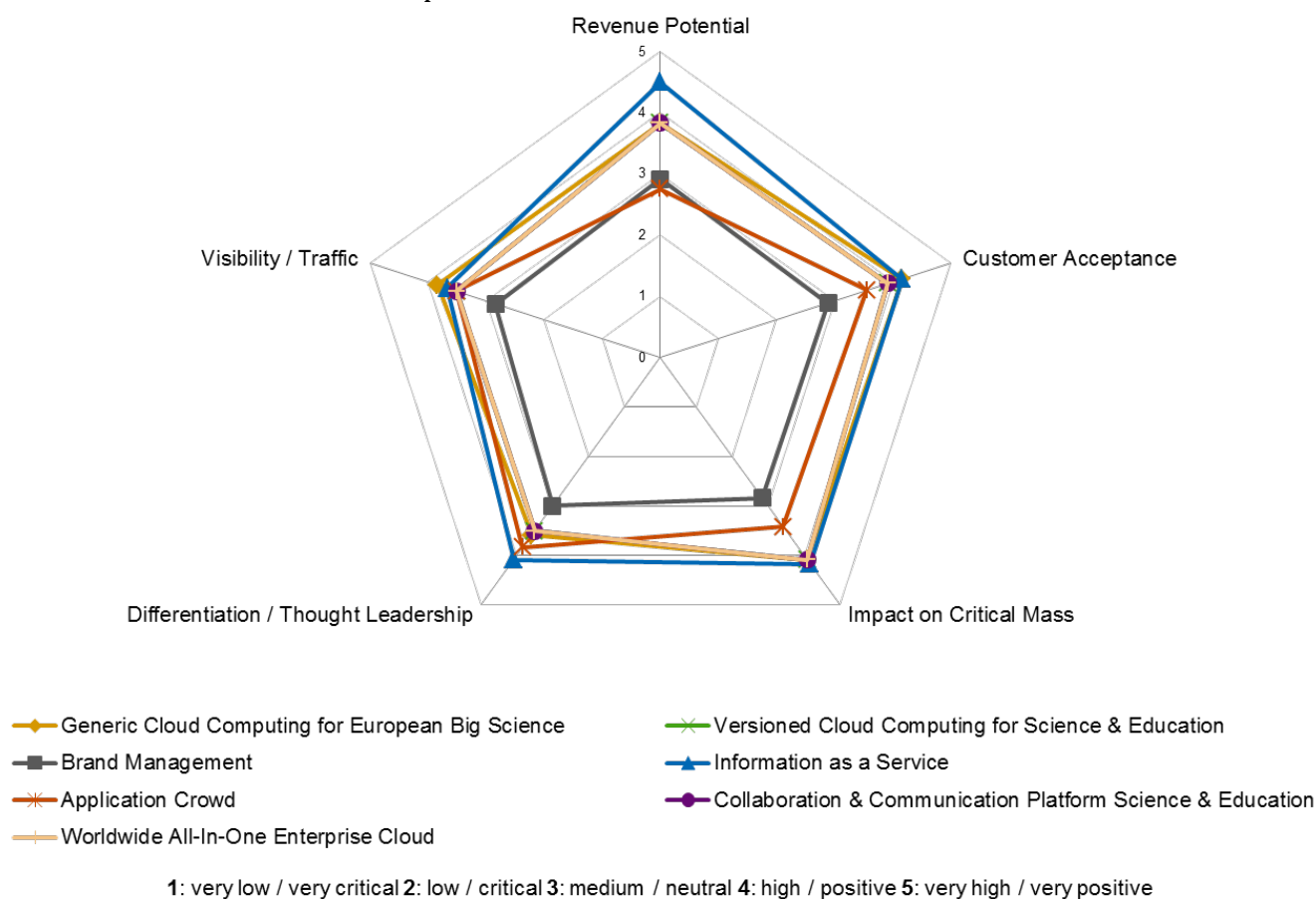
## 4.5 Conclusion for the Business Model Options

The interim conclusion for the BM options addresses the following two issues. (a) The overall evaluation results are presented by eventually comparing the experts' opinions on the BMs. (b) The requirement of integrating EGI into HN (cf. design challenge (3) in chapter 3.2) is met by an overview showing which roles can potentially be assigned to EGI.

### 4.5.1 Overall Evaluation Results

Using a structured questionnaire, twelve cloud computing experts with both business and technology knowledge working at Helix Nebula suppliers and SAP evaluated the seven presented BMs. The evaluation ensures both a market and a supplier point of view.

The market view describes the BMs impact regarding revenue, customer acceptance, critical mass, thought leadership, and visibility. Figures 38 and 39 provide an overview for all evaluation results concerning the BMs' impact. We learn that "Information as a Service" excels in all but one criteria. The BM "Brand Management" will have a rather medium impact.

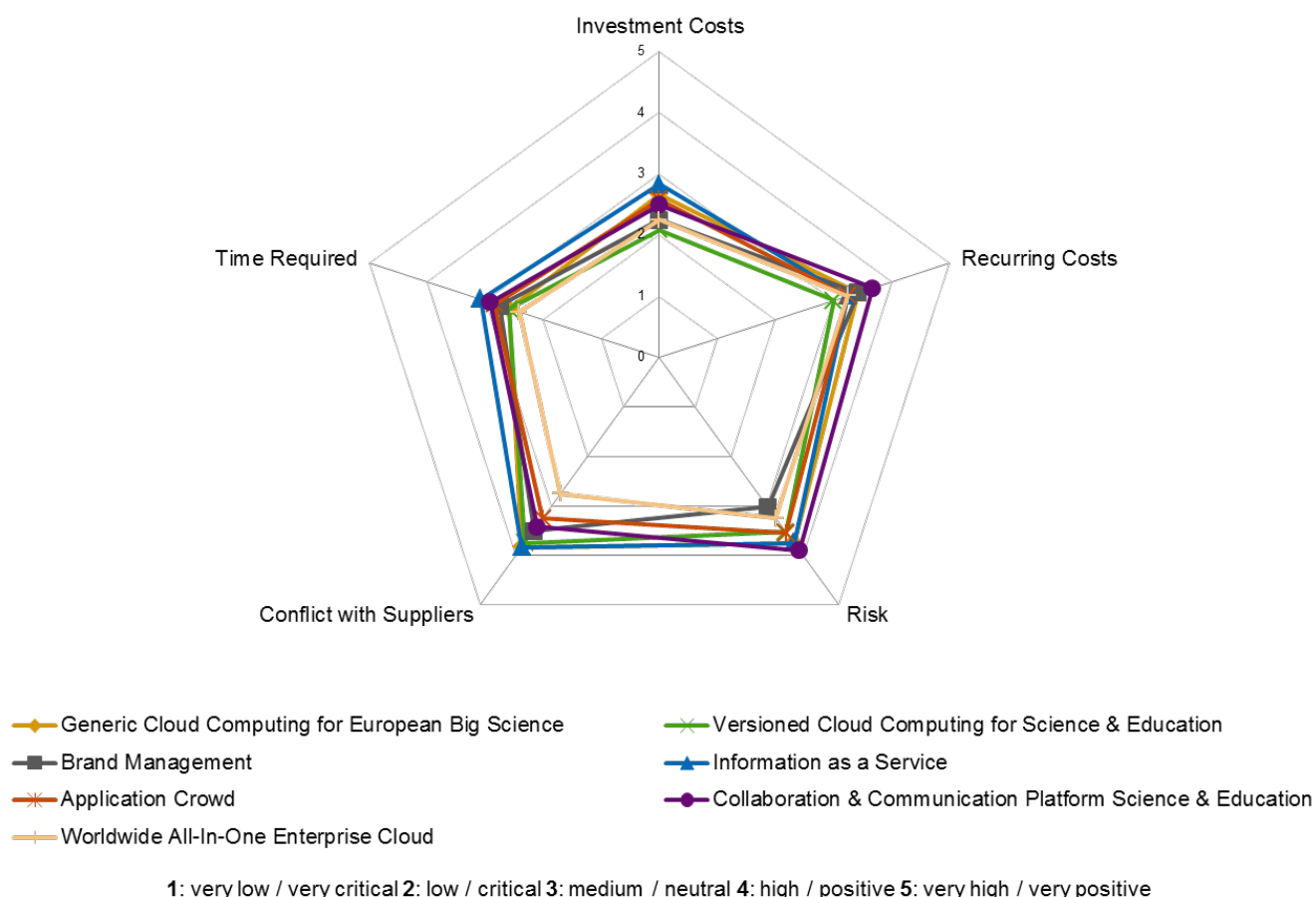


**Figure 38** Criteria Comparison for "Impact of Option" (Radar)

Impact of Option	Criterion	Revenue Potential	Customer Acceptance			Impact on Critical Mass	Differentiation / Leadership	Visibility / Traffic	Result
	Question	How do you value the revenue potential?	Need	Effort	Security	How do you value the number of partners and customers participating?	How do you value the novelty on the market and the distinction to competitors?	How do you value the potential to raise attention without explicit marketing campaigns?	What is the average over all criteria taking into account the weightings?
Business Model Options	Weighting	0.3	0.2	0.05	0.05	0.2	0.1	0.1	1
	Generic Cloud Computing for European Big Science	high 3.8	very high 4.8	medium 3.0	medium 2.9	high 4.1	high 3.6	high 3.8	high 4.0
	Versioned Cloud Computing for Science & Education	high 3.8	high 4.3	medium 3.0	medium 3.2	high 4.1	high 3.5	high 3.5	high 3.8
	Brand Management	medium 2.9	medium 2.9	medium 3.3	medium 3.1	medium 2.8	medium 3.0	medium 2.8	medium 2.9
	Information as a Service	very high 4.5	very high 4.5	high 3.5	medium 3.4	high 4.2	high 4.1	high 3.7	high 4.2
	Collaboration & Communication Platform for Science & Education	medium 3.0	high 4.2	medium 3.4	high 3.5	high 3.9	medium 2.7	medium 3.3	high 3.5
	Worldwide All-In-One Enterprise Cloud	high 4.0	high 3.8	medium 3.3	medium 3.0	high 3.9	medium 3.3	high 3.9	high 3.8
	Application Crowd	medium 2.8	high 3.8	medium 2.9	medium 3.1	medium 3.4	high 3.8	high 3.5	medium 3.3

Figure 39 Criteria Comparison for "Impact of Option" (Table)

The supplier view describes the BMs efforts to be undertaken costs, risks, conflicts with HN suppliers' strategies, organisational structure or processes, and the required time until the first service is sold. Figures 40 and 41 provide an overview for all evaluation results concerning the BMs' ease of implementations.



**Figure 40** Criteria Comparison for "Ease of Implementation" (Radar)

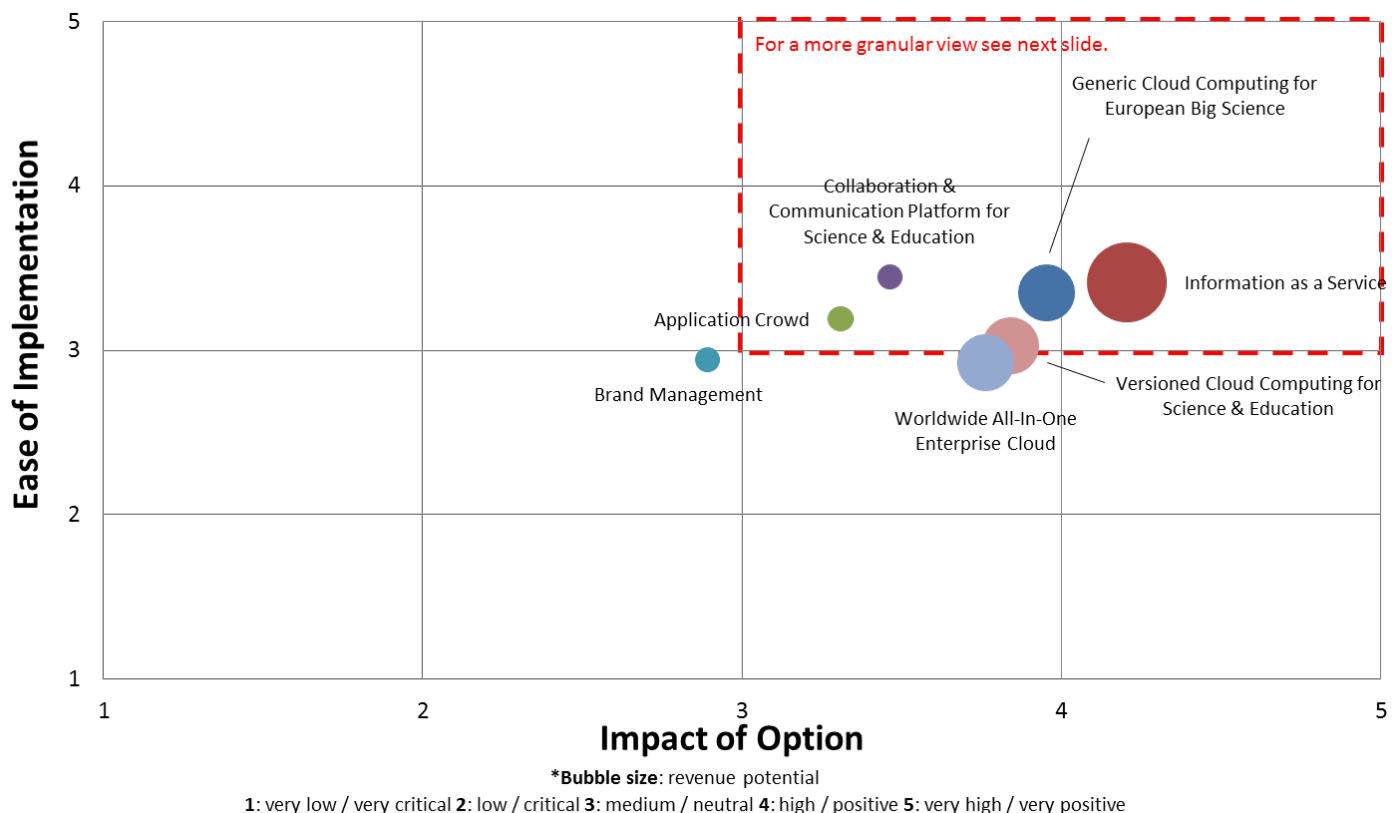
Ease of Implementation	Criterion	Costs		Risk			Conflict with Suppliers	Time Required	Result
		Onetime	Recurring	Feasibility	Expertise	Legal			
Business Model Options	Question	How do you value initial investment costs?	How do you value costs that appear on an ongoing basis?	How do you value the objective technical feasibility with today's knowledge?	How do you value your organisation's knowledge to realize the BM?	How do you value legal risks that might appear?	How do you value conflicts with your organisation's strategy, structure and processes?	How do you value the required time until the first service is sold?	What is the average over all criteria taking into account the weightings?
	Weighting	0.2	0.2	0.2	0.1	0.1	0.1	0.1	1
	Generic Cloud Computing for European Big Science	neutral 2.7	neutral 3.4	positive 4.0	positive 3.9	neutral 3.1	positive 3.8	neutral 2.6	neutral 3.4
	Versioned Cloud Computing for Science & Education	critical 2.1	neutral 3.0	positive 3.8	positive 3.7	neutral 2.9	positive 3.8	neutral 2.6	neutral 3.0
	Brand Management	critical 2.3	neutral 3.4	neutral 3.4	neutral 2.7	neutral 2.6	positive 3.5	neutral 2.8	neutral 3.0
	Information as a Service	neutral 2.8	neutral 3.3	positive 4.0	positive 4.2	neutral 2.8	positive 3.8	neutral 3.1	neutral 3.4
	Collaboration & Communication Platform for Science & Education	neutral 2.5	positive 3.7	very positive 4.6	positive 3.6	neutral 2.8	neutral 3.4	neutral 2.9	neutral 3.4
	Worldwide All-In-One Enterprise Cloud	critical 2.3	neutral 3.3	neutral 3.3	positive 3.5	neutral 2.8	neutral 2.8	critical 2.4	neutral 2.9
	Application Crowd	neutral 2.6	neutral 3.3	positive 3.9	positive 3.6	neutral 2.8	neutral 3.3	neutral 2.8	neutral 3.2

Figure 41 Criteria Comparison for "Ease of Implementation" (Table)

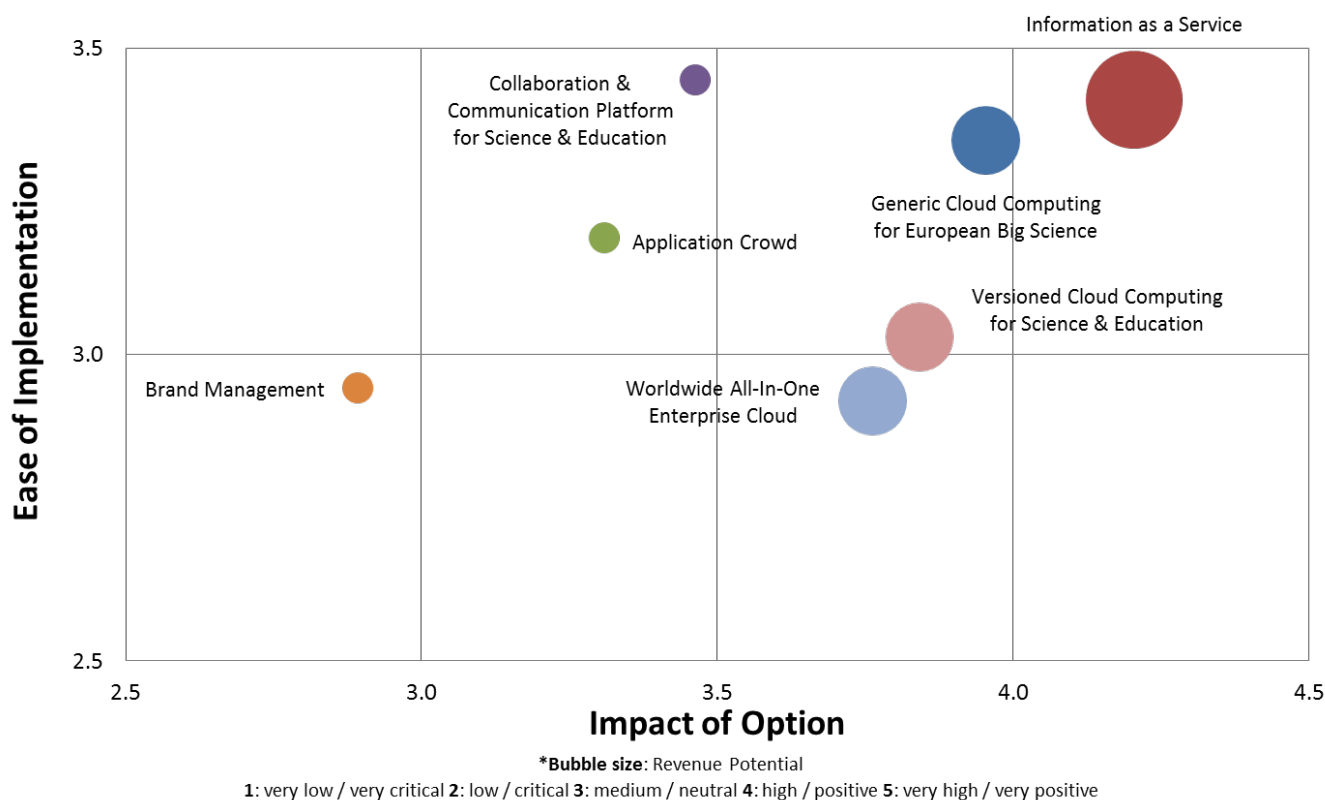
The consolidation of the generated data results in a matrix (cf. figure 42 and 43) that depicts the BMs according to their ease of implementation and impact of option. Further, the bubble size represents the relative revenue potential.

The fundamental learning of the matrix is that there are neither positive nor negative extremes concerning the ease of implementation, as all values are to be found in a range from 2.9 to 3.4. Nevertheless, the BMs “Information as a Service”, “Generic Cloud Computing for European Science”, and “Collaboration & Communication Platform for Science & Education” with the values 3.4 have a strong tendency to even positive evaluations. Thus, considering the actual complexity of cloud computing marketplaces at first glance, it is interesting and very good to know that the complexity is not critical in any BM. This means that the technical knowledge required for realising the BMs exists and is available within the expertise of HN suppliers.

Turning to the impact of all options, optimism arises. Four of the seven BMs have a high expected impact. One of them, namely “Information as a Service”, also has a very high revenue potential, whereas the other have high revenue potentials.



**Figure 42** Consolidation Matrix (Continuous Axes)



**Figure 43 Consolidation Matrix (Discontinuous Axes)**

### **Recommended Business Model Roadmap**

After final discussions the recommended business model roadmap is the following and will be further elaborated in D7.4:

First Phase:

- Generic Cloud Computing
- Information as a Service

Second Phase:

- Versioned Cloud Computing for Science & Education (optional)
- Worldwide All-In-One Enterprise Cloud

In the first phase of HN the business models Generic Cloud Computing and Information as a Service should be established. Generic Cloud Computing addresses the objective of the project to deliver a cloud solution to science, whereas information as a service addresses data driven research organizations such as ESA that can deliver valuable “knowledge” to the cloud.



It has to be clear that both business models should be planned and implemented now. However, Information as a Service will take much longer to go live. There are several issues to be clarified: legal issues such as who owns the data, whom can it be sold to as well as content issues such as with what other data could it be aggregated in order to enable valuable analyses. In order to succeed with this business model in a timely manner these issues have to be clarified now.

In the second phase, once the cloud is established the gained expertise and resources can be utilized in order to address a broader audience. One of the HN visions is to address governments, businesses and citizens. This is the final objective of the second phase. In order to reach this HN can be opened up step by step to other segments such as Science & Education by exploiting the business models “versioned cloud computing for Science” and addressing these segments with targeted versions.

After the BMs were compared in-depth, one question remains. How can the BMs be brought to life initially? The following chapter outlines potential best practices to implement BMs and by leveraging network effects (NE) how to reach a critical mass of users.

#### 4.5.2 EGI’s Attendance for Undertaking Overarching and Specific Broker Roles

In chapter four, OBRs and specific broker roles were presented. An assignment of one or more of these roles to EGI.eu or one of its affiliated NGIs states a possible way to integrate EGI.eu into Helix Nebula. The final decision upon which role respectively roles are finally going to be assigned to EGI is to be made at General Assembly III in close cooperation with EGI. Chapter 6.2 presents the required next steps including a list of decision points concerning decision making for business models and the broker roles. In order to improve decision making we provide figure 44 explaining whether EGI shows either (a) complete, (b) limited, or (c) no attendance in undertaking the respective role. These statements are not commitments and, thus, they are not legally binding. They are rather to be seen as propositions that need to be taken into account at General Assembly III. For the Integrator and Aggregator role, an assignment to National Grid Initiatives (NGIs) is more appropriate to meet customers’ national legal, technical, and financial requirements. “[NGIs] are organisations set up by individual countries to manage the computing resources they provide to the [EGI]. They represent the country’s single point of contact for government, research communities and resource centres as regards ICT services for e-science. NGIs are the EGI main stakeholders, together with CERN and EMBL” (EGI.eu 2012).

The “Blue Box” or Technology Broker, as we name it, is fairly defined in its tasks, yet it has not been described who and how many partners are supposed to manage its functionalities. In order to summarize and complement the “Blue Box”, we see five basic roles within it. These roles are included in the matching process to EGI as they remain to be assigned as well.

Broker Role Category	Decision Point	Level of Attendance
Overarching Technology	Transparency	EGI.eu has long term experience in transparent integration of independent resource providers into a federated service provision and is positioned as neutral and trustworthy partner in the scientific community.
	Integrator	An assignment to National Grid Initiatives (NGIs) affiliated with EGI.eu is more appropriate to meet the local customer's national legal, technical, and financial requirements.
	Aggregator	
	Orchestrator	EGI.eu positions itself as valid candidate through the consolidated federated operations, human network, and technical services.
	Authentication	EGI.eu already manages authentication processes, technology, and policies for a European-wide infrastructure with international reach; Helix Nebula can benefit from the established function within the scientific community.
Overarching Business	Trading Exchange Platform	EGI.eu is in advanced process to set up a federated resource allocation process and tool for the EGI resource providers; this can be expanded and enriched to include Helix Nebula supply side to evolve towards a general trading platform for cloud services for science in Europe.
	Yello Strom	EGI.eu is unwilling to take the business risks with this model.
	Working Groups Management	EGI.eu already provides the value creation of this role for the European area involving around 320 publicly funded resource providers; the function can be expanded to the Helix Nebula supply side; assigning the function to EGI.eu would produce economy of scale and re-use existing capabilities within e-Infrastructure area.
	Up-/Cross-Selling Potentials	EGI.eu is ready to manage this role within the proof of concept phase for now as experience in the area of customer relationship management (CRM) exists.
	Financials	These roles are not EGI.eu's core capabilities and there is no strategic fit.
	Law	
Business Model Specific	Versioned Cloud Computing for Science & Education Broker: <b>Market Research &amp; Versioning</b>	EGI.eu already covers the non-profit part of this business model; it is viable to expand the service portfolio and the functions with the Helix Nebula commercial suppliers
	Brand Management Broker: <b>Franchising &amp; Marketing</b>	EGI.eu already manages the EGI brand. There might be a conflict of interest in managing the Helix Nebula brand.
	Information as a Service Broker: <b>Data Management</b>	This role might be more a fit for research communities to develop domain-specific information as a service businesses; EGI.eu can be a consultant and enabler.
	Collaboration & Communication Platform Broker: <b>Front End Provisioning</b>	There is no strategic fit for EGI.eu and the market is too crowded from NRENs and others.
	Worldwide All-In-One Enterprise Cloud Broker: <b>International Strategy &amp; Communications</b>	Through the international relations with initiatives of IT infrastructures for data-intensive research, EGI.eu provides a solid base to build this functionality.
	Application Crowd Broker: <b>Appstore Provider</b>	EGI.eu already provides an application catalogue for the community ( <a href="http://appdb.egi.eu">appdb.egi.eu</a> ); this can be expanded to add a certification process and charging model to generate revenues.

Level of Attendance: **Complete** **With Limitations** **None**

*Figure 44 EGI's Attendance for Role Undertaking*

After (a) the BMs were compared in-depth and (b) the integration of EGI through an assignment to one or more potential broker roles was discussed, one question remains. How can the BMs be brought to life initially? The following chapter outlines potential best practices to implement BMs and by leveraging network effects (NE) how to reach a critical mass of users.

### 4.5.3 EGI Integration Recommendation #1: Level Playing Field

#### Problem Statement

The EC identified the fragmentation of the digital single market encompassing publicly funded and commercial providers as an obstacle to the uptake of cloud services in Europe. Thus, policy action within HN is required (“Unleashing the Potential of Cloud Computing in Europe” 2012). HN’s commercial suppliers raised the issue of a level playing field and synergies across publicly funded infrastructures and commercial providers. EGI.eu found in its WP6 the right words to motivate this issue. “With regards to the creation of a single digital market for cloud services targeted at research communities encompassing both publicly funded infrastructures and commercial providers, it is essential to ensure a level playing field and synergies across the two domains” (Andreozzi and Asero 2013). Further analysis to eradicate the real fear of unfair internal competition between the publicly funded research infrastructures and the commercial actors goes through the identification of appropriate business models and policies.

EGI is a federation of publicly funded resource providers for European researchers that is evolving its service portfolio towards cloud services (EGI.eu 2012). Resources are paid for by public money and deliver services free at point of use to authorized users from primarily the science community. Helix Nebula brings together European cloud providers under the same umbrella and is currently driven mainly by for-profit organizations. The issue is how to ensure such a level playing field to reach a fair competition. D7.2 addresses this recommendation by using and further evolving EGI.eu’s analysis and ideas (cf. D6.1, section 4.1, recommendation 1).

Thus, it is necessary to evolve the analysis from the viewpoint of the resource providers to understand what rules are necessary to ensure fair competition. It should be also considered that often the resources installed in publicly funded resource centres are owned by research communities who would like to use the owned resources in integration with commercial resources (a private distributed cloud to be integrated with a public cloud). Other research communities use publicly funded resources based on allocation that they receive through an application process where they present a scientific case and then they need to deliver results within the given allocation, but at zero cost to the researcher at the point of use. We present the following list with customer segments. For each segment it is defined, if publicly funded, commercial, or both kinds of suppliers are available.

So far, the focus is set on fair opportunities for commercial providers to enter the market of cloud services for science. We also add the user’s viewpoint which is ensuring European researchers needing cloud services for their activities a fair access or equal opportunities. The following customer’s segments analysis evolves into understanding the different needs and spending capabilities of potential users and also the nature of their activities. Thus, it seems meaningful to expand the focus and also include aspects such as freedom of choice and no lock-in that are relevant to enable real users’ mobility. EGI.eu’s integration will lead to support this aim of lowering lock-in and freedom of choice.

### **Level Playing Field for Provider Selection**

**Cloud Owning Research:** Research groups who own IT resources at publicly funded resource centres and wanting to expand their usage to Helix Nebula commercial providers, should be able to connect the owned resources to the Helix Nebula BlueBox and continue to use them for free. The provision of free services from publicly funded resource centres should be limited to non-profit research activities coming from within the public sector (charges for the use of BlueBox may apply).

**Non-funded Research:** Research groups who have interesting scientific case, but do not have direct funding to buy cloud services nor own resources, should be able to benefit from publicly funded infrastructures even though connected to Helix Nebula. This should be allowed for non-profit research activities for which temporary access to free resources has been granted by the publicly funded resource providers to meet the national respectively European priorities on excellent science. The research outputs (e.g., publications, data, and applications) should be released under an open access policy. Commercial providers may decide to offer free resources as well.

**Commercially Exploitable Research:** "Research groups who have commercially exploitable applications must go to the commercial cloud providers; a prototyping phase could be supported by the publicly funded infrastructures during the incubation phase ..." (Andreozzi and Asero 2013) if the lack of initial funding is hindering the opportunity to exploit valuable business ideas.

**Cloud Funded Research:** "Research groups who have funding for cloud services will choose among the publicly funded infrastructures or commercial providers according to the service functionalities, service levels, and pricing models" (Andreozzi and Asero 2013). The publicly funded infrastructures should define a pricing model that reflects the full cost of providing the service.

**Consumers, Administrations, and Businesses:** HN has the future goal of ultimately paving the way for a cloud computing platform for governments, businesses and citizens. These segments must go to commercial cloud providers for commercial activities. Governments may be served by the publicly funded infrastructures for non-profit research.

In order to tackle the customer's and provider's worries of unfair competition, further rules that go beyond the definition of customer segments are defined in order to establish a level playing field.

### **Front-end and Back-end Rules of Cooperation**

**Ranking Mechanism:** A transparency broker finds the best service fit and price for the customers' needs. Therefore, a price/performance ratio is to be calculated for each offered product. Further, it tells the customer which HN resource providers he can choose from. We highlight that HN is working on defining a common service catalogue with clear parameters that enable easy service comparison.

**Logic of Cooperation:** A trading exchange platform between suppliers allows to trade infrastructure resources. Such a role could establish and manage a spot and future market, comparable to the energy spot and future market. This platform enables infrastructure providers to sell and buy computing capacity in order to better meet the customers' needs and to earn money with unused resources. Following an ex-ante clearly defined logic, publicly funded providers could allow commercial providers to use the public resources. For some countries, this may not be allowed by the law as there are strict limitations to research purpose and some publicly funded resource providers cannot receive money for the provided services. The opposite direction, i.e. publicly funded resource providers use resources from commercial providers, is more easy to underlay with a logic of resource trading. In both directions a trading exchange platform would contribute to an exploitation of the strengths of platform-based partner ecosystems as both publicly funded and commercial providers were enabled to meet peak demands.

### **Competitive Advantage - Generic Cloud Computing for Science**

The integration of publicly funded e-infrastructure is crucial for the success of the Generic Cloud Computing business model. It will distinguish HN from the rest of the market. The objective is to deliver a clear message to the market being “the cloud marketplace for science”. In order to establish this image integrating the trusted partners of science such as EGI and GEANT is an important step. A hybrid cloud model sets Helix Nebula apart from other commercial suppliers such as Amazon and can be the decisive factor. It will confirm the message of delivering “the cloud marketplace for science”, by providing accordingly to the needs of science.

As seen in the level playing field section, once Helix Nebula moves to a more open business model as worldwide all-in-one Enterprise Cloud, most of the segments would be exclusively addressed by commercial suppliers. But as a stepping stone, in order to reach this business model the integration of publicly funded e-infrastructure will be essential to address the first segment: science.

## **4.6 Network Effects**

It has to be clear that the decision of integrating EGI as a “supplier” is separate from deciding on a potential broker role assignment. EGI definitely shows competencies for both. To address the main demand of science an ecosystem of partners is required. None of the Helix Nebula partners could have addressed this need alone. To create a sustainable ecosystem a win-win situation has to be established, in which partners complement each other with their capabilities. The broker roles assignments will be discussed further on the supplier side in order to clarify all suitable partners and then taking an informed decision.

In two strategy workshops with the supplier side including amongst others T-Systems, Atos, and EGI problems, objectives and challenges for BM design and implementation were defined (cf. Design Challenges in chapter 3.2). Design challenge 13 asks how the generated HN BMs can be initiated successfully. Thus, after a short introduction to the term and theory of NEs, we will outline the most appropriate best practice

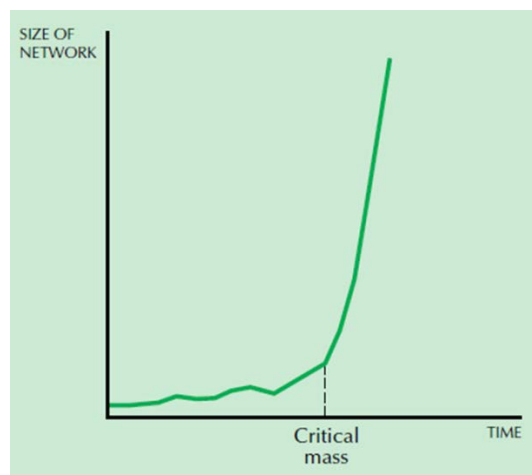


from our toolset to reach a critical mass of users. The complete topic of network effects is SAP's intellectual property, namely of Simone Scholten (2013). The material is exclusively presented.

#### 4.6.1 Introduction to Network Effects

The BMs presented in chapter four describe the rationale of how an organization, marketplace, or consortium creates, delivers, and captures value. Further, in the context of BMI it is imperative to understand, whether the customers' validation of the value proposition is subject to NEs, indicating that the value of a product or service is dependent on the number of others using it.

We define the term *network effects* as the increasing value of a product or service for each user as the number of users grows. Hence, a consumer's willingness to pay is determined by their intrinsic interest and the number of other people using the good – the larger the user population, the more they are willing to pay. The decisive question is the following. In which BM and where within this very BM are NEs present? Most value propositions are not subject to NEs as users probably do not care whether other users e.g. buy the same trousers or the same caterpillar. NEs are present if users prefer a product or a service over another one as its value increases with the amount of users using it. Depending on whether the value proposition reaches critical mass, NEs might be a friend or an enemy to every business model (cf. figures 46 and 47). We use the term *critical mass* as introduced by Rogers (1962) who defines it to be the point in time within the adoption curve at which the adoption of the innovation is self-sustaining and network growth takes off dramatically (cf. figure 45)



**Figure 45** Visualisation of the Term Critical Mass (Shapiro and Varian 1998)

There are the following two types of NEs.

- **Direct NEs:** Different members of a group A enjoy interacting with one another through a network; value increases with new members. Yet, this effect might turn to a pitfall through congestion. The



presence of additional members of group A on a network reduces the value of the network to members of group A, e.g. limited bandwidth (cf. figure 46).



**Figure 46** Positive and Negative Direct Network Effects

- **Indirect NEs:** The greater the number of members of group A on a network, the more members of group B will be attracted to the network, which in turn increases the value to members of group A. In this case, the repulsion pitfall is possible. The presence of members of group A may repel members of group B even though the presence of members of group B attracts members of A, e.g. too many advertisers (cf. figure 47).



**Figure 47** Positive and Negative Indirect Network Effects

Even though each BM has its peculiarities, parallels exist as outlined in the following sources of NEs.

- **Exchange/Interaction:** Networks become more valuable the more people join because users might communicate with more people (e.g. Facebook). Exchange embraces any data stream, such as movies, music, money, video games, and computer programs. Exchange requires standards that allow interconnection to snare network effects.
- **Long-term viability:** Users aim at sustaining their investments, trying to avoid switching costs. Networks with greater numbers of users suggest a stronger long-term viability. Switching costs can strengthen the value of network effects as a strategic asset. The higher the value of the user's overall investment, the more they're likely to consider the long-term viability of any offering before choosing to adopt it.
- **Complementary Benefits:** Complementary benefits are those products or services that add additional value to the network, e.g. "how-to"-books, software add-ons, even labour.
- **Pricing:** Finding the right price is of utmost importance as high prices create a market for competitors. High volume combined with a modest commission seems to be a sustainable formula for a market place in order to attract users to a marketplace. Later on, companies like Google or price line Group offer users that require more exposure to pay more on an opt-in basis, e.g. bidding scenario of Google

AdWords. At the beginning it is more important to prove the platform as a viable and efficient distribution mechanism.

- **Innovation/Co-Innovation:** Continuous innovation on the core value proposition as well as on (third party) complements is one of the primary ways to differentiate from the competition in network markets.

The given theoretical foundation allows to study in how far the seven NH BM options can be triggered. Therefore, we outline best practices to leverage NEs in HNs' BMs.

#### 4.6.2 Leveraging the Helix Nebula Business Model Options

##### Start with a Niche

Pick a specific target market and try to dominate it, e.g. a specific geographical location, a demographic or niche interest. Envision how to logically expand into larger markets, but only do so when dominating the niche. Recognition and momentum is needed to move into a larger segment. In established markets, focus on a single niche an incumbent is either over- or under-serving.

##### Move Early

Being the initial occupant of a market segment allows any kind of organization to benefit from first mover advantages and start the network effect's snowball rolling. That way, the first entrant might gain control of resources that followers may not be able to match. Such a resource could be data in cloud computing BMs. The faster and the more consequent data providers are found and incorporated, the less data providers are available for followers. "In case the BM becomes institutionalized early adopters that invested within the fashionable phase can realize over-proportional higher returns in comparison to late investors due to first mover advantages" (Moser 2011). An example is Sony's PS 2. It enjoyed an 18-month lead over Xbox and succeeded in the market, whereas the technically superior PS3 showed up months after Xbox 360 and resulted in losses for Sony. There are several drivers to enable this NE.

- *Technological leadership:* Looking on "Information as a Service," selling enriched structured data sets requires a data warehousing approach integrating data from one or more disparate sources encompassing structured, semi-structured, and unstructured data. Selling knowledge induces analytics using data mining methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. Thus, both options within this BM allow for differentiation in the competition.
- *Pre-emption of scarce assets:* The scarce asset is structured, high quality, and large scale data from the few providers CERN, ESA, and EMBL. If they decide for cloud storing and processing of their data at HN, a pre-emption of data usage can be assured.
- *Switching costs:* Of course, HN has the aim to lower its switching costs within the market of HN. But the switch to competitors outside HN states a possibility for raising switching costs. This would lead to a higher difficulty for competitors to get access to the data of e.g. ESA, as ESA would hesitate to switch to e.g. AWS.

- *Buyer choice under uncertainty:* If market non-transparencies are that high that buyers decide for a data and knowledge provider under uncertainty, they might tend to decide for the first mover in this segment. A well-known example is Apple. The market for smartphones lacks transparency as a high number of devices from low budget to premium are sold. Thus, many decide for Apple's iPhone simply because they were the first mover for premium smartphones. Thus, HN suppliers should be highly motivated to be the first mover.

### **Ensure Compatibility with Leading Standards**

Make the product or service compatible with the leading standards in order to benefit from an instant base of add-on content already available for the leading standards. E.g., Microsoft's Live Maps and Virtual Earth 3D adopted the same keyhole markup language standard used by Google. The keyhole mark-up language is an XML notation for expressing geographic annotation and visualisation within Internet-based, two-dimensional maps and three-dimensional Earth browsers. Another example is AirBnB which is an online service that provides a platform for individuals referred to as "hosts", generally private parties, to rent unoccupied living space and other short-term lodging to guests. AirBnB offers compatibility to the craigslist. Craigslist is a classified advertisement website with sections devoted to jobs, housing, personals, for sale, items wanted, services, community, gigs, résumés, and discussion forums.

### **Facilitate Switch**

Facilitate switch by providing a better user experience than existing incumbents and facilitate switch of their users in order to piggy back traction from an established incumbent. Salesforce.com is a leading example of this network effect. It offers good usability ([Desisto](#) at Gartner 2012). In contrast, Oracle is still on its way to unfold its highest potential of good user experience. Thus, salesforce.com enters the market with a better usability and profits from the traction that Oracle brought to sales force automation which enables "... B2B organizations to automate sales activities, processes and administrative responsibilities for sales professionals" ([Desisto](#) at Gartner 2012).

### **Ensure Continuous Improvement and Lower Entry Hurdles**

Continuously improve utility and user experience to attract new users. Lower entry hurdles e.g. through technical improvements or complementary services. E.g., Google and Airbnb constantly enrich their service portfolio.

### **Publish Pre-announcements to Delay Customers' Purchasing Decisions**

A company might cause potential adaptors to delay their purchasing decision until the new effort is rolled out. Notice that pre-announcements only work if a firm is large enough to pose a credible threat to current market participants. Statements from startups often lack credibility to delay user purchases.

### **Enable Viral Promotions and Marketing**

Means of viral marketing enable companies to target the attention of the masses by encouraging individuals to pass on a marketing message to others (word-of-mouth), creating the potential for exponential growth in the message's exposure and influence. Hotmail, for example, gave away free email addresses and services and attached simple tags at the bottom of every free message sent out: "Get your private, free email at <http://www.hotmail.com>". Other users signed up and propelled the message still wider to their own ever-increasing circles of friends and associates. Further, most Skype users have been recruited by others to share free and low-cost Internet calls. Within Facebook, feeds help activities to spread virally.

### **Build a Vivid Community Prior to Launch**

Establish an engaged passionate audience prior to launch by producing relevant content and fostering interaction among users. Create forums, advisory boards, meet ups and dedicated interaction tools to connect users.

### **Offer High Demand Content**

Seed a platform with content or applications, preferably material that is already in high demand, in order to attract users. The Apple Store is an example.

### **Attract Marquee Users**

Attract marquee content developers on the supply side and marquee customers (demand side) and offer them attractive reasons to participate.

### **Subsidize Adoption of One Side**

Multisided platforms have to overcome the chicken and egg challenge. Users want content and applications before they will use the platform, whereas developers want users before they will provide content and applications. Each side expects the other side to commit before it will spend resources to adopt the platform. To attract users to the platform one strategy is to subsidize initial adoption of early adopters, such as price reductions, rebates or other give-aways. There are pricing rules to follow.

- Subsidize the price elastic side and charge the price inelastic side.
- Subsidize the creators of value.
- Attract marquee users and provide them with better deals.

E.g., PayPal offered users a rebate as a sign up incentive to encourage adoption.

### **Offer Complementary Services or Benefits in Addition to Core Services**

Offer complementary services to add additional value to the network and therefore indirectly impact the utility a buyer receives from the offering. This might include any services that accompany the core product or services such as 'how-to' books, software add-ons, even labour or any services that support its acquisition, installation, usage, maintenance, and disposal.

## 5 Public Procurement Assessment

### Introduction

So far the terms “Research Organisation” or “Institute” were used for the three initial demand-side partners CERN, ESA, and EMBL. They are inter-governmental research organisations. As any kind of national public organisations (e.g. ministries or agencies) are likely to benefit from and migrate to HN as well, we label the entire group as “public organisations” in the following.

The project “Helix Nebula - the Science Cloud” will support the massive IT requirements of European scientists and aims to pave the way for the development and exploitation of a Cloud Computing Infrastructure, initially based on the needs of European IT-intense scientific research organisations, while also allowing the inclusion of other stakeholders’ needs (governments, businesses and citizens).

Knowing, understanding and applying procurement rules is important for all players within HN, especially since the demand-side public organisations are governed by their stakeholders in this respect. And procurement rules may influence a viable implementation of a cloud computing BM across jurisdictions, which is being assessed in the context of WP7. Accordingly, WP7 has researched the existing procurement rules and conducted interviews with the demand-side to investigate potential implementations of procurement that would best support the most-beneficial business models having been identified and proposed:

- Information-as-a-Service
- Generic Cloud Computing for European Science.

This document is an assessment only. It is not intended to be a complete and definitive statement of all aspects of procurement, nor does it advise with respect to the procurement of the Institutions involved.

### Overview of procurement rules

#### 1. Background

Public organizations like the flagship customers have to prove that they spend the taxpayers’ money responsibly. EU Institutions are subject to EU procurement rules. The procurement rules define procedures for e.g. service contracts, bilateral and group framework contracts and PPPs. However, several leading Research Institutions in Europe have been granted exceptions due to their missions or status as inter-governmental organisations and have their own Stakeholder structures and governance. The procurement rules of such Institutes are therefore more specific and reflect the needs of the users and the frameworks defined by the respective stakeholders.

The success of Helix Nebula requires that free and open competition be adhered to as the general policy of HN and that all HN members follow this policy. On top of that EU policies and several public organisation-

specific policies need to be taken into account e.g. fostering job creation in the EU or providing geo-returns to Member State stakeholders.

## 2. Current Implementations

- a. CERN is an inter-governmental organisation and its procurement rules enable it to execute procurements in a short time frame through restricted tenders. Such tenders – for service or framework contracts – are for purchases on its own behalf. Group framework contracts or PPPs have not been exploited to a large extent yet. EU procurement guidelines are not being used. A special type of procurement that is used is the industry policy procurement which enables CERN to procure an infrastructure or service and make it available also to other Research Institutes. The prerequisite is that the particular infrastructure is installed on CERN premises. Service and operations of such infrastructure can be performed by industry.
- b. EMBL is an inter-governmental organisation and its procurement rules enable it to execute procurements in a very short time frame through restricted tenders. Especially in highly innovative areas procurements can be processed within days once the requirements have been formalized and agreed with stakeholders. EU procurement guidelines are not being used.
- c. ESA is an inter-governmental organisation. Due to the nature of its projects, where a high percentage of work is performed by industry its procurement process is characterized by a very strong governance and procurement cycles lasting several months or longer. The rules enable e.g. service and framework contracts. Typically, ESA would procure a science cloud service through an industry consortium led by a prime contractor. EU procurement guidelines are not being used.

## Assessment

The potentially most-beneficial BMs for HN – “Information-as-a-Service” and “Generic Cloud Computing for European Science” – both are based on creating an ecosystem where users share elements of service as well as individually consume services “as-needed”. The character of an ecosystem is that the benefits of the shared elements can grow strongly over time and make the ecosystem more beneficial for an ever larger community. Taking the existing procurement rules into account the implementation therefore should provide a solution for both shared and individual elements. Since the most beneficial model of such an innovative ecosystem has not been determined in full detail yet, initially a PPP approach could be envisaged, that eventually could be transferred into a regular procurement process. However, the diversity in governance and stakeholders between the potential participants of the PPP (demand and supply-side) might lead to a long and time-consuming process to establish such PPP if available frameworks, e.g. the EU PCP and PPI, have to be further analysed for applicability.

A more pragmatic approach can be to separate the shared and individual elements of the ecosystem and for each find a solution (dividing into “lots”). The individual elements should be defined such that they are



independent of the shared elements and that each can be made subject of separate competitive tender procedures (non-conditional procurement).

Applied to the defined business models this could imply e.g. following procurement elements:

	<b>Shared Elements</b>	<b>Individual Elements</b>
<b>Information-as-a-Service</b>	<ul style="list-style-type: none"> <li>• Information Management</li> <li>• Federation Management</li> <li>• Storage</li> <li>• Service Management of shared elements</li> </ul>	<ul style="list-style-type: none"> <li>• Processing</li> <li>• Access</li> </ul>
<b>Generic Cloud Computing for European Science</b>	<ul style="list-style-type: none"> <li>• Cloud Federation Management</li> <li>• Service Management of shared elements</li> </ul>	<ul style="list-style-type: none"> <li>• Processing</li> <li>• Storage</li> </ul>

Taking into account the feedback of the three flagships potential solutions to procure the shared elements are:

- A restricted tender to industry. However, if this implies the Institutes would need to procure shared services individually the potential benefits of the ecosystem are likely to be sacrificed since it would be very difficult for providers to manage the risks of such model.
- Use an existing compatible group framework e.g. the industry policy procurement from CERN, whereby other Research Institutes would need to confirm if the required operation on CERN premises is acceptable to them.

Since procurement of individual elements can be established through separate competitive tender procedures these can follow the common practice at each Institute e.g. through restricted tender and lead to service and/or framework contracts. This could also be developed into a service provided by Helix Nebula.

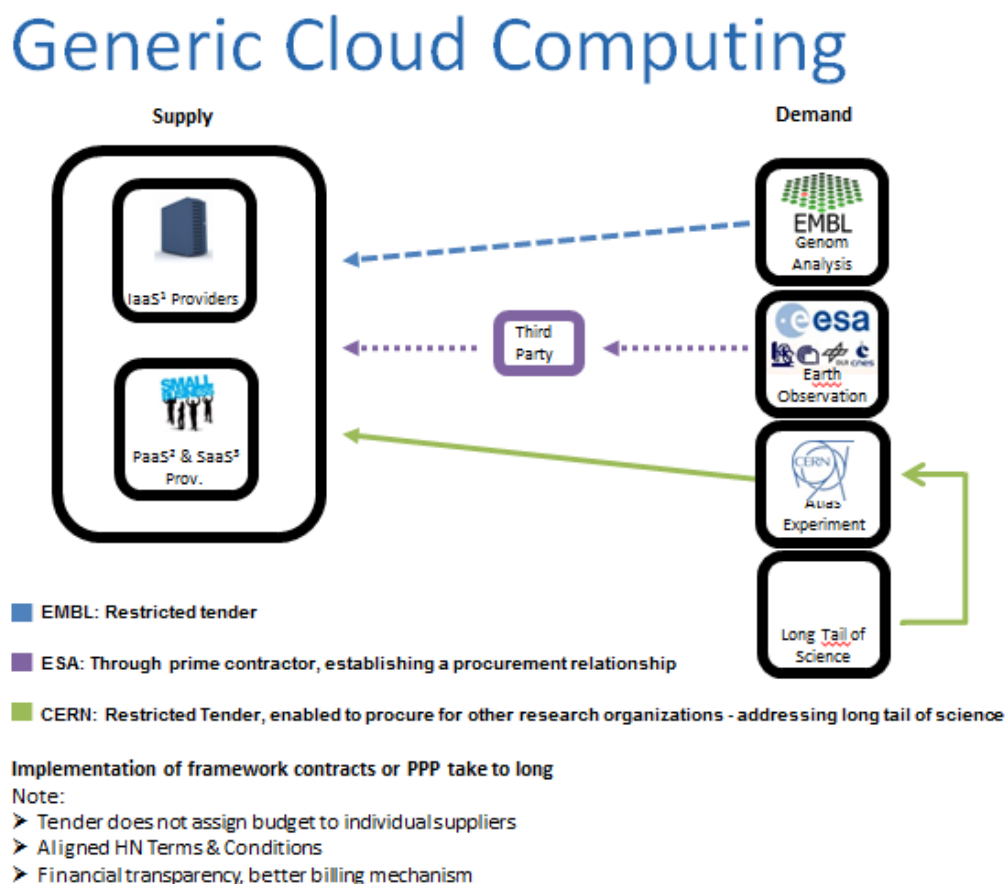
Benefits of the ecosystem could be secured by a competitive tender for the shared elements e.g. by applying following principles to the requirements:

- A service fee model with decreasing service costs when the number of participants increases e.g. the number of Institutes, users, service providers and resources connected
- Include incentives in the service model for e.g. the extension of services, service catalogues and information accessible.

### **Potential Procurement Scenarios**

After a final round of interviews with the demand side the following proposals regarding procurement for the business models Generic Cloud Computing and Information as a Service could be created. They have to

be confirmed by the supply side. The scenarios will be jointly elaborated by the demand side and their corresponding procurement officers.



**Figure 48 Procurement Scenario for Generic Cloud Computing**

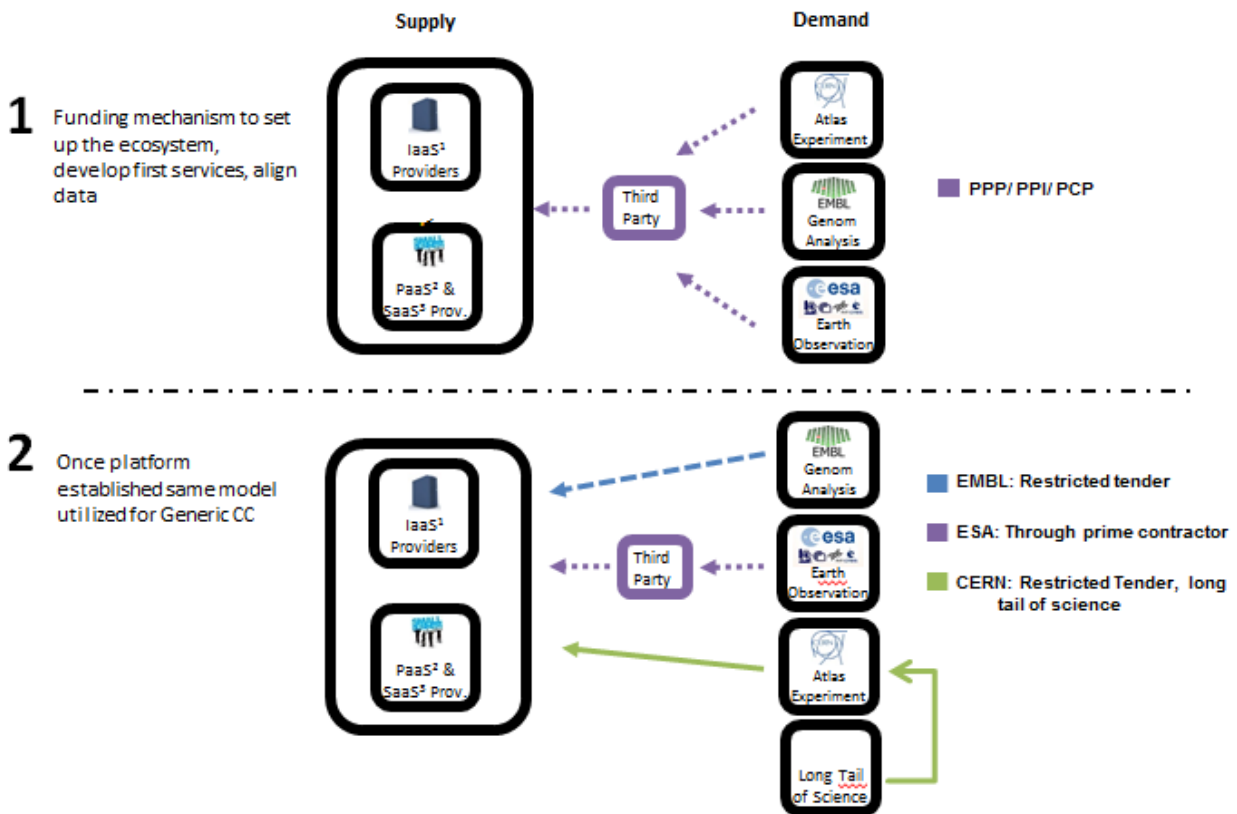
Due to the fact that time is restricted until reaching the productivity phase a framework contract or PPP would simply take too long to be implemented. Hence, the proposal is to conduct restricted tenders. Each organization of the demand side would file a separate restricted tender with the group of the Helix Nebula suppliers, determining a certain budget to be spend in a certain timeframe without committing to when exactly or from which exact supplier it would be purchased. This budget can then be spent over the defined timeframe. Once either budget or time is used another tender would be required.

There are some specifics for ESA and CERN:

- ESA would go through a third party in order to build up a procurement relationship which then ensures the procurement through the HN supplier group.
- CERN can procure for other smaller research organisations (the long tail of science) and act as a trusted partner of HN.

In order to further improve the procurement process for the demand side the supply side was asked to align for example their terms and conditions as well as establishing financial transparency and corresponding billing mechanisms.

## Info as a Service



**Figure 49 Procurement Scenario: Info as a Service**

For the business model Info as a Service several issues such as who owns the data, with what other data can it be aggregated and whom can it be sold to have to be clarified. Hence, there is still a research and development phase ahead that has to be financed through another constellation such as a PPP (step 1). After the platform and services are established and ready for consumption a procurement scenario similar to the proposed version for generic cloud computing can be put in place (step 2).

The next decision to be taken is the price and amount to be sold. Cost Calculations will be conducted in D7.3 in order to investigate the profitability for both sides. The question is if the solution can be more attractive than in-house. In order to achieve lower prices it could be conceivable to agree on a higher volume. If prices are not attractive the long tail of science can consume through CERN. Once EOS are achieved the solution would be attractive to CERN. Cloud is the way to go in the future.

### **Procurement Conclusion**

If the pilot phase for HN proves successful the flagships have indicated the desire to establish an operational system that enables the federation of public and commercial cloud computing services in early 2014. Since a procurement process for such operational service will last at least 4-5 months taking the above into account it should be decided in Q4 2013 which approach to take. The Helix Nebula General Assembly 3 from 23-25 September provides an opportunity to take appropriate steps.

## 6 Conclusion

### 6.1 Summary

After the theoretical foundation for BMs was established (cf. chapter 2) and the systematic, integrated BMI approach was applied and documented (cf. chapter 3), the overarching broker roles, seven BMs, and the BMs' specific broker roles were explained based on a defined description framework (cf. chapter 4). In order to match on-demand cloud computing with the requirements of public procurement, possible changes and adaptations of public procurement processes were recommended (cf. chapter 5). Basically, the following seven BMs are options for the Helix Nebula partner ecosystem to realise initially or in future.

#### **Generic Cloud Computing for European Science**

Although experts were worried about the little number of customers, the data volume and setting as proof of concept convinced them. The sheer data volume and a market niche of European big science was reason enough for experts to value its customer need very high with the best value of all BMs. Basically, it has solid evaluation results in all criteria.

#### **Versioned Cloud Computing for Science & Education**

Leaving the concentration on the core use cases at ESA, CERN, and EMBL, this BM addresses the entire world of science and education with all its customer groups. The consequence of including research, development & education from consumer, business, and public markets and the differentiation between profit and non-profit is an explicit versioning of prices, revenue models, SLAs, and services.

#### **Brand Management**

With the first two BMs being successful, a brand may develop and be exploited. Above all, this is of great interest as the online advertising market for cloud computing is estimated to have a current volume of \$65-billion (Hassan and Huh 2013). Further, other cloud computing providers might raise interest to participate on the HN marketplace and donors might be attracted by new science paths.

#### **Information as a Service**

Capturing, processing, analysing and archiving of highly attractive data from ESA and EMBL creates an opportunity to cooperate with further data providers in order to enrich the data in its context. The selling of resulting data sets and knowledge is evaluated as the most promising BM in terms of market need, impact on critical mass, differentiation, and thought leadership. Yet, the required time is long.

#### **Application Crowd**

The basic idea of this BM is to establish a marketplace where application users can outsource and "crowdsource" domain-specific development projects to thousands of developers from around the world. Application Crowd fixes the problems with the traditional development process including a slow turnaround, expensive rates, limited application options, uncertain results, and high risk.

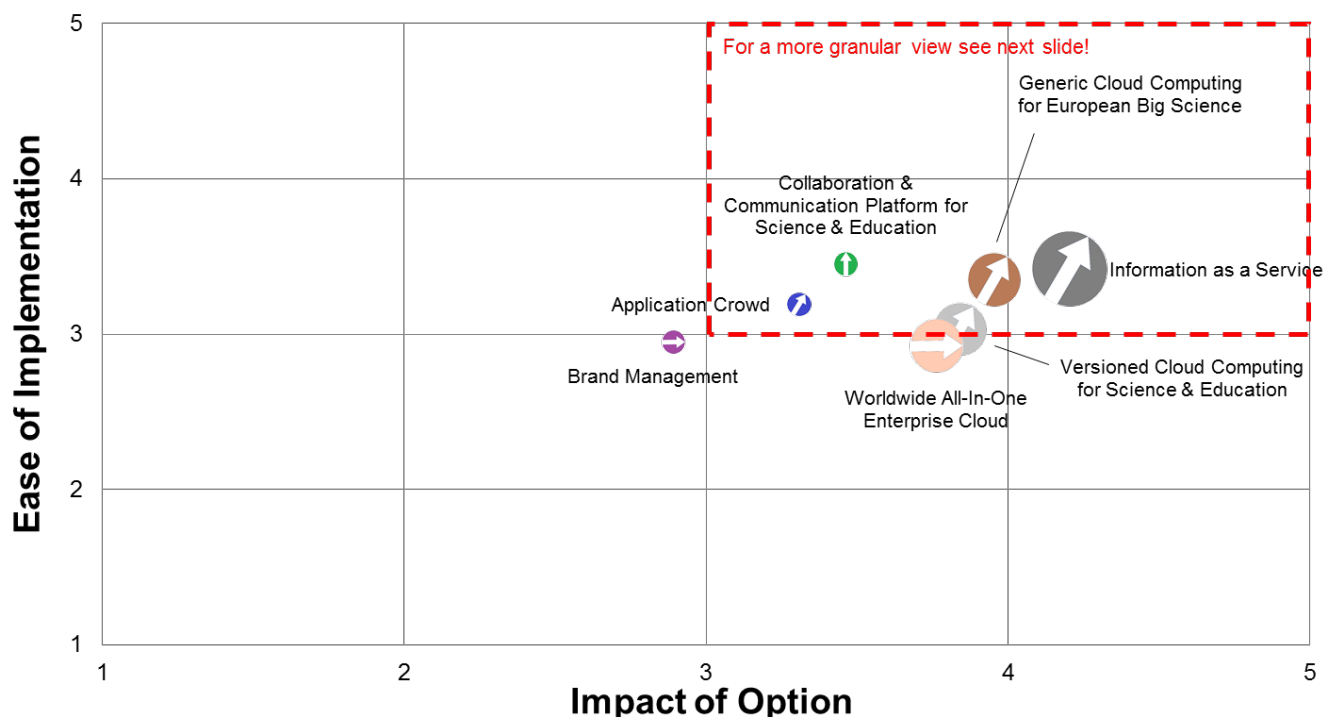
## Collaboration & Communication Platform for Science & Education

This BM combines social networking, scheduling, data interchange, and secure communication integrated in one web frontend. Scientists and researchers can share papers, ask and answer questions, find collaborators, and schedule and organize events, from simple lectures to complex meetings, workshops and conferences with sessions and contributions. E-learning is offered to students, pupils, and teachers.

## Worldwide All-In-One Enterprise Cloud

The “Worldwide All-In-One Enterprise Cloud” eventually paves the way for a cloud computing platform that offers a unique resource to governments, businesses and citizens. This is a defined aim by the European Union. It can be the ultimate BM for big players consolidating different business activities and strategies, including an ecosystem approach or comprehensive SaaS.

The in-depth expert evaluation based on structured interviews with twelve cloud computing experts from SAP and the Helix Nebula supply side with business knowledge revealed four dimensional consolidation matrix that aims to enable decision making (cf. figures 48 and 49). The four dimensions are the impact of the option (abscissa), the ease of implementation (ordinate), the revenue potential (three-stage bubble sizes meaning very high, high, and middle), and the objective technical feasibility (arrow direction).

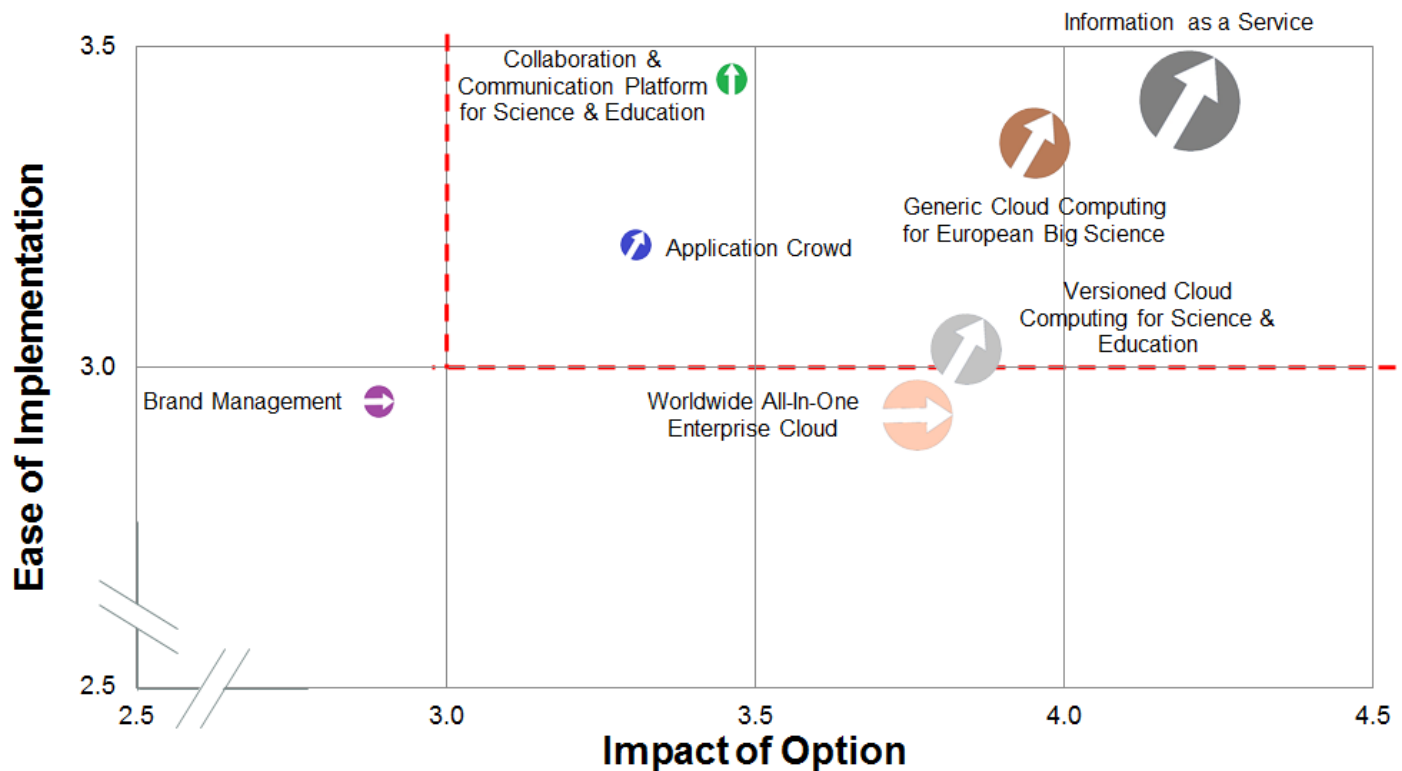


\*Bubble size: revenue potential | Arrow direction: objective technical feasibility

1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

**Figure 50** Four-dimensional Consolidation Matrix (Continuous Axes)





\*Bubble size: Revenue Potential | Arrow direction: Objective Technical Feasibility  
1: very low / very critical 2: low / critical 3: medium / neutral 4: high / positive 5: very high / very positive

**Figure 51** Four-dimensional Consolidation Matrix (Discontinuous Axes)

These matrices in conjunction with the data presented in chapter 4.5 enables a profound decision making upon the following questions. It is recommended to familiarize with the findings in D7.2 before the General Assembly III in order to contribute to an informed decision.

- Which business models should be implemented and how?
- Which broker roles should be realized and which party should take over the corresponding role?
- Which framework contract model should be implemented?
- Which best practices to leverage network effects do you want to apply to which business model?

## 6.2 Next Steps

In order to provide a guideline that helps in dealing with the gathered information, we list all required decision points in the following section (cf. figures 50, 51, and 52).

	Decision Point	Further Information Required	Postponed	Approved	Approved with Limitations	Discarded	Role Assigned
Overarching Business Broker Roles	Trading Exchange Platform						
	Yello Strom						
	Working Groups Management						
	Up-/Cross-Selling Potentials						
	Financials						
	Law						
Business Models & Specific Broker Roles	Generic Cloud Computing for European Big Science						
	Broker: No specific role						
	Versioned Cloud Computing for Science & Education						
	Broker: Market Research & Versions						
	Brand Management						
	Broker: Franchising & Marketing						
	Information as a Service						
	Broker: Data Management						
	Collaboration & Communication Platform for Science & Education						
	Broker: Front End Provisioning						
	Worldwide All-In-One Enterprise Cloud						
	Broker: International Communications						
	Application Crowd						
	Broker: Appstore Provider						

**Figure 52** Decision Making for Business Models and Broker Roles



#### Motivation

The three flagship use cases CERN, ESA, and EMBL need to follow public procurement rules including negotiations and tendering processes. But cloud computing use cases with on-demand access cannot follow repetitive procurement processes for the sake of avoiding disproportionate effort. Framework contracts can bypass tendering processes and enable on-demand procurement.



#### Bilateral Framework Contract (BFC)

After a single initial tendering process, the contractual relationship between the customer and the successful tenderer will be governed by a BFC. Framework contracts involve no direct commitment and, in particular, do not constitute orders *per se*. Instead, they lay down the legal, financial, technical and administrative provisions governing the relationship between the customer and the contractor during their period of validity.



#### Group Framework Contract (GFC)

A GFC is a variant of the BFC. One customer subscribes a GFC on behalf of all participating customers instead of multiple contracts having to be established.



#### Public-Private Partnership (PPP)

A PPP is a cooperative venture between public authorities and private enterprises that can provide effective ways to offer services to the public.

	Decision Point	Further Information Required	Postponed	Approved	Approved with Limitations	Discarded	Role Assigned
Public Proc. Models	Bilateral Framework Contracts						
	Group Framework Contracts						
	Public-Private Partnership						

**Figure 53** Decision Making for Public Procurement Assessment

<b>Niche Start</b> • Pick a specific target market and try to dominate it!	<b>Early Move</b> • Be the initial occupant of a market segment!	<b>Compatibility</b> • Make the service compatible with the leading standard!	<b>Facilitate Switch</b> • Provide a better user experience than incumbents!	<b>Improvements</b> • Continuously improve utility and user experience!	<b>Announcements</b> • Delay the adapters' purchasing decision!
<b>Promotion</b> • Encourage the passing on of words-of-mouth!	<b>Community</b> • Establish an engaged passionate audience!	<b>Content</b> • Seed material already high in demand!	<b>Marquee Users</b> • Offer them attractive reasons to participate!	<b>Adoption</b> • Overcome the chicken and egg challenge!	<b>Additions</b> • Offer further services to add additional value!

	Decision Point	Further Information Required	Postponed	Discarded	Envisaged Business Model(s)
<b>Best Practice to Leverage Network Effects</b>	Niche Start				
	Early Move				
	Leading Standard Compatibility				
	Switch Facilitation				
	Improvements & Low Entry Hurdles				
	Pre-announcements				
	Viral Promotions & Marketing				
	Vivid Community Prior to Launch				
	High Demand Content				
	Marquee Users				
	Adoption of One Side				
	Complementary Services & Benefits				

**Figure 54** Decision Making for Network Effects

### **Potential Roadmap**

The partnership has the technical elements for this generic cloud platform at the IaaS level as tested via the Helix Nebula flagship deployments, but it needs to be turned into a production service (i.e. there is the need for an agreed interface, appropriate support structure and a common set of contractual terms and conditions).

In terms of procurement, with the above common technical specifications and contract terms and conditions for this generic cloud platform, the public organisations have the necessary material in order to start their procurement processes. These would be independent, but based on a common technical specification and contract terms.

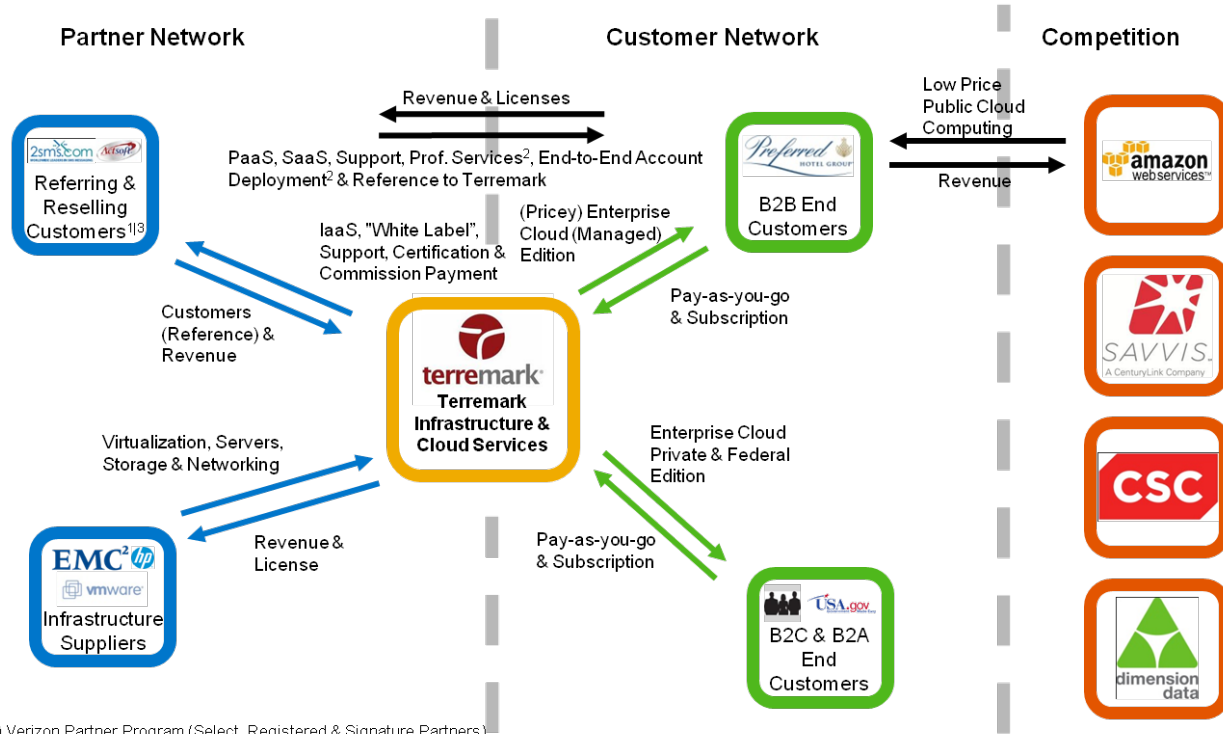
Once the basic production system is in service, it can also act as a platform for innovation with other actors (SMEs, downstream industry etc.) using it to develop new services.

In addition, the Research Accelerator Hubs, as described in the [EIRO forum e-infrastructure implementation plan](#), would allow operators such as CERN to perform aggregated procurement on behalf of their research partners thereby simplifying the overall procurement model.

If we can put this “Generic Cloud Computing for European Science” BM in production for 2014 then we can work in parallel with the supply-side and demand-side to develop higher-level services and expand towards the “Information as a Service” BM. Hopefully then in 2015 we can move some of these higher-level services into production and progressively move up the stack and broaden the scope and engagement.

## Appendix

**Figure 1: Network View of Terremark Infrastructure & Cloud Services**



1) Verizon Partner Program (Select, Registered & Signature Partners)

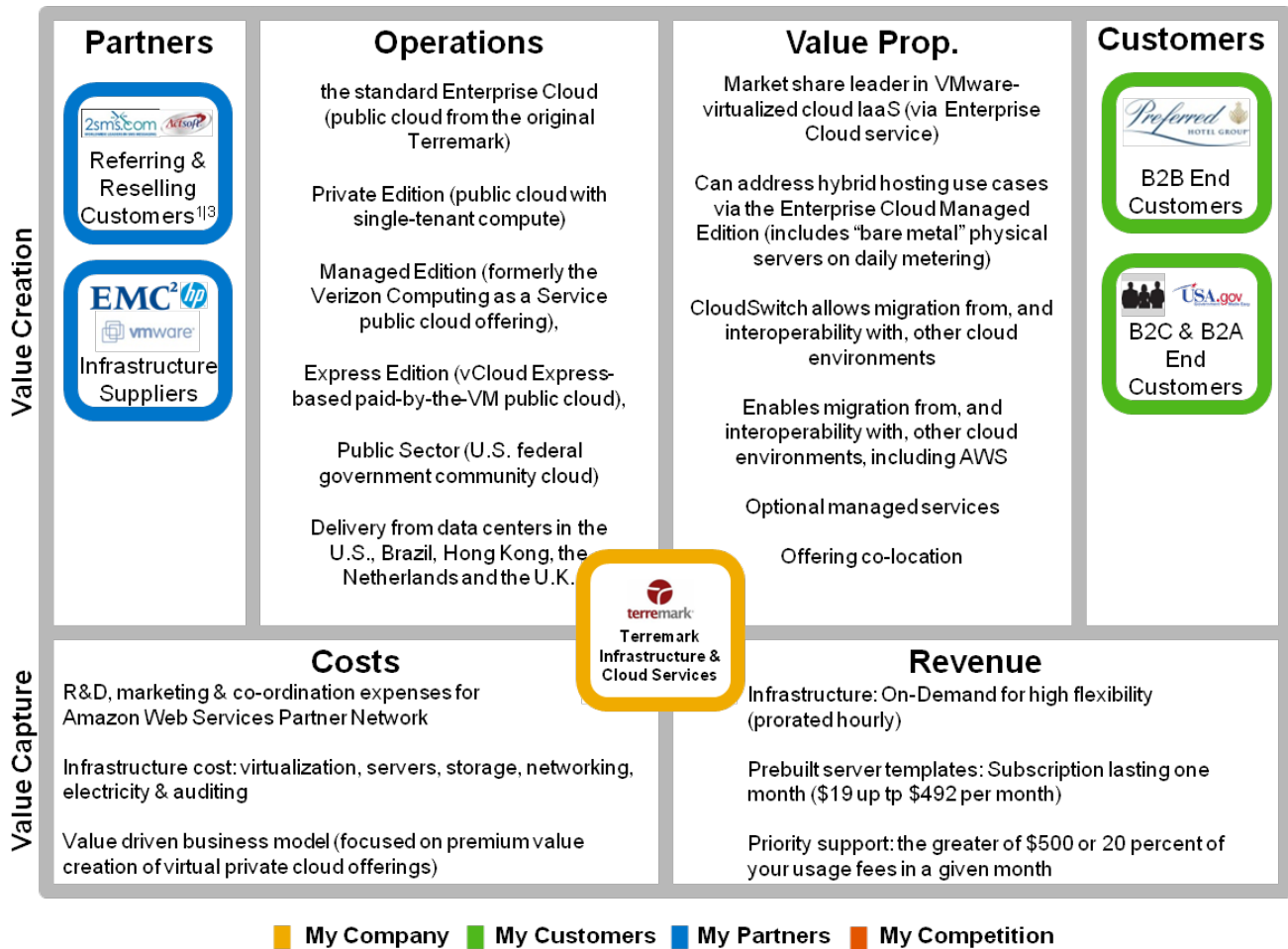
2) Includes design, architecture, migration & building

3) Includes ISVs, VARs, SaaS, PaaS, developer tools, management and security vendors

■ My Company ■ My Customers ■ My Partners ■ My Competition



**Figure 2: Enterprise View of Terremark Infrastructure & Cloud Services**



**Figure 3: Network View of Salesforce.com**

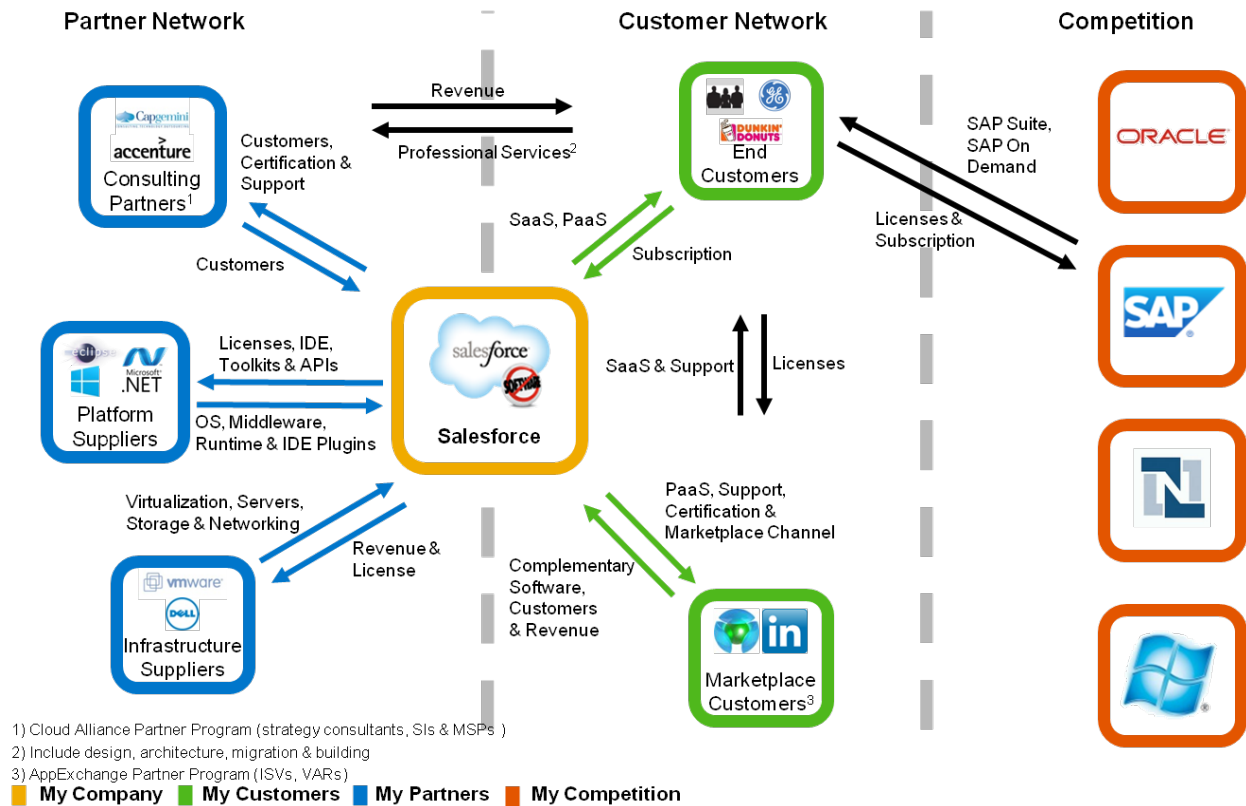
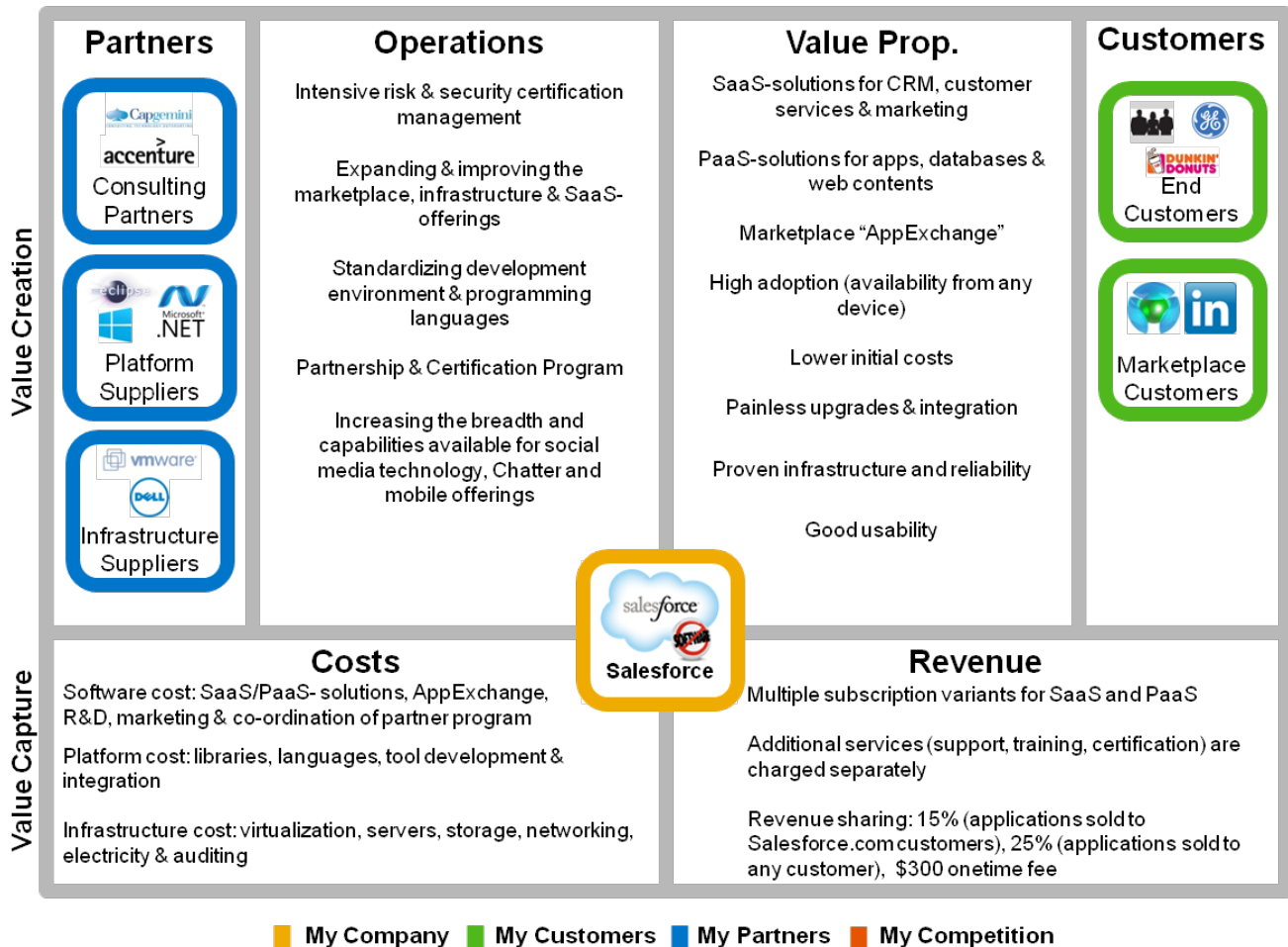


Figure 4: Enterprise View of Salesforce.com



### Figure 5: Exemplary “Logo Battle” Instantiation



### Figure 6: Method Application Impression



Figure 7: The Cluster of the Prospective Business Model “Brand Management”

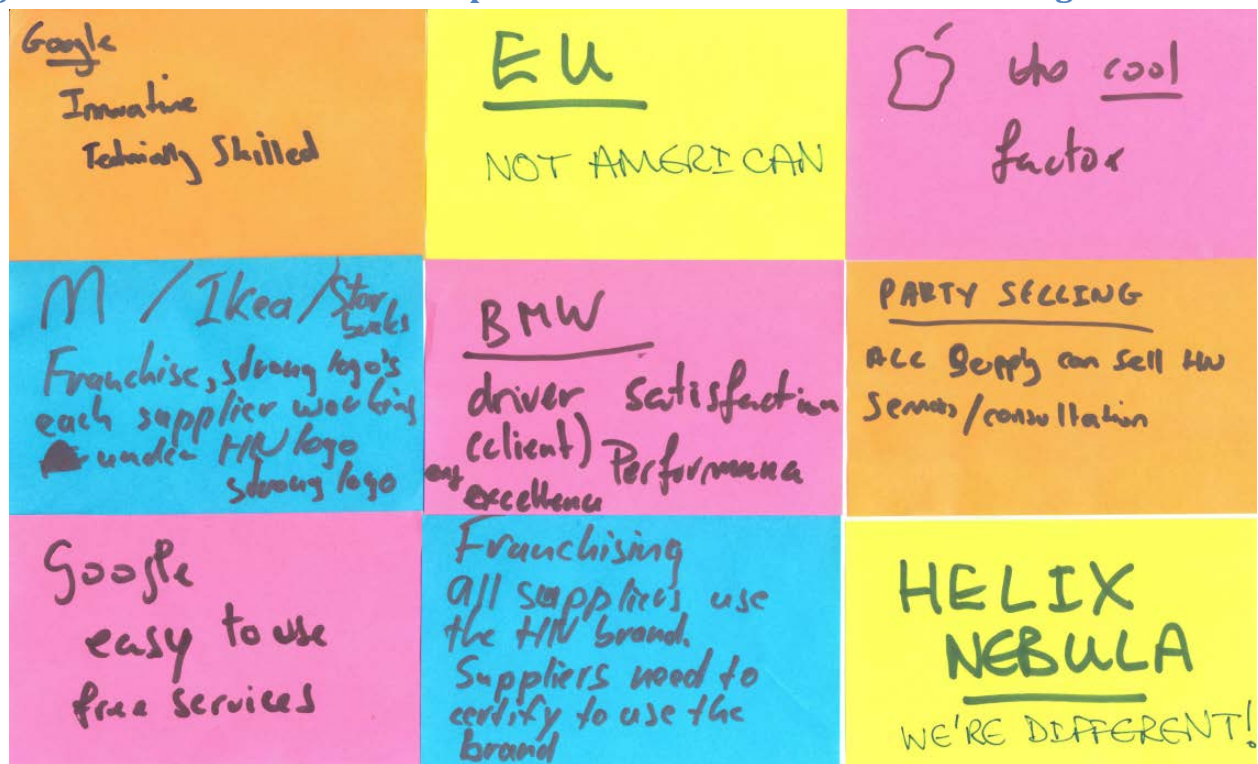




Figure 8: Exemplary Simplified Business Model Prototype

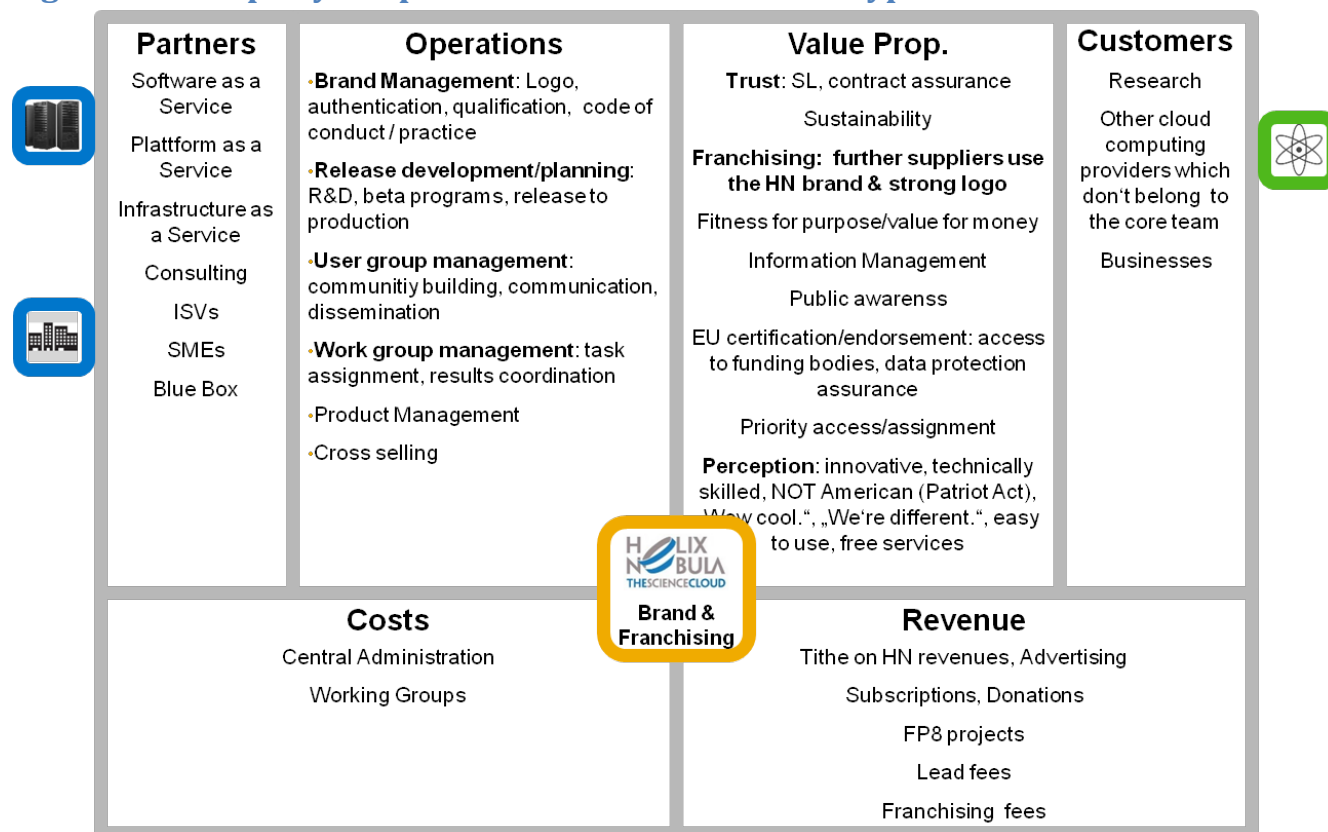




Figure 9: “Impact of Options” Expert View

Impact of Options											
Impact		Revenue Potential			Customer Acceptance			Impact on critical mass	Differentiation / Thought Leadership	Visibility / Traffic	Result
Options	Direct	Indirect	Need	Effort	Security						
	0.2	0.2	0.15	0.1	0.05	0.1	0.1	0.1	1		
1 Generic I/P/SaaS Platform for European Science	very high	high	very high	high	high	high	high	very high	very positive	4.55	
2 Versioned I/P/SaaS Platform for European Science	very high	very high	high	high	very high	very high	very high	very high	very positive	4.75	
3 Information as a Service	very high	very high	high	high	very high	very high	very high	very high	very positive	4.75	
4 Appstore & Services for the Long Tail of Science	medium	medium	medium	low	very high	medium	medium	very positive	3.2		
5 Science Collaboration & Communication Platform	very high	very high	very high	very high	very high	very high	high	very positive	4.9		
6 Blue Box Services for European Science	high	high	very high	very high	very high	medium	medium	neutral	4		
7 Helix Nebula Brand Management	medium	high	low	high	very high	low	low	positive	3.15		
8 Worldwide I/P/SaaS Provider	very high	very high	very high	high	low	very high	low	neutral	4.25		

Figure 10: “Ease of Implementation” Expert View

Ease of Implementation												
Ease		Cost			Risk			Conflict with Suppliers		Time Required		Result
Options		One time		Recurring	Technical/ Feasibility	Expertise		Legal/ Privacy				
		0.2		0.2	0.2	0.1		0.1	0.1		0.1	1
1	Generic I/P/SaaS Platform for European Science	neutral →	positive ↗	positive ↗	positive ↗	positive ↗	very positive ↑	very positive ↑	very positive ↑	neutral →		3.9
2	Versioned I/P/SaaS Platform for European Science	very positive ↑	very positive ↑	very positive ↑	very positive ↑	very positive ↑	positive ↗	very positive ↑	very positive ↑	neutral →		4.7
3	Information as a Service	very positive ↑	very positive ↑	very positive ↑	very positive ↑	very positive ↑	positive ↗	very positive ↑	very positive ↑	neutral →		4.7
4	Appstore & Services for the Long Tail of Science	very positive ↑	positive ↗	critical ↘	critical ↘	critical ↘	critical ↘	neutral →	neutral →	neutral →		3.2
5	Science Collaboration & Communication Platform	very critical ↓	very positive ↑	positive ↗	positive ↗	positive ↗	neutral →	neutral →	neutral →	very critical ↓		3.1
6	Blue Box Services for European Science	very critical ↓	positive ↗	critical ↘	critical ↘	critical ↘	very critical ↓	positive ↗	positive ↗	very critical ↓		2.2
7	Helix Nebula Brand Management	critical ↘	critical ↘	positive ↗	positive ↗	neutral →	very positive ↑	very positive ↑	very positive ↑	very critical ↓		3
8	Worldwide I/P/SaaS Provider	very critical ↓	critical ↘	very critical ↓	very critical ↓	very critical ↓	critical ↘	neutral →	neutral →	neutral →		1.7

Figure 11: “Impact of Options” Overall View

Impact of Option	Criterion	Customer Acceptance				Revenue Potential	Impact on Critical Mass	Differentiation / Leadership	Visibility / Traffic	Result
		Need	Effort	Security						
	Question	How do you value the customers' objective need of this sourcing solution?	How do you value the customers' subjective acceptance of the migration effort?	How do you value the customers' subjective acceptance of security issues?		How do you value the revenue potential?	How do you value the number of partners and customers participating?	How do you value the novelty on the market and the distinction to competitors?	How do you value the potential to raise attention without explicit marketing campaigns?	What is the average over all criteria taking into account the weightings?
	Weighting	0.2	0.05	0.05	0.2	0.3	0.2	0.1	0.1	1
Business Model Options	Generic Cloud Computing for European Big Science	very high 4.8	medium 3.0	medium 2.9	high 4.1	high 3.8	high 4.1	high 3.6	high 3.8	high 4.0
	Versioned Cloud Computing for Science & Education	high 4.3	medium 3.0	medium 3.2	high 4.1	high 3.8	high 4.1	high 3.5	high 3.5	high 3.8
	Brand Management	medium 2.9	medium 3.3	medium 3.1	medium 2.8	medium 2.9	medium 2.8	medium 3.0	medium 2.8	medium 2.9
	Information as a Service	very high 4.5	high 3.5	medium 3.4	high 4.2	very high 4.5	high 4.2	high 4.1	high 3.7	high 4.2
	Collaboration & Communication Platform for Science & Education	high 4.2	medium 3.4	high 3.5	high 3.9	medium 3.0	high 3.9	medium 2.7	medium 3.3	high 3.5
	Worldwide All-In-One Enterprise Cloud	high 3.8	medium 3.3	medium 3.0	high 3.9	high 4.0	high 3.9	medium 3.3	high 3.9	high 3.8
	Application Crowd	high 3.8	medium 2.9	medium 3.1	medium 3.4	medium 2.8	medium 3.4	high 3.8	high 3.5	medium 3.3

Figure 12: “Ease of Implementation” Overall View

Ease of Implementation	Criterion	Costs		Risk			Conflict with Suppliers	Time Required	Result
		One-time	Recurring	Feasibility	Expertise	Legal			
Business Model Options	Question	How do you value initial investment costs?	How do you value recurring costs that appear on an ongoing basis?	How do you value the objective technical feasibility with today/s knowledge?	How do you value your organisation's knowledge to realize the BM?	How do you value legal risks that might appear?	How do you value conflicts with your organisation's strategy, structure and processes?	How do you value the required time until the first service is sold?	What is the average over all criteria taking into account the weightings?
	Weighting	0.2	0.2	0.2	0.1	0.1	0.1	0.1	1
	Generic Cloud Computing for European Bfg Science	neutral 2.7	neutral 3.4	positive 4.0	positive 3.9	neutral 3.1	positive 3.8	neutral 2.6	neutral 3.4
	Versioned Cloud Computing for Science & Education	critical 2.1	neutral 3.0	positive 3.8	positive 3.7	neutral 2.9	positive 3.8	neutral 2.6	neutral 3.0
	Brand Management	critical 2.3	neutral 3.4	neutral 3.4	neutral 2.7	neutral 2.6	positive 3.5	neutral 2.8	neutral 3.0
	Information as a Service	neutral 2.8	neutral 3.3	positive 4.0	positive 4.2	neutral 2.8	positive 3.8	neutral 3.1	neutral 3.4
	Collaboration & Communication Platform for Science & Education	neutral 2.5	positive 3.7	very positive 4.6	positive 3.6	neutral 2.8	neutral 3.4	neutral 2.9	neutral 3.4
	Worldwide All-In-One Enterprise Cloud	critical 2.3	neutral 3.3	neutral 3.3	positive 3.5	neutral 2.8	neutral 2.8	critical 2.4	neutral 2.9
	Application Crowd	neutral 2.6	neutral 3.3	positive 3.9	positive 3.6	neutral 2.8	neutral 3.3	neutral 2.8	neutral 3.2

Figure 13: Exemplary ESA Data Product Showing an Interseismic Strain

