Pierre Audoin Consultants

D3 – Baseline Scenario for 2020

Economic and Social Impact of Software & Software-Based Services

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EXECUTIVE SUMMARY

This report follows on the work presented in the D2 report as part of the "Economic and Social Impact of Software and Software-Based Services" in Europe.

The objective of this document is to project the most likely economic and social impact of the EU SSBS industry on Europe (EU27) in the next 10 years from now, with a specific focus on the impact of the development of the *Internet of Services* on this industry.

In this rapidly changing environment, the second objective of this report is to identify the barriers for the development of the European software and software based service industry and to determine policy measures to remove or mitigate them.

SSBS within the context of the Internet of Services

In this part, the Consortium focuses on the current impact of the Internet of Services (IoS) on the SSBS industry and market. The goal here is to present the state of the art as of 2009 from a definition, segmentation, market sizing as well as nature of the different players that are active in this industry.

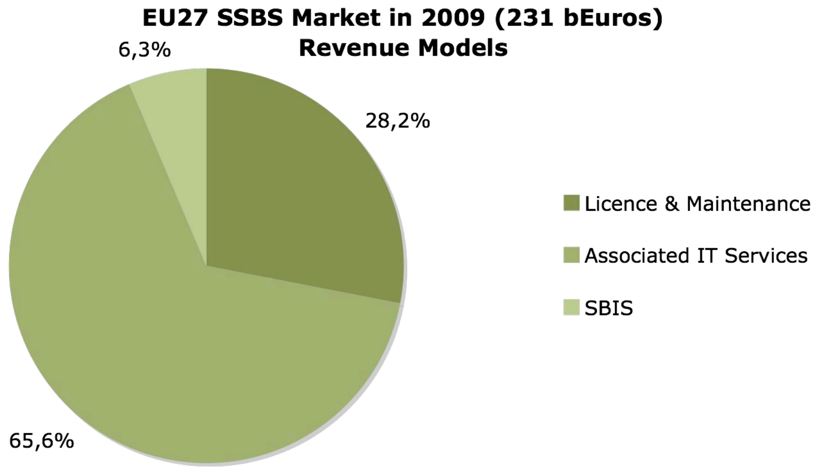
The first step in the definition of the SSBS industry within the context of the emerging Internet of Services is to define "Internet of Services". After briefly reviewing the literature on this matter, the Consortium will retains the following as a definition of Internet of Services: *Generic services that can be automated and optimized through the use of ICT, delivered leveraging Internet platforms and that can be combined in order to provide value-added services to services users.*

We then make a clear distinction in between Software-Based Internet Services (SBIS) and Software-Enabled Internet Services (SEIS) that are the two constitutive segments of the IoS (IoS = SBIS + SEIS). SBIS is the part of the IoS that is of critical interest to the current study. Such services cover capabilities for which the value to the customer is intrinsically related to the IT resources that are delivered via the Internet. These include the use of software and infrastructure resources such as the ones delivered in IaaS (data storage, computing power…), PaaS (software development and integration capabilities…), and SaaS (Customer Relationship Management, Human Resources… capabilities) models.

SBSS has been defined in the D2 report with Paid-Web-Based and Online Advertising as two emerging segments rendered possible thanks to the Internet. The SBIS market corresponds to revenues coming from Paid-Web Based and Online Advertising as defined in the D2 report. Most of those activities are generally made available through the World Wide Web, but more and more services can be accessed directly with widgets, thin clients or direct integration into databases.

In the D3 report the Consortium emphasizes much more on this SBIS segment, the part of the SSBS industry that is also part of the Internet of Services.

The Software-Based Internet Services market is still relatively small in size compared to the more traditional SSBS revenue models: Licence & Maintenance and IT Services. In recent years, the pace of growth of the SBIS segment was 4 to 5 times faster than the growth of traditional segments.



The SSBS market size in the EU27 area is estimated at about 231 billion Euros in 2009. A detailed analysis of the trends and growth drivers for each segment can be found in the D2 report[1].

In the D3 report the Consortium details how the advent of the Internet of Services impacts the development of the SSBS industry and its players in particular. For the sake of this exercise 5 types of players have been retained: Independent Software Vendors (ISVs), IT Services providers, Telecom operators, Internet players and other companies that are not part of the ICT industry, but can sometimes partake in the SSBS industry by selling software that they have developed.

The Consortium gives a thorough description of these categories of players including their activities, business models, and positioning in Europe.

This first part sets the stage for the remaining of the report that focuses on giving indications on where the SSBS industry and markets could evolve in the next five to ten years.

Key Techno enablers for the future development of the SSBS industry.

Numerous technology trends could have a major impact on the development of SSBS and SBIS in the coming years. Depending on their availability on time, their cost and their level of adoption by end users (niche or mass market), they could help or not to accelerate the growth of the overall SBSS market and especially its Internet of Service part. They can therefore have a major influence in the development of the market, and need to be taken in account for prospective scenarios.

There are two main kinds of technology trends to analyze:

- Some of those technologies are new software technologies that could represent new market segments and new opportunities in the SSBS industry. Most of the time, they would rather be combined or integrated with other technologies rather than made available as standalone. Their development is therefore dependent of the SSBS itself, for which they are internal growth drivers. They would most likely be used as a lever for a faster growth.

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[1] *http://cordis.europa.eu/fp7/ict/ssai/study-sw-2009_en.html*

- Other technologies will develop almost independently of the SSBS industry. They would be more enablers to ensure a faster development of the software rather than pure software technologies. While SSBS industry needs could accelerate their developments (by helping to find sustainable business models), their development should be seen as exogenous as their availability will depend also heavily on other industries (like other ICT industries like contents or communications, or even non-ICT industries). Their development is also dependent on technology breakthroughs related to physics, mechanics or energy management.

In this second part, the Consortium presents what we believe will be critical technologies and concepts for the future of the SSBS industry.

- Artificial Intelligence (AI)
- Semantic Web
- Information Management
- Digital ID
- Interoperability
- Ubiquitous Networks
- RFID
- Security
- Datacenter
- Ultra-Broadband

These techno-enablers are part of the important underlying technology forces that will drive the evolution of the SBBS industry in the next years. We explain then how these impact our foresight scenarios (baseline and theme scenarios) that will be presented further into the report. Some technology drivers have been in fact directly integrated fully in the baseline scenario, especially for technologies with limited interaction with the theme scenario. Other technologies are already included in the baseline scenario, but not to their full extent. They are indeed either the leading driver of one of the scenario, or offer some additional leverage on one or two theme scenario.

Emerging markets and their potential impacts on the SBIS Industry

The following part focuses on the emerging SSBS markets identified in the D2 report. The Consortium focuses here on the interactions in between these fast growing markets and the development of the SBIS. In particular, we explain for each emerging market the current positioning of the SSBS players (ISVs, IT Services providers, Telecom operators, Internet players, and Others) as well as how there positioning should evolve in the future in these markets.

The Winners: Internet players

Internet players will benefit the most from the evolution and development of the different emerging segments presented above. In theory, they are the best positioned to benefit from the development of SBIS and the impact of Internet of Services on the SSBS industry. Most players are from origins outside of Europe. There are European players in this category (cf. the definition of this category of industry players in Chp. 1.3.4.2) with OpenPortal, RunMyProcess, Sidetrade, EtapOnline, Oodrive, Synertrade, Datev, Onventis, Talentsoft… – which are born with the Internet and rely mostly on paid-web based solutions – although their number is small and they currently lack a strong visibility on the market. They should grow rapidly in the next few years.

The Challenged: ITS and ISVs.

The incumbent players are facing major shifts in the market: shifts in demand, shifts in the competition with new types of players entering the market. Not surprisingly, they – especially the larger players – are against this flow of change, which can represent a real threat to their business models and the recurring revenues that they have in place in the run and maintenance of their clients information systems. They today represent the vast majority of players in the industry. They will have to evolve though in the coming few years and reposition their activities in a renewed SSBS ecosystem.

The Challengers: Telcos

These players are positioned to benefit strongly from the evolution of the SSBS industry within the context of the Internet of Services. They are a crucial piece of new software delivery models as they own part of the infrastructure. Their role in the strengthening of the European SBIS industry could be critical in this space. Whether or not they can embrace the SBIS models at the application level remains to be clarified, though.

Others

Emerging models (OSS, Cloud…) enable them to enter the SSBS industry. This raise the difficult question of identifying these new players in industry statistics.

SSBS industry competitiveness

The main determinants and patterns of European SSBS competitiveness have been examined by looking at: factor conditions of production; related and supporting industry; and industry strategy, structure and rivalry.

The analysis of the factor conditions has shown that the US had the largest stock of the ICT researchers in 2006. Comparably, the EU15 (approximately 180,000 researchers) had three times less ICT researchers, and Japan, with 30,000 ICT researchers, ranks third. When looking at the proportion of science graduates per 1000 inhabitants, the largest figure is was found in France, Finland and Ireland, and most EU countries outperformed the US according to this measure. The analysis of the capacity for innovation and quality of research shows the US as the country with the highest score, but only slightly higher than Belgium, Germany, the UK and Finland. Finally, the score on availability of the venture capital funding across countries is found highest in the US, although some leading EU countries (Netherlands, Finland and the UK) are only slightly lower than the US.

The analysis of the supporting industry and other related factors shows that The EU 27 lags behind the US and East Asia in fields of: financial services; information society; innovation and R&D; liberalization network industries; enterprise environment; social inclusion; and sustainable growth. However, individual countries within the EU perform better than the US. Namely, Sweden, Denmark and Finland outperform the US in innovation, financial services, social inclusion and sustainable development. In terms of the IT sector analysis, the US has a leading position in terms of innovation followed by Denmark, Sweden Finland and the United Kingdom. The supporting industry of broadband and mobiles is well developed in the EU and in some cases with subscription rates higher than those in the US (Denmark and Norway in the case of broadband, and Italy, Greece, Luxemburg, the Czech Republic, Portugal and the UK in the case of mobile). The perception of intellectual property protection in the EU is high, and in the case of the most developed countries, within a similar range to that of the US.

The analysis of industry strategy, structure and rivalry factors shows that the software industry is characterised by very different typology of companies. In particular, few large companies account for a large share of the total sales revenues. The same is true for the expenditures amounts on R&D investments. However, it is interesting to note that small companies make similar or larger contribution to R&D investment when analysed in relative terms (R&D investment per employee). Overall the findings indicate that the software sector is characterised by economies of scale, and network economies play a major role in determining the position of the company in the market. There is also little turnover in the companies positioned at the top of the ranking.

The implications of this is that past experience shows that it has been very difficult to gain leader positions in the software sub-sector, and less so in the internet and computer services sub-sectors. ***It is unlikely that, under current circumstances, existing market players will be successful in gaining the top position.*** *The opportunities will come in the provision of new services where new business models are developed, such as emerging segments in the software industry. However, the* ***success of new market players will be limited by the extent to which size, network effects and reputation will dominate in the new industry that is emerging.***

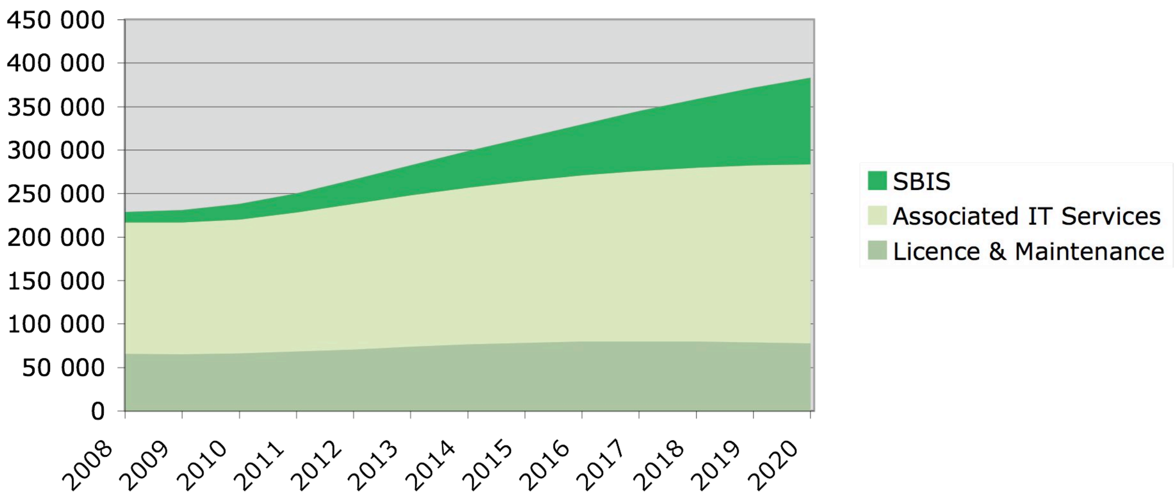
SSBS and SBIS – Foresight 2020

This part presents the main results of the forecasting exercise for the SSBS market in 2020.

Market sizing in 2020

The following graphs and table present the evolution of the different SSBS market segments for the 2008-2020 period in the EU27 region. This is the baseline scenario of the SSBS market development for the next 10 years.

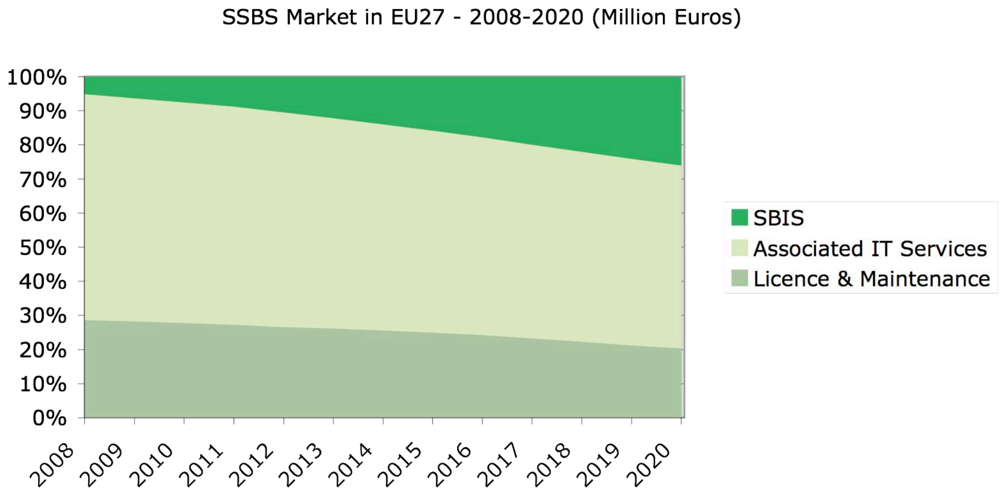
SSBS Market in EU27 - 2008-2020 (Million Euros)



In the baseline scenario, the SSBS market in the EU27 region goes from **228.7 billion Euros** in 2008 to **383.5 billion Euros in 2020**, a **4.4% CAGR over the 2008-2020 period.**

Segments	**Market share 2008**	**Market share 2020**	**CAGR 08/20**
Licence & Maintenance	28.6%	20.3%	1.5%
Associated IT Services	66.2%	53.6%	2.6%
Paid Web Based	5.2%	26.1%	19.2%
Total SSBS market	100%	100%	4.4%

Evolution of the emerging segments share compared to the rest of the SSBS market



During the 2008-2020 period, the structure of the SSBS spending by companies and administrations is changing dramatically as the weight of traditional revenue models (License & Maintenance and Associated IT Services) is decreasing in favour of the Software-Based Internet Services that include Paid-Web-Based and Online Advertising models.

Whereas average annual growth rates of the SBIS segment remain very dynamic in the 2008-2020 period in this baseline scenario, market shares will likely remain in the 25-30% range in 2020. In fact in this scenario, *which is the most likely*, these models do not swipe the traditional models out, the latter having still a positive, although limited growth over the same period.

SSBS market in 2020 - International Comparisons

Geography	Market Shares		CAGR 2008/2020
	2008	2020	
EU27	32%	28%	4.4%
North America	39%	33%	4.1%
APAC	17%	21%	7.8%
Rest of the World	12%	18%	9.3%
World	100%	100%	5,7%

SSBS spending growth in the U.S. in the baseline scenario is in line with the growth in the EU27 region. In Asia (including Japan) as well as in the rest of the World, SSBS spending growth is estimated to be about twice as fast as the EU27 growth. *In particular the SBIS market will develop much faster than in Europe or in the U.S as legacy systems and investments are not as developed as in the old economies.* Therefore, APAC companies buy in the SBIS models more easily than U.S. or European companies. Hence, market share of mature countries will decrease in the 2008-2020 period, to the benefit of the Emerging countries in Asia Pacific (APAC), Eastern Europe (outside of the EU27), Latin America and Middle East Africa.

SSBS Market – Four Theme Scenarios

The baseline scenario represents an extrapolation of the most likely route of ongoing development and innovation trends. Some of the assumptions embedded in the baseline scenario have high level of uncertainties regarding the rate of these segments' development in the future. In order to better comprehend the potential impacts of the development of selected market forces, we have built four theme scenarios, each focusing on the intense development[2] of one particular market force.

These theme scenarios have been selected for different reasons:

- **Cloud computing** – this segment is at the core of the SBIS industry. One of the key objectives of this project is to better understand the impact of the development of the Internet of Services on the software industry in Europe. This theme scenario looks at how the market and industry will look like if the developemnet of Cloud computing is more rapid than in the baseline scenario.
- **Mobility** – with the rapid diffusion of portable devices to consumers and professionals, SSBS players are finding new ways to use software technologies and, more importantly, new business models made possible by the combination of the internet, software technologies and the capability to use the software-based service wherever the end-user is located. This theme scenario examines the additional growth that could impact the SSBS industry if the development of mobile

[2] *In the CHAPTER 2 we have presented some of the key techno-enablers that underly the development of these scenarios.*

applications is faster than in the baseline scenario.

- **Open source** – as presented earlier in this document OSS is one of the key enablers of the cloud computing models. It is also a model that potentially destroys value in the software product industry. This theme scenario looks at the potential impacts a stronger development of OSS technologies could have on the SSBS market and industry.
- **Offshore** – Offshore is not a market segment in itself. It is a constraint of the IT services market, a key component of the SSBS market. In the D2 report, we have explained some of the risks and potential benefits of the offshore delivery models. This theme scenario takes a quantitative approach to the question of the offshore models and looks at the potential impacts on the SSBS market and industry if these models were to develop faster than in the baseline scenario.

These theme scenarios have differentiated impacts on the overall growth and development of the SSBS market. Mobility is the only one presenting a positive Δ compared to the overall SSBS baseline scenario. This is in fact one of the major growth opportunities for SSBS players in the coming years as it will strongly impact the usage of software technologies.

The three other theme scenarios yield a reduction of the overall SSBS market in 2020, although it remains limited: less than 10% even for the offshore scenario which produces a very strong development of the offshore models during the 2013-2020 period. Cloud computing, open source and offshore market forces all have negative impacts on the growth of the SSBS market in EU27 compared to the baseline scenario, mostly because they give in important price reductions on SSBS products and services.

What can be seen as a paradox is explained by an interesting phenomenon that can be found in the overall IT market: the positive price elasticity of IT products and services. Numerous examples exist in the literature explaining this occurrence that sees demand in IT products and services increase when their prices decrease. Offshore, open source and cloud computing all have a strong negative impact on prices, although as a result, the value destruction is not as important as one could have expected. In effect, this price decrease triggers some additional value creation in the market through for instance, new projects that were not economically viable before, projects in SMEs for which investments were too important, or just because these new models have made some room in the IT budgets of companies that can continue to invest more on a domain that continuously yields great value for its business and its activities.

Cloud computing – part of the SBIS segment – is the one market factor that has the highest impact on the SSBS market structure with direct and indirect impacts on the costs of IT resources, both at the infrastructure (storage, hosting, computing power…) and application (custom software development, application maintenance…) levels. This represent ***important opportunities for customers*** as it reduces the total cost of ownership of Information Systems and consequently ***lowers the barrier to acquisition of IT systems*** for the (smaller) enterprises.

This also represents – ***in theory – important opportunities to SBSS players*** of all kinds as they can provide their software and services to a larger number of customers. However, these models are also ***major threats to their existing business models and recurring revenue streams*** as it reduces the overall growth of the market (cf. theme scenarios). Subsequently, it comes at no surprise to see large, leading, traditional SSBS players (both ISVs and IT Services providers) being relatively reluctant to rapidly and thoroughly embrace the cloud computing models.

These models offer nonetheless a crucial opportunity for smaller, more agile providers in Europe to distribute more easily and in a more cost effective way their software solutions to European customers.

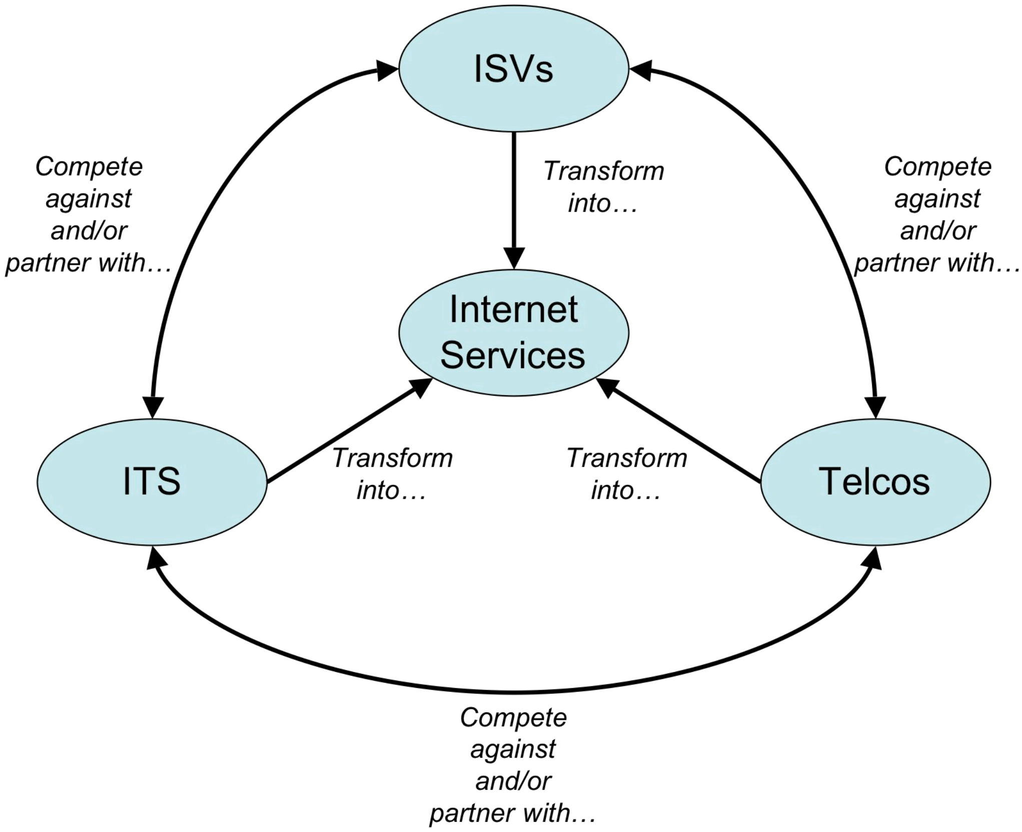
SSBS players in 2020

Looking at the next ten years, the SSBS industry should remain a dynamic one with massive growth opportunities for all players. Two major trends should nonetheless be more prominent than the other ones:

- ***Serviciation*** – the move towards services – all actors will transform their business models towards activities under an “as-a-service” mode. These services might be based on reusable components and solutions – for the sake of profitability, and time to market – however the clients will buy services in the end.

- ***Internetization*** – the Internet will emerge as the prominent delivery channel for the SSBS industry. All players will have to transform themselves in order to embrace this new delivery mode.

These evolutions are represented in the following figure:



SSBS 2020 – future jobs contribution

Using the supply forecasts elements provided in the DG Enterprise's e-skills study ("Monitoring the e-skills demand and supply in Europe"[3]), the SSBS study team developed a growth baseline scenario for the total number of SSBS jobs in Europe.

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3 *The full study report is available at: http://www.eskills-monitor.eu*

Baseline scenario	2008	2020	CAGR 08/20
Total SSBS jobs	1,715,000	2,400,000	2,8%

Expected social contributions

The future social impacts are addressed in a qualitative way, in order to give examples of the contribution that a different pace (slow, medium, fast) of SSBS development could bring on the adoption of software technologies within the nine key social domains that were identified and presented in the D2 report (e-government, e-inclusion, transportation, security, economic processes, sustainable development, health and education).

A few additional percentage points of growth can make a big difference in the diffusion and subsequently the usage of software technologies in the European society. The correlation is true for economic processes (mostly via productivity increases and top line growth via innovation) but also for other social domains and the quality of life (sustainable development, transportation, health…) of European citizens.

Outline to barriers and Policies for the development of the European SSBS industry

As shown in prior sections the market for software and software-based services is starting to change. Related industrial policies also started to change in recent years. In this context two developments have to be taken into account in the analysis of barriers and possible policy measures: the re-emergence of industrial policies and the shift within industrial policy towards an innovation-driven approach.

Given the current structure and the expected future development of the SSBS industry ***our analysis focuses on the emerging segment of Software-Based Internet Services (SBIS)*** for several reasons. The main aim is to develop a future-oriented innovation-driven industrial policy as part of a European Software Strategy that enable the European SSBS industry to foster innovation, new businesses and markets. Within our time horizon of ten years the rise of the SBIS sector is the most significant development. Moreover the structure of the existing SSBS industry that is mainly dominated by American companies cannot be changed easily. Finally ***the emergence of SBIS offers a window of opportunity for changing this situation in the medium and long term.***

To achieve this aim we follow a three-step approach. The first step aims at collecting, reviewing and analysing existing background materials, such as documents about EU initiatives like i2010, the New Industrial Policy or the ICT Task Force, as well as on recent studies and position papers on the European SSBS industry and to some extend EU ICT industry. Based on this we carry out an empirical analysis that is itself two-folded. In a first part we conduct ***a series of 55 face-to-face and telephone interviews*** where we asked SSBS stakeholders to assess the barriers and measure and possibly add new ones. In a second part the results of this interviews are complemented by a ***workshop with stakeholders and policy makers***. The workshop will validate, enrich and if possible or necessary specify the results of the interview process. Finally, in a last third step, we will develop a method to determine which policy measures that are significant for the European SSBS and especially SBIS industry can be addressed with specific measures for them. This report covers an overview on the work done in the background analysis as well as the results from the interview process.

Identifying barriers and measures

Given the constantly growing importance of information and communication technology and especially of software based technologies in the last decades it is no surprise that the number of policy documents related to the ICT and SSBS industry has significantly grown in the recent years. As a result a various number of documents exist, which cover a broad spectrum of viewpoints from different stakeholders, including policy makers, industry representatives, national industry associations as well as user industries and customers. In a first step we analysed these studies to extract them and build a framework based on the SI approach to consolidate them. Stakeholders assessed these results during the interview phase.

For that purpose the identified barriers as well the measures or respectively clear objectives for measures were classified into four categories (technical, economic, social and cultural, legal and policy). The preliminary results are presented below.

Technical barriers and measures

Interoperability and standardisation are considered as the most critical barriers for the current as well as the future development. The results underline especially the high importance of interoperability for software and software-based services.

Less prioritized, but also often named was ***security***. Although these topics are already addressed within the framework of industrial policies, they have specific dimensions for the SSBS sector that can be addressed by additional vertical measures.

Other relevant results are the current importance of ***mobile broadband*** as well as the raise of ***lack of cloud infrastructure*** and ***Internet governance*** as topics in the future. These developments seem to be especially relevant for the development of the take up and the future development of the SBIS segment.

Given the strong emphasis as barriers for the European SSBS industry it is clear that ***enforcing interoperability*** and with some distinction the support of standardisation processes are the most named measures. But while interoperability has a distinctive dimension in software and services, the support of participation in standardisation processes is ***already covered by other horizontal measures***.

Broadband availability and ***support of software engineering*** reach also a considerable size and priority. In the case of broadband especially the support of the mobile broadband infrastructure, which is essential for the take up of important segments of SBIS, has a clear importance for the sector. The support for software engineering programs that refers to the obstacles of security and critical information systems is very specific measure for the SSBS sector. Especially since the acceptance and adoption of new software and services delivered by the Internet the ***need for reliable and secure products and services is crucial for the uptake of SBIS in Europe.***

Economic barriers and measures

Not surprisingly, the current ***economic crisis*** is considered to be the most important barrier for current development. This judgement may incorporate a bias and as a consequence it should be excluded for long-term strategy considerations.

A more long lasting and also often named and prioritized barrier is the ***market fragmentation***. It is a ***general topic***, which is already addressed in different horizontal measures, because of the particular importance of network effects and the fact that stakeholders expect a growing significance in the future. In parts this judgment is also significant for the low adoption of SSBS/SBIS by SMEs.

A more particular barrier for the SSBS sector is the problem of ***investment cycles***, which will grow in the future. Also the importance of the ***level of R&D spending*** and the ***competition through offshoring*** will rise in future. While the particularity of offshoring for the SSBS sector is obvious, the low level of R&D spending is a general problem that has already been taken up by several measures (Lisbon goals).

Special characteristics for the SSBS and especially the SBIS markets are the ***commodization*** and the ***lack of revenues due to copyright infringement*** and cannibalization, which have a low level of priority at the moment, but the growth in the future shows the need for actions.

The relatively low results for ***the access to credit and financing solutions*** are interesting, because in other studies of the overall ICT sector this was always considered to be one of the major problems. In opposite to this the ease of access to it and the ***support for seed and venture capital*** are highly required objectives for economic measures. Although there are initiatives at a horizontal level, there are possibilities for specific measures targeted at SSBS and especially SBIS companies.

More different is the situation in the field of ***support for SSBS SMEs***, which is the most desired objective for measures. Because of the fact that the support of SMEs is a goal of the overall EU economic policy, there are several initiatives ongoing. In contrast, the ***awareness for SSBS*** seems to be particular for the SSBS sector as it has not been addressed yet.

Social and cultural barriers and measures

There is a high prioritization of topics related to ***skills and education***. It addresses

SSBS companies (technical and managerial skills, entrepreneurship) as well as user's skills. They all have already been identified and addressed before. Only the growing significance of particular ***managerial skills*** is not represented in existing studies.

Also often named as a current and a future barrier, but less prioritized was ***the lack of cooperation between research and industry***. More particular for SSBS and SBIS are the barriers of ***change management*** as well as ***the lack of trust and privacy concerns***. While change management is a clear barrier for the growth of the European companies, trust and privacy concerns are more ambiguous, because they can also be considered as a chance. A more user-oriented software development with respect to trust and privacy can be a competitive advantage for European SSBS firms.

Only governance issues seem to be a possible topic in future. As a consequence there is also a strong emphasis on skills and education within the measures. Especially the ***technical education*** in schools and the ***promotion of management skills*** for SSBS firms show a clear need for more and better educated professionals in the SSBS industry.

Although several measures at broad level have already been undertaken, there are some possibilities to shape or complement them with ***specific actions for the SSBS industry***. This is also valid for the ***promotion of e-skills for end-user***, which should be expanded towards new required skills in Internet services. Concerning the emerging segment of SBIS areas like trust, data protection and security have a high importance. There are several possibilities to act in support of the take up in these services.

Legal and policy barriers and measures

One major priority is the ***low level of R&D*** either in form a lack of R&D funding or in form of a lack of tax incentives for R&D. The other priority is the ***lack of support for innovative SSBS SMEs***. These barriers are only partly specific for SSBS. Another point of importance is the ***lack of legal harmonization***, which has a specific significance for the SSBS and SBIS and which will rise in future. This is underlined by the fact that the lengthy regulatory processes that hinder dynamic firms and markets refer also, but not exclusively to similar problems and will also rise in the future perspective. Although both are general barriers they contain several issues that are specific for SSBS and especially SBIS. In parts this also applies to the problems with ***cross-border-operations*** and ***internationalisation***.

In contrast the ***lack of procurement policies*** is considered to be a declining obstacle, though it has in parts high relevance for especially SBIS. ***IPR regulation***, which has a great specific component for SSBS, is also seen as a topic that will gain of importance in future. On the level of policy and legal measures two fields of actions outreach the other. One of them is the support of R&D either by more funding or by tax incentives. While the latter is neither SSBS specific nor part of the regulative set of the EU, the increase of R&D funding on EU level is already implemented. The other area is the ***harmonization of the internal market***. Although this is already addressed on broad horizontal level with the single market strategy, there are some points that are of high relevance for their further development of SBIS like the VAT regulations.

Also highly prioritized is the ***support for SSBS SMEs***, where specific measures for SSBS SMEs could complement the horizontal measures for SMEs. Less prioritized are the establishing of ***SSBS clusters*** and the reduction of regulatory issues for SBIS. Somewhat surprising is the low level of ***IPR enforcement*** and ***public procurement***, which both can have great significance.

<u>Summary</u>

Concluding we can state that some of the prioritized barriers and measures are topics that are due to their non-specific character like SME promotion or single market that are already addressed by horizontal policies. Furthermore these results for current and future barriers confirm to some extent the results from other studies. In some of the cases like interoperability, procurement or the lack of access to finance it is possible to use supplementing respectively complementing measures or instruments to encounter SSBS specific obstacles. But there are also several prioritized issues, especially for the future development, that directly deal with SSBS and SBIS specific problems. ***There, specific measures and instruments are***

possible.

<u>Outlook</u>

These results will be presented in a policy workshop where they will be discussed among stakeholders' and policy experts. The aim is to ***consolidate, enrich and if necessary specify the results***. The second aim is ***to discuss the results in the context of the existing framework of (industrial) policies*** within the EU to identify more barriers and measures that are ***specific for the European SSBS and especially SBIS industry***. In the final step of this phase we will develop and apply a matrix approach based on methodology introduced and integrating the EU industrial and innovation policy framework to ***select a list of operational and coherent policy instruments***. In the following final phase of the project the potential economic and social impact of these policy measures will be assessed accordingly to the impact assessment guidelines of the EU.

CHAPTER 1

SSBS IN THE CONTEXT OF THE INTERNET OF SERVICES

In this chapter, the Consortium focuses on the current impact of the Internet of Services (IoS) on the SSBS industry and market. The goal here is to present the State of the art as of 2009. This part sets the stage for the remaining of the document that will focus on giving indications on where the SSBS industry and markets could evolve in the next five to ten years.

1.1 DEFINITIONS

1.1.1 ABOUT INTERNET OF SERVICES (IOS)

1.1.1.1 IoS Definition

The first step in the definition of the SSBS industry within the context of the emerging Internet of Services is to define "Internet of Services".

The generic sense of "Service" as an economic activity is difficult to define precisely and can encompass lots of different economic and non-economic interactions. The most industrialized countries have entered a post-industrial era where their prosperity is largely created through a service economy. There has been a clear transition from a manufacturing based economy to a service based economy. The service sector has become in recent years the biggest and fastest growing business sector, employing most people in the World. Services already account for 70% of the U.S. economy and even 35% of the Chinese economy, and these percentages are growing rapidly.

IBM[4] provides a definition of such services: "A service is a provider/client interaction that creates and captures value." It is important to note here that without a recipient a service can not be rendered: it is always related to another person or economic unit.

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[4] *http://www.research.ibm.com/ssme/services.shtml (as of July 2008).*

IBM continues by providing the following example: “For instance, most everyone is familiar with a typical doctor/patient interaction, in which both sides benefit from the transaction - referred to as "capturing value" in services parlance. The doctor receives a fee; the patient gets a health assessment and (it is hoped) recovers from the illness. This basic principle also underlies the work between a services provider and a corporation.”

There is still uncertainty in every attempt to identify and to scheme services because of constant changes and creations of new "services". This results in political arbitrariness of known classification schemes. Another spectrum of the classification and definition problem is the less known EU policy, which defines the major features of "services in the information society" as following: rendered for money, at a distance, electronically, on customers demand. The policy enumerates exceptions in a long list: services, which are provided in immidiate presence of both, the recepient and the provider, even when they are provided electronically and services which are provided through data communication without individual demand to simultaneous receipt through an unlimited number of individual recipients.

The development of Information and Communication Technologies (ICT) in recent years has enabled to automate a wide range of economic processes[5]. Additionally, the development of the Internet enables previously offline services (such as booking a train ticket) to become more widely and easily available (the French national railway company SNCF now sells more than 40% of its train tickets on the Web). It has also tremendous impacts on intermediation services. Due to indirect network externalities, “users have larger expected gains, the larger the number of users on the other side of the market[6]”.

The SOA (Services Oriented Architecture) approach combined with Web 2.0

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[5] cf. p183 Optimization of Economic Processes in the D2 report – The European Software Industry published in July 2009.

6 “Chicken & Egg: Competition among Intermediation Service Providers”. Bernard Caillaud and Bruno Jullien, 2002.

technologies[7] should make innovation in services easy to implement, consume, and trade. Hence the use of ICT and Internet enable online services to yield higher productivity, thus providing more value to the services client at a lesser total cost.

Internet of Services includes all such services that are accessed purely electronically and delivered via public networks and via the Internet in particular. In "The Internet of Services: Vision, Scope and Issues"[8], four members of the research community in Europe define Internet of Services as "software-based components" that are delivered via the Internet and that "involve interactions between the software systems of the provider and consumer (not excluding interfaces accessible by humans), (…)"

The Consortium will retain the following as a definition of Internet of Services: *Generic services that can be automated and optimized through the use of ICT, delivered leveraging Internet platforms and that can be combined in order to provide value-added services to services users.*

1.1.1.2 IoS and Software-Based Services

The Internet of services (IOS) has been very successful in recent years. The best known class of services is e-commerce, with such leading firms as eBay and Amazon. For these players, new capabilities offered by virtual stores (1 000 000 books referenced at Amazon.com) combined with a much bigger market potential were key to their successes. The importance of searching and of the related online advertising revenues enabled the growth of Google. Similarly, the development of social networking saw Facebook, Twitter and their competitors grow rapidly. Location-based services, such as those that show where people are, or where to find a suitable local restaurant, are expected to extend social networking systems to mobile devices.

The Internet is also being used for vertical applications, by end-users or by

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[7] *SAP is involved in research programs arounf the IoS concept. http://www.sap.com/about/company/research/fields/internet_services/index.epx*

[8] *"The Internet of Services: Vision, Scope and Issues » July 2008 - Man-Sze LI, Servane CRAVE, Jörg P. MÜLLER, and Steven WILLMOTT.*

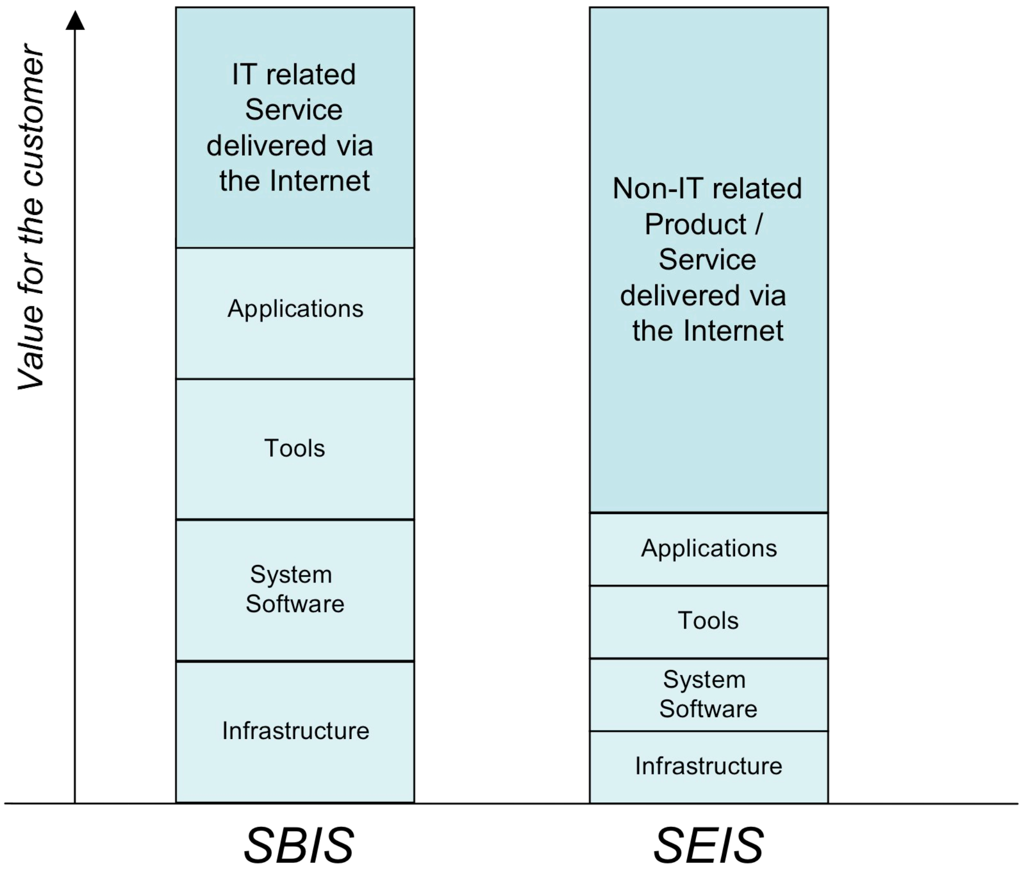
professional users. Beyond e-commerce, major initiatives have already been taken in administration, healthcare (personal data stored on the Internet, remote monitoring of patients and/or chronicle diseases), energy (smart metering) or transportation (fleet management, optimisation of moves, instant security). The Internet is indeed fuelling new services and growth within the other industries.

Within the breadth of services that are or can be provided leveraging the Internet, a key distinction can be made in between different categories of services:

- **Software-enabled Internet Services (SEIS):** The software part is a key part of the service since such capabilities derive meaning and value from being realized and delivered on the Internet. However, the value of such services is mostly associated with the sale of the product or service itself (a book, a car, an airplane ticket, a diagnosis…), not with the software.
- **Software-based Internet Services (SBIS):** Such services cover capabilities for which the value to the customer is intrinsically related to the IT resources that are delivered via the Internet. These include the use of software and infrastructure resources such as the ones delivered in IaaS (data storage, computing power…), PaaS (software development and integration capabilities…), and SaaS (Customer Relationship Management, Human Resources… capabilities) models.

From a customer point of view

The graph below gives a representation of the differences in terms of value generated for the customer. Both SBIS and SEIS rely strongly on an IT platform (infrastructure + system infrastructure software + tools + application software) – available through the Internet – which clearly is the engine of the Internet service. In the case of SBIS, the customer buys and therefore only values the IT related resources – the IT platform + potential IT related services provided on top of it – which subsequently has a specific price. In the other case, SEIS, the customer values the product or service – which is not IT related – that is enabled by the IT platform and delivered through the Internet.



IT related services and Business Process Outsourcing (BPO)

PAC considers[9] BPO services as the “Takeover of responsibility for an entire business process (or parts of it), also including specialized administrators besides the related infrastructure and application management. In most cases, assets and/or staff are taken over. BPO also includes processing services such as payroll, card or transaction processing". PAC only considers processes that are to a significant degree supported by IT (e.g. accounting, human resources, logistics, billing, card processing, etc.).

In a similar fashion the Consortium defines « IT related Services » as services that are to a significant degree supported by IT. In other words, in the cost structure of providing such services , the IT platform makes up for more than the majority (eg. 70%) of the costs.

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[9] *Software and IT Services SITSI® Definitions – Pierre Audoin Consultants 2010 – http://www.sitsi.com*

From an industry point of view

Taking the software industry perspective, SBIS is clearly part of the SSBS industry, which has been defined in the D2 report as an industry that generates direct revenues from the production and commercialisation of software and IT services. This industry – in terms of industry players – is developed in further detail in a subsequent part in this report.

SEIS is, by definition, classified outside of the ICT sector. For instance Amazon or eBay, VoyagesSNCF.com are retailers. The e-governments portals of the Ministry of Finance in France that are used by citizens or companies to pay their taxes are public sector initiatives. In such cases, the IT platform enabling the service is either built by the organization's internal team and therefore is a production of the invisible software industry and remains outside of the SSBS industry, or it is built by providers external to the organization such as independent software vendors and IT services firms which revenues are already accounted for in the SSBS industry.

1.1.2 SSBS WITHIN THE CONTEXT OF IOS

In the D2 report, the Consortium has drafted a definition for the Software and Software-Based Services (SSBS) industry based on a broad definition – corresponding to the software and IT services industry – in order to be able to assess the impact of the development of emerging services such as Cloud Computing services, which include not only software-based internet services such as Software-as-a-Service (SaaS), but also IT infrastructure related services such as Infrastructure-as-a-Service. Later in this report the consortium takes a closer look at the different shift in value for the industry players from one segment to the other. Having this broad definition is mandatory in order to be able to make informed and relevant comparisons.

In addition since one of the objectives of the project is to assess the impact of the development of Internet of Services on traditional players, namely independent software vendors and IT Services firms, it was legitimate to consider their full market in which they operate, namely the software and IT services industry.

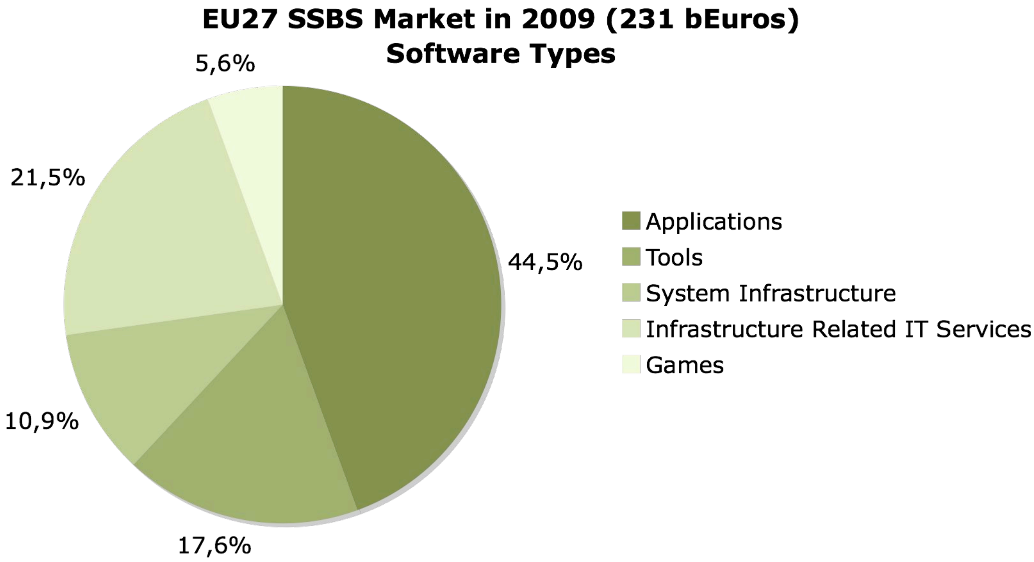
As explained above, Software-based Internet Services include all activities based of the delivery of raw data or software (tools, games, system, etc…) over the Internet. This corresponds to revenues coming from Paid-Web Based or Online Advertising as defined in the D2 report. Most of those activities are generally made available through the World Wide Web, but more and more services can be accessed directly with widgets, thin clients or direct integration into databases.

In the D3 report the Consortium emphasizes much more on the part of the SSBS industry that is also part of the Internet of Services.

1.2 SSBS MARKET IN 2009

1.2.1 SSBS MARKET IN EU27

The following graphs present the structure of the SSBS market in 2009. Its size in the EU27 area is estimated at about 231 billion Euros. A detailed analysis of the trends and growth drivers for each segment can be found in the D2 report[10].



The largest segment is Applications Software. Games – a B2C market – is relatively small in size compared to the other SSBS

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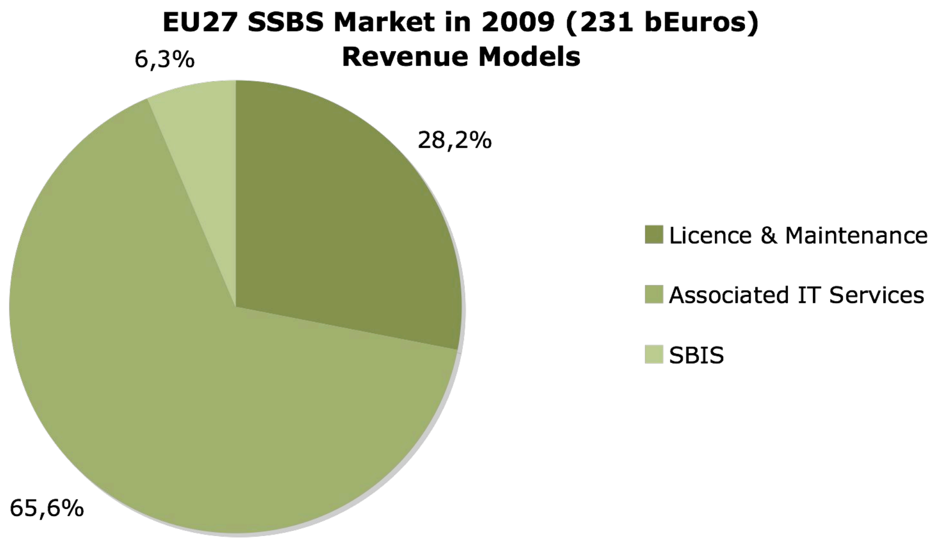
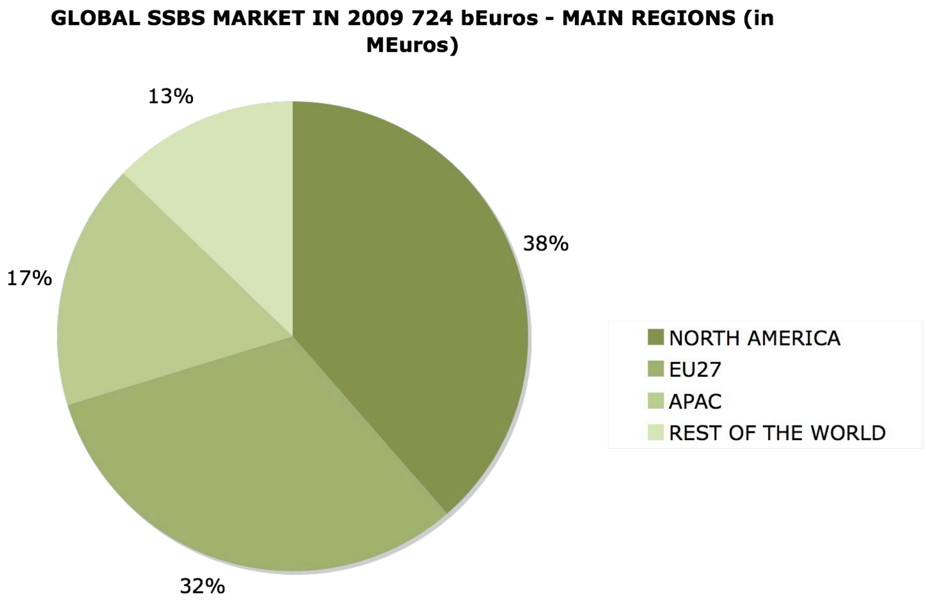
[10] *http://cordis.europa.eu/fp7/ict/ssai/study-sw-2009_en.html*



The Software-Based Internet Services market is still relatively small in size compared to the more traditional SSBS revenue models: Licence & Maintenance and IT Services. In recent years, the pace of growth of the SBIS segment was 4 to 5 times faster than the growth of traditional segments.

1.2.2 INTERNATIONAL COMPARISONS

In terms of size the EU27 region is the second largest SSBS market in the world after the U.S. and ahead of APAC (including Japan).



1.3 SSBS INDUSTRY PLAYERS

In the D3 report the Consortium details how the advent of the Internet of Services impacts the development of the SSBS industry and its players in particular. For the sake of this exercise 5 types of players have been retained: Independent Software Vendors (ISVs), IT Services providers, Telecom operators, Internet players and other companies that are not part of the ICT industry, but can sometimes partake in the SSBS industry by selling software that they have developed.

This part focuses on the description of these categories of players including their activities, business models, and positioning in Europe.

1.3.1 INDEPENDENT SOFTWARE VENDORS (ISV)

1.3.1.1 SSBS activities and business models

Independent Software Vendors (ISVs) are the manufacturers of software products.

The production of software is to translate logic in a language understandable by the IT hardware. This is a codification process. There are generally 3 main steps in creating a software product: analysis & design, production and programming and delivery.

Faced with increasing demands and complexity of interactions between software and hardware, the software design part has been rapidly industrialized. The establishment of various design patterns, such as rigorous methodologies, helped facilitate the smooth conduct of development projects, and respond more precisely to initial requirements. These methodologies often incorporate the concepts of industrial production processes. As a consequence, ISVs' stakes in terms of investment, research and development, and control of production processes are similar to those that can be found in manufacturing industries production of high technology goods.

In addition, ISVs have to maintain research & development activities as well as training of internal teams in order to retain and develop their technological and functional expertise. These fixed costs represent a major part of total operating costs for ISVs, and this share is increasing as the complexity of software technology and business challenges increase. As a result initial investments linked to the creation of an ISV or the launch of a new version of the software product, represent a significant risk, based on future compensation connected to the use of designed software.

Other key characteristics of the ISVs' activities include:

- Low marginal costs: the initial cost of production is high but the marginal cost of reproduction is almost zero;
- The influence of network effects on the economics of software: an "group" effect (since it allows the exchange of data and files between users, software induces a positive externality of consumption) and an “installed base” effect (the larger the user base, the lower the cost of adoption by the last user);
- Lack of physical wear to use: the lifespan of a software product cannot be judged in terms of physical wear, unlike material goods equipment or consumption.

These three characteristics help explain the changes occurring in the economy of software: a structural trend in the concentration of supply, the mechanical adoption of standards by the market and the race to innovation in which ISVs constantly enrich their products with new functionalities.

The combined "group" and “installed base” effects are natural market concentration factors. Hence, the number of consumers is paramount in this industry. These factors are key to explain a major competitiveness difference in between US players and European players: due to the fragmentation of the European market European ISVs are below a critical size that keep on increasing.

The delivery models of application software products are dramatically changing with the advent of the cloud computing and SaaS models. In the D2 report, the Consortium explains the interest of these models for ISVs, including:

- Reduced R&D costs – some pure players acknowledge that such models could reduce these costs ‘by as much as 50% (no management of multiple products versions for multiple platforms (OS, databases...), which means one version for all customers).
- All R&D efforts can therefore be concentrated on new functionalities and new platforms rather than on heavy and costly non-regression testing processes. This also implies a better reliability of the software.
- The installed based can act as a community that reacts through the Internet channel on new versions, new functionalities, user interface, evolution of needs... This can dramatically decrease the time to market of new software.

1.3.1.2 Positioning in Europe

US software vendors play an important role in this industry, as within the Top 20, the 14 US software vendors account for more than 37 % of the worldwide market. There are only 3 European software vendors among the Top 20 (5% of the worldwide market).

Worldwide - Leading Suppliers ranked by Software Products* Revenue (in million EUR)							
Rank	**Company**	**Natio-nality**	**FY End****	**2007**	**2008**	**Growth 2007/08**	**Market Share 08**
1	Microsoft	US	30-juin-08	30 895	31 385	2%	18,0%
2	IBM (incl. Cognos as Feb 08, Telelogic as of Apr 08 & Ilog as of Aug 08)	US	31-déc-08	13 300	13 610	2%	7,8%
3	Oracle (incl. BEA as of Jan 08)	US	31-mai-08	11 065	12 425	12%	7,1%
4	SAP (incl. Business Objects as of Jan 08)	DE	31-déc-08	7 391	8 405	14%	4,8%
5	EMC (incl. VMware & RSA)	US	31-déc-08	3 890	4 040	4%	2,3%
6	Symantec	US	31-mars-09	3 890	4 010	3%	2,3%
7	HP (excl. EDS)	US	31-oct-08	3 174	3 213	1%	1,8%
8	CA	US	31-mars-09	2 735	2 735	0%	1,6%
9	Adobe Systems	US	30-nov-08	2 220	2 298	3%	1,3%
10	Intuit	US	31-juil-08	1 945	1 965	1%	1,1%
11	NEC	JP	31-mars-09	1 650	1 760	7%	1,0%
12	Autodesk	US	31-jan-09	1 460	1 475	1%	0,8%
13	Fujitsu (excl. FSC)	JP	31-mars-09	1 405	1 470	5%	0,8%
14	Sage	UK	30-sep-08	1 444	1 427	-1%	0,8%
15	SAS	US	31-déc-08	1 390	1 360	-2%	0,8%
16	BMC Software	US	31-mars-09	1 140	1 210	6%	0,7%
17	Dassault Systemes	FR	31-déc-08	1 063	1 154	9%	0,7%
18	Hitachi	JP	31-mars-09	1 080	1 115	3%	0,6%
19	Infor Global Solutions	US	31-mai-08	850	1 055	24%	0,6%
20	Apple	US	30-sep-08	702	881	25%	0,5%
							© PAC, July 2009

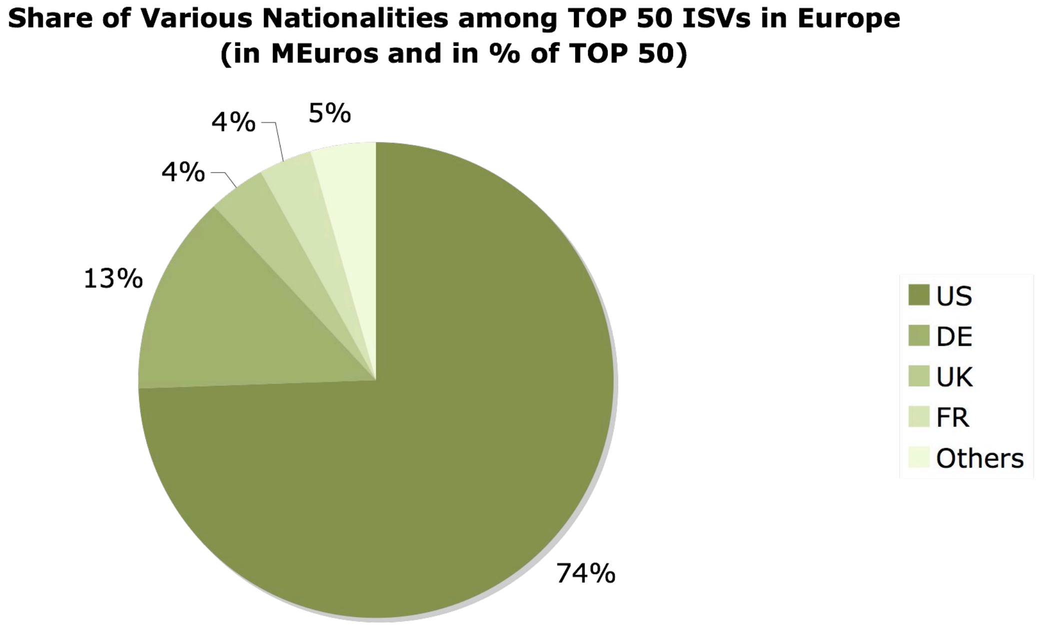
*comprising Systems Infrastructure Software, Tools, and Application Software Products

**FY End used for 2008

Although many European players are in strong position in niche or local markets, the difference in financial power is decisive in concentration phases. The European industry of software products, structured mostly around actors in small or medium size, seems fairly vulnerable to future movements of concentration.

American domination

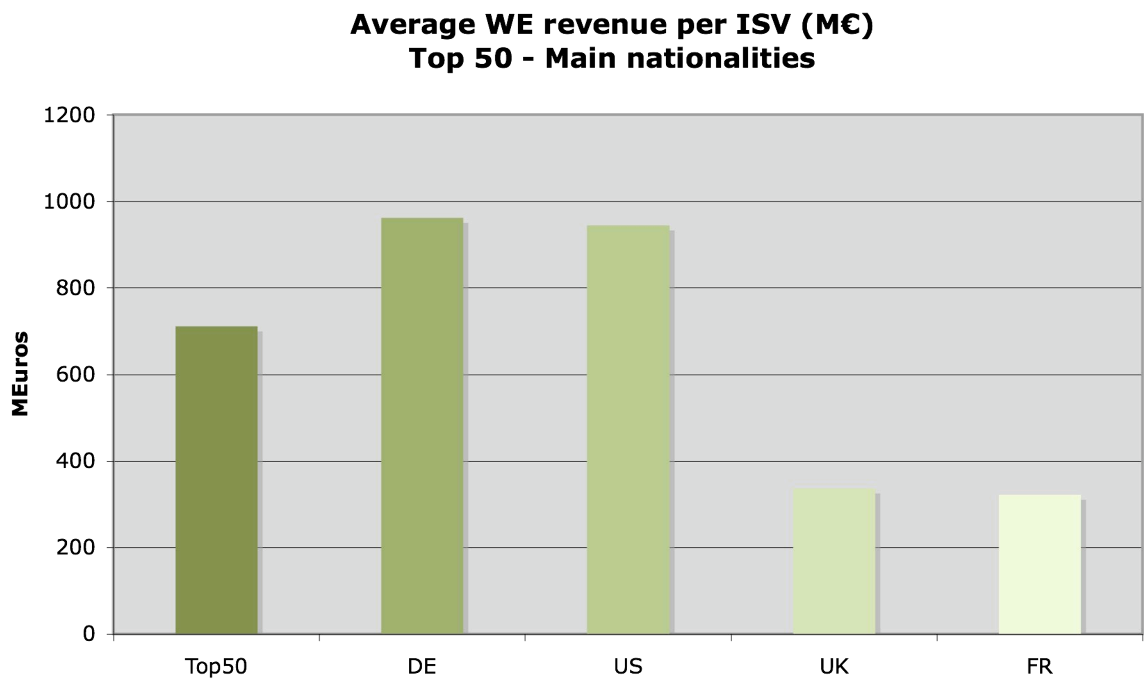
The graph[11]and chart below show the concentration of ISVs by nationality in Europe amon the 50 largest ISVs operating in Europe.



As part of the Top 50 German, French and UK ISVs, which belong to the 3 largest EU27 markets, only account for about 20% of the revenues generated by the 50 largest ISV players in Europe. More than 50% of the companies of the top 50 are U.S. based companies as indicated in the following chart.

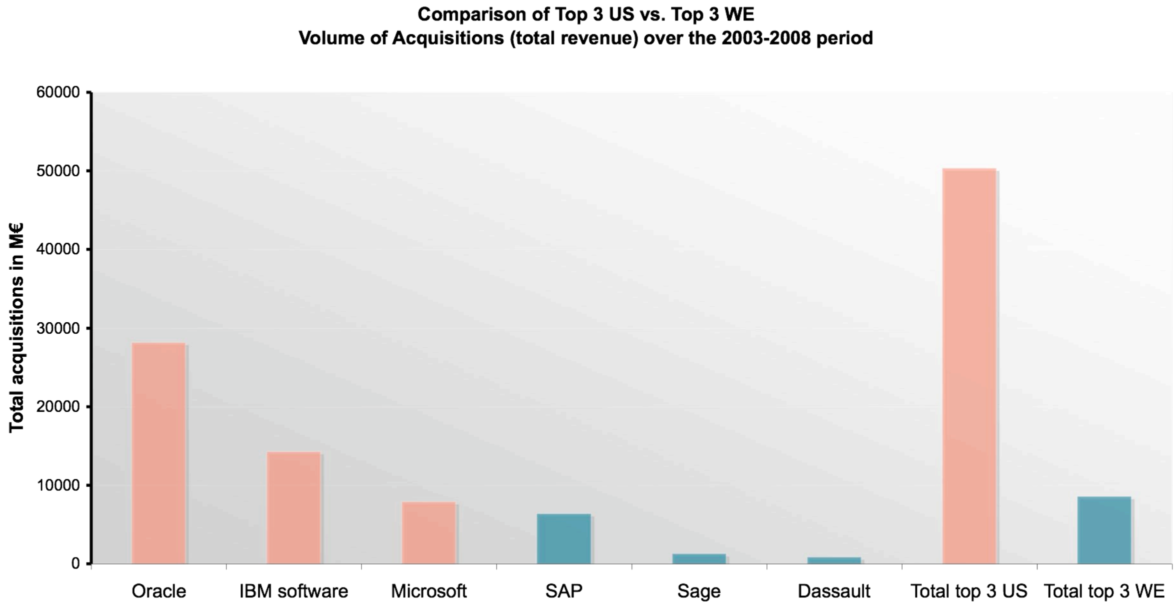
Nationality	Number of Companies
Canada	1
Germany	5
Finland	1
France	4
Japan	4
Netherlands	2
Norway	1
UK	4
USA	28
Total	**50**

American software suppliers make up more than half of the European Software market, mostly because of their weight in infrastructure software and tools. As a result, not a single European company is present among the Top 10 infrastructure software providers.



The presence of SAP enables the German software product industry to be well positioned in Europe and in the World. On the other hand, this example is unique in Europe with French and UK leaders being smaller in size and scope.

This American domination has been increasing with time, since they have a higher acquisition rate than that of the Europeans as presented in the following graph.



It is interesting to note that the US Top 3 (which are also the Top 3 worldwide) represent in 2008 more than 57 billion Euros in software products revenue (or close to the equivalent of the European market) and five times as much as Europe's Top 3. These three global leaders have bought the equivalent of their software supplier revenue over the 2003-2008 period, and six times more than Europe's Top 3.

For example, IBM Software reinforced its platform by acquiring the Swedish provider Telelogic on real-time development, or Ilog on Business Process Manangement. For its part, Oracle acquired BEA Software. The various significant acquisitions in the Business Intelligence domain also fall in line with this rationale.

Medium-sized ISVs have also entered the race to reach critical size

In the application domain, where local specificities (regulations, industries) impose their rules, this often occurs through a reinforcement of European positions: Unit 4 Agresso/Coda, Cegid (VCS Timeless and Civitas).

The local particularities and the strong European economy have allowed for the emergence of a solid Application Software industry with global, mid-sized and niche players.

For infrastructure applications, where Europe is recognized for its expertise in development tools, Business Intelligence, and BPM/SOA, the rule is "go global or perish”. This strategy is pictured in the acquisitions of American targets: Software AG/ Webmethods or Axway/Tumbleweed. However, even with these successful acquisitions, there are no large European suppliers in Tools & System Software.

The European Software industry is a winning one in domains **where software suppliers see growth greater than 50%**, such as:

- Enterprise search: Sinequa (Fr), Exalead (Fr)
- Mobility: Netviewer (Ger), BIS (UK)
- Business Intelligence: QlikTech (Sw)
- Vertical: GK Software, (Ger), COR (Ger)

In that last area, the economies of every European country have given rise to solid vertical suppliers: banking/finance (Temenos, Murex, Simcorp, Linedata, etc.), the public sector (Isoft in the UK, Computergroup in Germany or GFI Progiciels, Berger Levrault in France), PLM (Centric, Cocreate bought by PTC, Nemetschek, Lectra, IGE XAO, etc.), and many segments/niches – in those areas where the local particularities get in the way of concentration and internationalization.

1.3.2 IT SERVICES PROVIDERS

1.3.2.1 SSBS activities and business models

IT Services providers clearly differentiate from ISVs in one critical way: they provide mostly “brainpower” through their IT services offering, whereas ISVs sell products. Traditional activities of ITS providers cover mostly three aspects:

- “Plan” or “Design” activities – also referred to as IT consulting services. ITS firms provide consulting time to their clients to advise them on the organization of their IT department, the architecture of their IT systems, the selection of software technologies… This part can represent 15-20% of the total revenues of a large IT Service provider. There are also a significant amount of smaller IT consulting firms throughout Europe. Such services are usually delivered on site at the customer premises.
- Build activities – In the EU27 this activity still remains the “bread and butter” IT Services providers. In the software space, it includes both custom software

development activities as well as packaged software implementation. Integration activities with the information systems of the client as well as its partners is also a critical part of build activities, which will gain a great importance in the years to come with the development of "systems of systems (SOS)"[12].

- Run activities – This activity includes the operation of a client's information system. These services are typically provided in an outsourced mode in developed countries. In such cases, the ITS provider takes at least part of the responsibility of running the IS along pre-defined service levels. The contracts that frame these relationships typically run over a period of 3-5 years, sometime even more. In less developed countries where the outsourcing services are not as developed, Run services are providedon time and material engagements.

The sinews of war in the IT services industry are the brain power provided by IT professional that are employed to deliver such IT services – be them plan, build or run types of activity. In fact, a significant part of IT Services were in the past delivered as "staff augmentation" services. Contrary to the software products industry, there are no R&D teams or budgets associated with the traditional IT Services industry. In addition, as no packaged products are related to the production of IT services firms, sales and marketing budgets are relatively small compared to the ISVs.

Nonetheless, ITS providers are facing factors that are similar to the ones impacting ISV players: the increasing complexity of software technologies and information systems as well as the reluctance of clients to see their IT budgets increase. Due to these strong factors, ITS firms have been forced in recent years to industrialize their activities in order to improve the maintainability of their outputs as well as to improve the productivity of their activities (mostly in terms of build and run). This industrialization phase is characterized by significant investments in methodologies and certifications (CMMI, ITIL, ISO among many others…), tools as well as innovative delivery models. This in particular triggered the development of offshore[13]

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[12] *"Examples of a readily recognised SoS might include the control of groups of cars in an urban environment or airplanes at an airport, where the car or airplane itself is one constituent system and the overall goal is to optimise traffic or coordinate for efficiency." From WORKSHOP ON SYSTEMS OF SYSTEMS, BRUSSELS SEPTEMBER 21ST 2009*

[13] *The Consortium developed a detailed analysis of the risks of Offshore models in the D2 report.*

delivery centres throughout the developing regions of the world and especially in Asia-Pacific.

IT Services have come a long way from “staff augmentation”. ITS providers are today more and more focused on delivering business services – as presented in the IBM definition[14]- that are more aligned to the needs of individual costumers in every industry.

As part of their industrialization efforts, IT services providers are also increasingly investing in emerging models that are cloud computing as well as platform solutions.

Cloud computing impacts the run part of their activities. Hosting and application outsourcing are two of their traditional activities that are greatly impacted by the Cloud models which enable them to provide more flexibility to their clients in comparison to traditional outsourcing models.

With platform solutions, ITS providers are getting closer to the business of ISVs. These solutions – which are usually tied to R&D investments – are semi-finalized software products designed to increase the time-to-market of the information systems built by IT providers. The goal of ITS firms is then to rapidly and efficiently customize these solutions according to the client’s needs and operate them on industrialized infrastructures. In the end, solutions should enable ITS players to provide competitive on-demand services to their clients.

1.3.2.2 Positioning in Europe

Contrary to the software products industry in which software technologies are global and leading ISVs have strongholds in most regions and countries throughout the World, the IT Services industry is much more of a local industry. There are several reasons for this, the most important one being an historical one. Before the advent of global delivery models, IT Services were generally delivered on the customer premises under “staff augmentation” models. The development of the Internet and real time collaboration tools enabled some of the IT Services to be delivered from location outside of the clients premises as well as abroad. Still, the majority of the IT

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[14] *http://www.research.ibm.com/ssme/services.shtml (as of July 2008).*

Services workforce is located in the country where the clients are located.

Worldwide - Leading Suppliers ranked by Total IT Services* Revenue (in million EUR)							
Rank	Company	Natio-nality	FY End**	2007	2008	Growth 2007/08	Market Share 08
1	IBM (incl. Cognos as Feb 08, Telelogic as of Apr 08 & Ilog as of Aug 08)	US	31-déc-08	38 490	39 105	2%	8,7%
2	EDS (pro forma in 2008)	US	31-déc-08	15 936	14 300	-10%	3,2%
3	Fujitsu (excl. FSC)	JP	31-mars-09	12 810	13 680	7%	3,0%
4	HP (excl. EDS)	US	31-oct-08	13 083	13 164	1%	2,9%
5	Accenture	US	31-aoû-08	11 920	12 500	5%	2,8%
6	CSC (incl. FCG as of Jan 08)	US	31-mars-09	10 945	11 010	1%	2,5%
7	NEC	JP	31-mars-09	7 705	8 370	9%	1,9%
8	Capgemini	FR	31-déc-08	7 739	7 796	1%	1,7%
9	Hitachi	JP	31-mars-09	6 500	7 165	10%	1,6%
10	Northrop Grumman I&S (incl. NGIT)	US	31-déc-08	5 880	5 810	-1%	1,3%
11	Atos Origin	FR	31-déc-08	5 633	5 414	-4%	1,2%
12	ADP	US	30-juin-08	6 147	5 314	-14%	1,2%
13	Lockheed Martin IS&GS	US	31-déc-08	4 650	4 920	6%	1,1%
14	T-Systems	DE	31-déc-08	4 434	4 565	3%	1,0%
15	SAIC	US	31-jan-09	4 210	4 520	7%	1,0%
16	Logica	UK	31-déc-08	4 065	4 085	0%	0,9%
17	First Data Corp (FDC)	US	31-déc-08	4 335	4 080	-6%	0,9%
18	TCS (Tata Consultancy Services)	IN	31-mars-09	3 580	3 800	6%	0,8%
19	Dell	US	31-jan-09	3 970	3 765	-5%	0,8%
20	Siemens IT Solutions and Services	DE	30-sep-08	3 605	3 703	3%	0,8%
							© PAC, July 2009

*comprising Hardware Maintenance, Project Services, and Outsourcing

**FY End used for 2008

As in the software products industry, some major consolidations occurred in the IT Services sector throughout its history. To some extent, similar acquisitions patterns than the ones witnessed in the ISV industry were also identified in the ITS industry over the past few decades in Europe with large US based companies acquiring European based companies.

The following tables give two examples for the French market.

France - Leading Suppliers of IT Services - 1981 (in Meuros)			
Rank	Company	Natio-nality	1981
1	Capgemini Sogeti	FR	170
2	CISI	FR	135
3	SG2	FR	129
4	GSI	FR	126
5	Sema	FR	80
6	CCMX	FR	64
7	Sligos	FR	61
8	Thomson CSF Info.	FR	59
9	Télésystèmes	FR	56
10	Steria	FR	50

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France - Leading Suppliers of IT Services - 2008 (in Meuros)			
Rank	Company	Natio-nality	2008
1	IBM	US	2 520
2	Capgemini	FR	1 907
3	Atos Origin	FR	1 617
4	Accenture	US	871
5	Logica	UK	864
6	HP	US	649
7	Sopra Group	FR	588
8	Orange Business Services	FR	564
9	Steria	FR	536
10	GFI Informatique	FR	454

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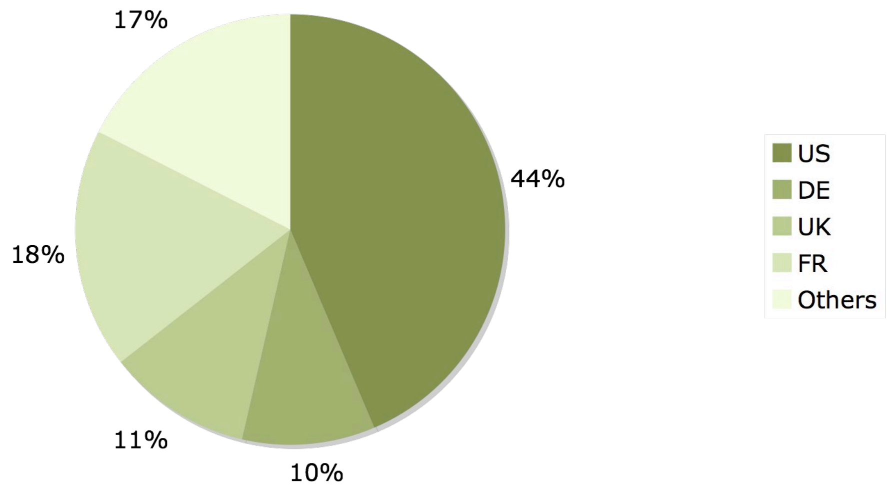
In these consolidation phases, ITS providers acquire human capital, whereas ISVs acquire mostly technologies, or software capital. There is a great value for large ISV acquiring a good technology. Leading technology providers already have dense sales networks and can push the acquired technology to the market without any major new investments.

On the other hand, mergers in the IT Services industry have yielded massive dilutive effects. Merging two different cultures (application vs. infrastructure), different organizations (local vs. global), or two different businesses (consulting vs. system integration) can be a much more daunting task than merging two technology stacks.

The share of U.S. companies within the top 100 companies in Europe in much less important than for the ISV players. In addition, large European ITS providers hold strategic positions in most of large European countries.

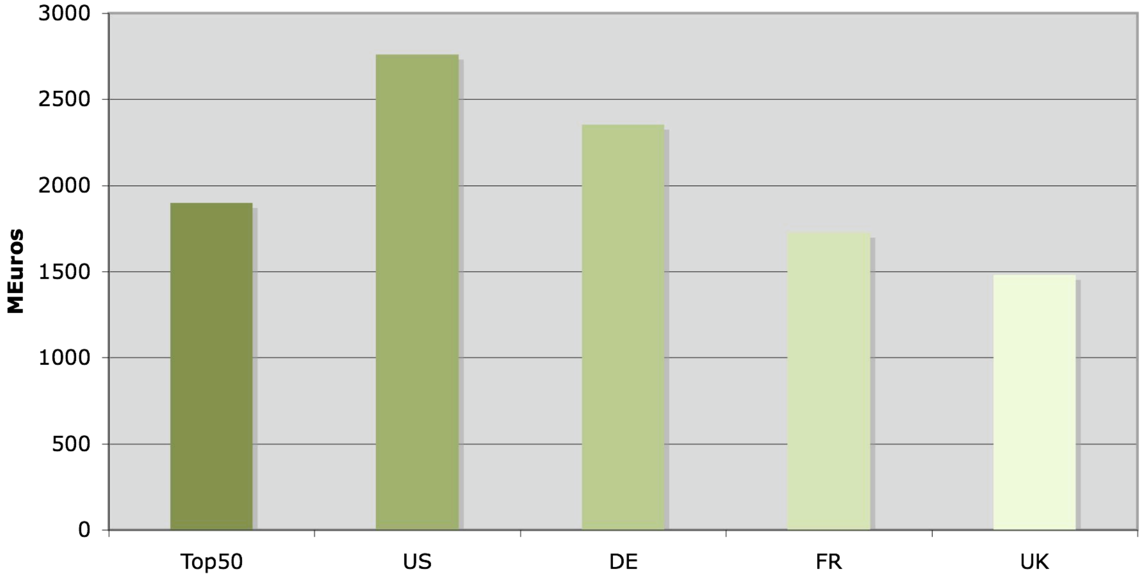
Share of Various Nationalities among TOP 50 ITS Firms in Europe (in MEuros and in % of TOP 50)



Compared to the Top 50 for ISVs, the market is less concentrated and shared in between a larger number of European nations (9 vs. 6 for the Top 50 ISVs). It is interesting to see that there are about half the number of U.S. companies. Also interesting is the presence of 3 Indian companies in the Top 50.

Nationality	Number of Companies
Finland	2
France	10
Germany	4
India	3
Italy	1
Japan	2
Netherlands	3
Norway	1
Spain	1
Switzerland	1
UK	7
USA	15
Total	**50**

Average WE revenue per ITS provider (M€)
Top 50 - Main nationalities



1.3.3 TELECOM OPERATORS

1.3.3.1 SSBS activities and business models

Telcos, especially incumbents but also major mobile-only operators (like Vodafone), are generally ICT powerhouses, as their activities is strongly leveraging ICTs and their financial power is huge.

As their revenues for their traditional activities are flattening in advanced countries, they have looked to diversification to generate new revenue streams. They are transforming their architectures into IP-based infrastructures over which can be offered the new services. For instance, telcos are now active within the media industry with IPTV and digital content, but also for some of them more recently in the health industry (e-health) or in the energy (smart grid)

Concerning SSBS, telcos have taken numerous initiatives that can position them as potential flagship players in the future SSBS/SBIS market for both consumer and professional services:

- IT services: telcos offer communication and collaboration tools to professionals and corporate users, which integrate more and more software features (VoIP, email, IM, etc…). Telcos deploy and integrate these software tools leveraging their own IT services teams. Being "in" the communication network of companies (both from a voice and data perspective) telcos are also inclined to move towards servicing the IT infrastructure needs of their clients. Telcos are more an more providing network management services – a move exemplified by the acquisition of Telindus by Belgacom a few years ago. From there, IT infrastructure related services such as data center outsourcing and cloud computing services are not too far.
- Web: with numerous services associated to their telecom services, telcos are operating leading portals (portals of incumbents and other leading broadband providers are generally in the top 10 of audience in Europe) and some of them have now their own online advertising network that could be easily extended for mobile services. Telcos Web services are still mostly used for basic services like email, file and page hosting or news. For other services (IM, search, maps,

commerce), consumers generally turn to other providers.

- Mobility: with a strong control of the device (via subsidies) and people not used to updates of mobile phones, telcos could accelerate the diffusion of mobile software. They are more and more following the footsteps of the Apple and Google and are trying to offer their own software (limited number of applications) and even their own application stores. At MWC 2010, 24 telcos and device manufacturers announced an initiative for interoperable application stores (or "app stores") that could foster
- M2M: after being reluctant to enter this market, mostly due to financial reasons (ARPU is definitely lower for a machine than a human), most telcos are now key players of this market. But their focus remains mostly on connectivity. The activities related to software are mostly operated by partners, except for M2M device management platforms.
- Internet of Things: telcos are developing first platforms that will aggregate the data to be associated with objects and things (like Orange with ONS). Commercial current offerings are still more focused on closed loops solutions around RFID integration, done also by partners.
- Cloud computing: telcos can build on their network pipes and their existing infrastructure to develop at least in the IaaS space, which will enable most of the future software solutions online. Only a few telcos are really positioned in this space and have entered this market in 2009 at best.

There are also initiatives in other markets, but they have had less success so far:

- Online games: a few telcos like France Telecom with Goa have been offering games by themselves (development and distribution). This is still a minor activity. But like for other content, especially on mobile, telcos can play a key role in the distribution of online games.
- Web 2.0: telcos are trying to replicate popular Web 2.0 services on the wireline and wireless Internet. But their services have yet to gain any traction.

With many applications and services moving online, the value of many industries (including the SSBS industry) could shift to the network, either at the core or at the access level. In the first case, differentiation will come from the data and therefore the infrastructure within the future networks, via IT infrastructure (datacenters) and software (databases, virtualization, parallel computing). In the second case, differentiation will come from performance of network pipes themselves (speed, latency, QoS), especially if resources are constrained. In both cases, especially in the second one, telcos have a key role to play.

Right now, telcos business models for most of the services is still close to the traditional approach. They are using software and IoS as a way to create the demand and attract users on their network solutions (fiber, mobile Internet, etc…). Therefore, they often do not get any revenues for the SBIS enabled by their networks. On mobile stores, they will get a commission on the sales of contents and applications (generally 30 to 50%)

For the SBIS services that they operate in their own name, there are many different cases, which reflect most of the time the approaches from traditional providers. The difference is that sometimes, instead of selling the service as standalone, telcos bundle it with other products:

- Consumer Web services are mostly offered for free and generally come bundled with network subscription. The exception is online gaming, for which telcos offer mostly paid solutions like traditional game providers. On mobile platforms, most of the services are paid.
- Professional services are mostly paid, even though they are mostly bundled with connectivity offerings for cloud/IaaS and M2M. IT services are generally sold in extension of network solutions, but separately. Most of the IT Services from telcos have limited scope anyway.

1.3.3.2 Positioning in Europe

While Europe is lagging behind North America for traditional software and software-based services, Europe is the leading market regarding telecommunications with 268 billion EUR in 2008 (EU27), ahead of Asia Pacific (257 billion EUR in 2008) and North America (228 billion EUR in 2008). In the coming years, Europe should be more and more challenged by Asia Pacific, boosted by the development of China and by few other emerging countries. Europe is a very competitive market with strong adoption of mobile technologies and first developments in the ultra-broadband space.

The telco industry is well organized in Europe and even after deregulation there are only a few players in each country for wireline and wireless activities, compared to the fragmentation in the USA (even though consolidation has also occurred there) or the Japan structure of wireline broadband markets. There has been also some consolidation in the recent years leading to pan-European developments of a few major telcos (mostly France Telecom/Orange, Deutsche Telekom/T-Mobile, Telefonica/O2 and Vodafone, and although to a lesser extent TeliaSonera). Europe can therefore rely on a few major telecom operators and is clearly competitive also industry-wise.

Europe telcos are well represented in the top 20, with DT (4th), FT (6th), Telefonica (5th), Vodafone 57th), Telecom Italia (9th) and BT (10th), plus in the top 20 KPN and Telenor.

Table 1: The globe's top 20 telcos in 2008, in terms of sales

Ranking	Operator	Country	2008 sales (million EUR)	Growth 2007-2008
1	AT&T	USA	84 339	4.3%
2	**NTT**	**Japan**	**68 529**	**-2.5%**
3	Verizon	USA	66 201	4.2%
4	Deutsche Telekom	Germany	61 666	-1.4%
5	Telefónica	Spain	57 946	2.7%
6	France Telecom	France	53 488	1.0%
7	Vodafone	UK	51 539	15.6%
8	China Mobile	China	40 352	15.5%
9	Telecom Italia	Italy	30 158	-3.6%
10	BT	UK	26 877	3.3%
11	Sprint Nextel	USA	24 232	-11.2%
12	**KDDI**	**Japan**	**23 010**	**-2.7%**
13	América Movil	Mexico	21 119	10.9%
14	China Telecom	China	18 083	3.4%
15	**Softbank**	**Japan**	**17 586**	**-3.7%**
16	China NetCom	China	16 758	103.8%
17	KPN	Netherlands	14 427	15.8%
18	Telstra	Australia	14 064	4.2%
19	KT	South Korea	12 117	5.3%
20	Telenor	Norway	11 718	5.1%

Source: IDATE

1.3.4 INTERNET PLAYERS

1.3.4.1 SSBS activities and business models

All Internet players did not exist 20 years ago (and for most of them not even 5 to 10 years ago). They were born with the Internet. Their main characteristics is indeed that without the Internet they cannot exist.

These companies are generally operated by people with strong background in traditional software that offer their services (SBIS or SEIS) through the Internet to very large audience. The web has indeed to be seen mainly as software being accessible through the Internet. This report focuses only on Internet players with activities in the Internet of Services (IoS) part of the SSBS market, that is the SBIS.

Advertising has been seen for years as a potential business model disruption for the software industry, but generally represented only additional revenues as it was not cost-effective to distribute with only advertising revenues in the offline world. With the Internet, it is now possible to operate a sustainable business model based on mainly advertising revenues, even for advanced software, especially with performance-based advertising as everything can be measured and analyzed. Google is one of the key examples of players that have managed to generate billions of dollars with online advertising.

A few players are generating revenues with paid services on the web for consumer services. But this model is generally rare, except for premium content (content is out of the scope of this study) or sales of virtual goods to personalize its profile/web page/ avatar. A lot of players still offer freemium solutions, with entry-level solutions as free and premium version (no limitations) as paid, but the number of paid users remains.small (up to 10% of total users at best).

Some B2B Internet players – like Salesforce.com, GoToMeeting, Taleo… in North America and in Europe: OpenPortal, RunMyProcess, Sidetrade, EtapOnline, Oodrive, Synertrade, Datev, Onventis, Talentsoft… – are born with the Internet and rely mostly on paid-web based solutions. They generally target SMEs rather than large accounts. Consumer-oriented players like Google generally also offer SaaS products as professional adaptations of their consumer products (like Google Apps for email, office suites, etc…) with a freemium approach.

Internet players offer a very wide range of applications and services on the Internet, mostly through the web. Therefore, they are the dominant players for web and web 2.0 applications. To ensure faster and cheaper developments, they have also often been big promoters of open source solutions, and some of them even contribute to open source developments. The same approach has been followed with IaaS. Major Internet players like Google and Amazon have developed a large infrastructure to enable their own Internet services. In the recent years, they have open this infrastructure to third parties, positioning themselves into the IaaS and PaaS market with low-cost approach, as part of the SBIS market.

More recently, especially since 2007, Internet giants have been offering more and more mobile software both at the application level and the operating software layer (e.g. Google's Android). As the market is so far developing mostly with adaptations of existing web services (porting of Google, Facebook, etc…), the potential domination of Internet players in that category is not surprising. The initiatives at the OS level are more recent and have been launched to ensure a faster and cheaper development of the mobile Internet, and related mobile advertising revenues.

However, Internet players have no significant activities yet into M2M and Internet of things. Google is offering a software for energy management, but the impact is limited. Also, games are still mostly coming on the web from specialized game developers rather than Internet players.

1.3.4.2 Positioning in Europe

The major leaders of the global Web (Google, Yahoo! and Microsoft, plus Facebook more recently), which corner more than 70% of the market, are US-based firms. Those three players offer the most popular online search engines and software-based services (Yahoo! Mail, MSN/Hotmail, Gmail, etc.) in the World and also rank generally first in Europe among top Websites by number of visitors. The situation in Europe contrasts with Asia where some big local players enjoy leadership positions (Naver and Nate/Cyworld in South Korea, Sina, Baidu and QQ in China, etc.).

There are only a few European players that are leaders on their domestic market (like YellowPages players). Europe positioning is better on e-commerce websites or content-based websites which are out of the scope of this study, as they are coming from major offline players (BBC, SNCF, etc…), but leading players on the domestic markets are also often US-based (Amazon, e-Bay, YouTube, etc…). Only a handful of them have a true European or worldwide reach. Most of the innovation on the web (monetized with online advertising) is coming from the United States (and even generally from Silicon Valley or Route 128).

European players suffer from the intrinsic fragmentation of the European market, which is more an aggregation of national markets than a true 300 million people market. The only pan-European players are generally the US leaders. This leads to a situation in which winner takes all for a defined market (de facto monopoly) and encourage the existence of dominant players, around whom are organized ecosystems of smaller players.

Top 15 players at the global web are all US-based or China-based (Tencent, Baidu). Only one player is European in the top 25 (Orange).

Top 15 Worldwide Properties
Ranked by Total Worldwide Unique Visitors (000)*
Age 15+, Home & Work Locations
December 2008
Source: comScore World Metrix

Property	Total Unique Visitors (000)	% Reach of Total Worldwide Internet Audience
Total Worldwide Internet Audience	*1,007,730*	*100.0%*
Google Sites	775,980	77.0%
Microsoft Sites	646,915	64.2%
Yahoo! Sites	562,571	55.8%
AOL LLC	273,020	27.1%
Wikimedia Foundation Sites	272,998	27.1%
eBay	240,947	23.9%
Facebook.COM	221,791	22.0%
Amazon Sites	187,354	18.6%
CBS Corporation	178,844	17.7%
Fox Interactive Media	172,841	17.2%
Ask Network	164,513	16.3%
Apple Inc.	161,500	16.0%
Tencent Inc.	158,617	15.7%
Baidu.com Inc.	152,447	15.1%
Adobe Sites	123,623	12.3%

** Excludes traffic from public computers such as Internet cafes or access from mobile phones or PDAs.*

		Unique Visitors	% of Internet users
	Total Internet : Total Audience	822 990	100
1	Google Sites	605 576	74
2	Microsoft Sites	542 751	66
3	Yahoo! Sites	487 573	59
4	AOL LLC	240 810	29
5	Wikipedia Sites	240 754	29
6	eBay	239 900	29
7	Fox Interactive Media	158 216	19
8	Amazon Sites	155 193	19
9	Apple Inc.	139 213	17
10	CNET Networks	124 750	15
11	Ask Network	116 420	14
12	Adobe Sites	107 954	13
13	FACEBOOK.COM	100 319	12
14	Time Warner - Excluding AOL	90 468	11
15	Viacom Digital	83 583	10
16	The Mozilla Organization	82 593	10
17	WordPress	78 784	10
18	New York Times Digital	75 371	9
19	Baidu.com Inc.	66 711	8
20	TENCENT Inc.	66 228	8
21	Lycos Sites	65 454	8
22	SINA Corporation	59 507	7
23	**Orange Sites**	**58 415**	**7**
24	Gorilla Nation	55 597	7
25	Sony Online	55 358	7

1.3.5 OTHERS

This category of SSBS players includes companies that are not part of the above-described categories. These companies include ICT – such as IT equipment manufacturers – companies, which also have been moving into the software industry in recent years.

Heavy users of software for their own need, these organizations can also see a value in selling some of the software they have developed internally to other companies or organizations. Generally speaking these companies leverage strong information systems that are of strategic importance to their activities. Most companies in this category are today part of the Internet of Services industry. Examples exist of SEIS players (with retail or content aggregation activities) that diversify their original activities with a software business. They offer white label versions of their own software platforms. Pixmania, an online retailer in France, has developed internally its web platform and e-commerce engine. This platform now supports the ecommerce activities of the entire group. It has also been sold to some external clients including French telecoms provider Bouygues Telecom.

With advances in software development tools that make its easier to build software, as well as innovative distribution models that allow for an easier distribution and invoice of software, the consortium expects to see an increasing number of non SSBS companies enter the SSBS industry in the future.

CHAPTER 2 KEY TECHNO-ENABLERS FOR THE FUTURE DEVELOPMENT OF THE SSBS INDUSTRY

Numerous technology trends could have a major impact on the development of SSBS and SBIS in the coming years. Depending on their availability on time, their cost and their level of adoption by end users (niche or mass market), they could help or not to accelerate the growth of the overall SBSS market and especially its Internet of Service part. They can therefore have a major influence in the development of the market, and need to be taken in account for prospective scenarios.

There are two main kinds of technology trends to analyze:

- Some of those technologies are new software technologies that could represent new market segments and new opportunities in the SSBS industry. Most of the time, they would rather be combined or integrated with other technologies rather than made available as standalone. Their development is therefore dependent of the SSBS itself, for which they are internal growth drivers. They would most likely be used as a lever for a faster growth.
- Other technologies will develop almost independently of the SSBS industry. They would be more enablers to ensure a faster development of the software rather than pure software technologies. While SSBS industry needs could accelerate their developments (by helping to find sustainable business models), their development should be seen as exogenous as their availability will depend also heavily on other industries (like other ICT industries like contents or communications, or even non-ICT industries). Their development is also dependent on technology breakthroughs related to physics, mechanics or energy management.

Hence, in this part, the Consortium presents what we believe will be critical technologies and concepts for the future of the SSBS industry.

- Artificial Intelligence (AI)
- Semantic Web

- Information Management
- Digital ID
- Interoperability
- Ubiquitous Networks
- RFID
- Security
- Datacenter
- Ultra-Broadband

2.1 ARTIFICIAL INTELLIGENCE

Humans have always tried to optimize their own activities and to replace their own workloads by workloads done first by animals then by machines, and eventually by software. This automation has been the foundation of civilisation and has multiplied the capacities of humans. This ability to create intelligent machines has intrigued humans since ancient times, and today, with the advent of the computer and 50 years of research into Artificial Intelligence (AI) programming techniques, the dream of (very) smart machines is becoming a reality. Researchers are creating systems that can mimic human thoughts, understand speech, beat the best human chess player, and countless other feats never before possible.

Today, companies must be able to adapt to customer demand and market changes in real-time; Service Oriented Architecture (SOA), Business Process Management (BPM), Business Rules Management Systems (BRMS) and many more, have all been used to solve some of those issues. However, those systems remain limited to mere computing and do not scale, for a reasonable price, to permit insight, predictability and pro-activity.

It is a new IT frontier, where Europe is strong due to its academic, military and industrial research around financial trading systems, robotics, avionics, behavioural sciences, to name just a few… Those systems will give an edge to many European industries: arbitrage systems, air traffic management, security and military systems, power grid management systems, shop floor automation systems…

2.1.1 STATE OF THE ART

Artificial Intelligence refers to the science and engineering of making intelligent machines. It mainly refers to machines that can engage on behaviours that humans consider intelligent, relying on computer programmes able to solve problems and achieve goals by having computational procedures. There are two main ways to get to artificial intelligence: combine existing technologies and copy how the human brain works.

AI from combining multiple technologies relies on the association of Complex Event Processing (CEP) based tools, Business Intelligence (BI) tools, BRMS all based on SOA platforms. As those systems remain fairly complex to assemble and to maintain and most of this technology is owned by non-European companies, we will concentrate on the more cutting edge agent technology, the technology that emulates how the human brain functions: Multiple Agents Systems.

Business systems based on agent technology are based on a cutting edge concept: agents are totally distributed, hugely agile, and naturally aligned with the business. Those agent-based systems are capable of managing complexity levels that other systems cannot, dynamically correlating events, intelligently automating tasks, and providing businesses with the adaptability and the insight they need to respond to changing business conditions in real-time.

The agent concept is the current optimum in distributed technologies and software intermediation. It is based on business goals-oriented development, and therefore naturally falls in line with business requirements. Each agent assigns one or more objectives according to the organisation's processes and rules. They carry out their objectives in conjunction with the other agents they interact with, creating a sort of collective intelligence, similar to the collective intelligence of social insects or the way neurons interact. Agents allocate their resources according to company needs, and given that the agents and the system are goal-oriented, they are capable of dealing with unplanned exceptions and events. Therefore, they are capable of leveraging the traditional limitations of CEP, BPM and BRMS systems. Flexibility, reactivity and business alignment are hugely improved.

Scope

An AI agent is an entity that can adapt to and interact with its environment as it can receive external stimuli (queries, events, services, etc.), to which it can react by requesting internal or external services. Those agents interact between each other just like brain neurons. Those interactions are core to the "intelligence" they will be able to provide. The agent will respond to the stimuli, by providing automated actions, recommendations, accessible from user interfaces, messaging and web services. It is a different way of computing and as such, it has implications in all type of businesses.

From a business point of view, an agent is the "virtual clone" of a business element either physical element (truck, stock, operator, equipment, product, patient, etc…) or virtual element (client order, online booking, financial transaction, etc…). Those agents are the constituents of the multiple agent systems. Representing these elements by an agent provides:

- Real-time management of all the events to which they are subject,
- Optimisation of the activities in which they are involved,
- Simulation of multiple "what-if" scenarios

From an IT point of view, agents are distributed software components running on a server and that communicate with each other in an asynchronous manner. They are fully integrated into the information system as part of the service-oriented architecture, as agents consume and provide business services. Agents can connect to a wide range of applications: data bases, ERPs, web services, data flows, captors, devices, RFID, etc. Agents monitor the information system in real time as they sense business events, context modifications, user requests…

Agents constantly sense, monitor and analyze changes in their environment as well as they constantly interact with other agents to execute actions according to their assigned roles. The multiple agent systems are organised in domains that define a business area in which the agents act and/or to witch they provide solutions.

These are systems capable, in real time, of managing complex events that could not be managed by humans or other IT systems due to complexity or reactivity constrains. With its innovative approach, the multi-agent system replaces the current limitations of the classic SOA approach, which is still too rigid for adaptive processes, dynamic resource allocation, unplanned business rules, or the complexity of unexpected and random events. Agent technology is the platform for proactive companies, i.e., for those innovation-driven, network-structured enterprises that know that adaptability and dynamism are the keys to their success.

The agent concept can apply in numerous ways: fraud detection in finance and telecom, security and anti-terrorism, real-time management of military units on the ground, dynamic management of investment portfolios, management of errors for SCM, e-business, etc. Before, agent technologies were only used in very specific, mission critical systems such as defence systems for military aircrafts, autonomous robots for hazardous environments, hugely complex logistical chains, etc. Those systems were almost always custom-developed, costly, and difficult to manage.

Examples of use of AI

Here are some cases where this technology is deployed:

- Customer Relationship Management: Goal-based agent systems can help service companies to optimise their customer revenues. These systems can help to streamline hotline services due to their dynamic resource allocation capacities, and can also boost the revenues a company earns from a customer by tailoring the company's response to its customers' immediate needs.
- Green IT: Energy is becoming scarce and pollution costs are rising, so companies need to optimise these two points. Agent technologies empower companies with dynamic resources allocation, which helps them use the least expensive and/or the most efficient energy supplier. AI is especially suited for mesh and M2M device management. This technology can also monitor and manage the use of the energy inside the company, making it more energy-efficient and resulting in cost reductions.
- Supply Chain Management: In case of unplanned events, multi-agents systems can significantly reduce the time needed to solve SCM problems by dynamically allocating resources to where they are most needed. These systems can also be used to monitor the SCM and predict when problems will occur, thanks to their

correlation capacities.

- Manufacturing Execution Systems: With their automation and resource allocation capacities, multi-agent systems are uniquely tailored to pilot and solve problems on a production line or factory. Their unique distributed technology also allows for the presence of an agent on most of the machines inside a plant, thus becoming truly pervasive.
- Maintenance: Agents can help companies improve the way they do their after-sales service by optimizing it with intelligent and real-time automation, maintenance, and problem detection.
- Game playing: Some machines can play master level chess. There is some AI in them, but they play well against people mainly through brute force computation-looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.
- Speech recognition: In the 1990s, computer speech recognition reached a practical level for limited purposes. Thus United Airlines has replaced its keyboard tree for flight information by a system using speech recognition of flight numbers and city names, which is quite convenient. On the other hand, while it is possible to instruct some computers using speech, most users have gone back to the keyboard and the mouse as still more convenient.
- Understanding natural language: Just getting a sequence of words into a computer is not enough. Parsing sentences is not enough either. The computer has to be provided with an understanding of the domain the text is about, and this is presently possible only for very limited domains.
- Computer vision: The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two-dimensional. Some useful programmes can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present, there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.
- Expert systems: A “knowledge engineer'” interviews experts in a certain domain

and tries to embody their knowledge in a computer programme for carrying out some task. How well this works depends on whether the intellectual mechanisms required for the task are within the present state of AI. When this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Namely, its ontology included bacteria, symptoms, and treatments but did not include patients, doctors, hospitals, death, recovery, and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, death, recovery, etc., it is clear that the knowledge engineers forced what the experts told them into a predetermined framework. In the present state of AI, this has to be true. The usefulness of current expert systems depends on their users having common sense.

- Heuristic classification: One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

Relationships with other segments

- **Ambient Intelligence:** Artificial Intelligence is parts of the Ambient Intelligence paradigm. This refers to a vision of the future formation society stemming from the convergence of ubiquitous computing, ubiquitous communications, Machine to Machine, and intelligent user-friendly interfaces, putting the emphasis on user-friendliness, user-empowerment and support for human interaction. Those systems rely also heavily on the networks and the capture of business events, so technologies such as broadband or RFID are also very important.
- **Service-Oriented Architecture:** AI requires the development of extremely large, complex, heterogeneous, distributed systems. These must be built on

heterogeneous platforms capable of providing seamless networking so as to support the delivery of layers of value added services or functional services to the individual, to industry, and to administrations. These heterogeneous platforms will include domain-specific platforms.

- They will also include **Cloud Computing** to encompass software infrastructures that will enable flexible, secure, coordinated resource sharing among dynamic collections of individuals, institutions and businesses resources. The resulting AI systems, built on these platforms, will comprise myriad interacting embedded software components, having a huge reach and delivering a lot of value.
- **Web 2.0. and Semantic Web:** AI helps those systems to be more efficient and closer to the user behaviour (Cf: Ambiaent intelligence) to enhance, to humanise the interactions with the IT on those social web platforms. AI could also use the capacities of the social web to compute about human interaction. Behavioural computing is also an important part of the AI and so does crowd computing.

2.1.2 KEY DRIVERS AND CHALLENGES

Drivers

The Artificial Intelligence market is driven by several factors:

- The rising complexity of the business models and processes is becoming harder and harder to manage with traditional computer assisted human decisions. Supply chains and clients are global with numerous and intertwined factors. Solving those problems at the numerous business levels, from shop floor to global logistics for example, is more and more difficult. Taking the right decision is more and more tricky. AI can solve a good number of those problems.
- Agility: this complexity of our environment is coupled with a huge need for agility. You have to be able to modify and adapt your processes to an ever changing environment. Flexibility, speed, adaptability, reactivity are key concepts there. Agility and IT are keys for a company to survive today. So is an agile IT system. AI, by the way it is conceived, is naturally agile.
- Automation: a lot of human actions have been automated and normal computing has nearly reached its limits when it comes to further and effective automation. AI

will permit automation to progress in business and social life.

- Robotics: the rise of robots in our everyday life and in several specific activities such as the military or automated transports systems is a very promising future market. Those systems rely heavily on AI as the human environment is so complex that it cannot be modelled. Drones but also elderly helpers are good examples of this potential.
- Automated systems: more and more IT systems and software are used to create other IT systems and software; AI by mimicking human actions will help to get better software and IT systems.
- Optimisation: resources are scarce, so dynamic allocation and optimisation will be increasingly important to humans activities. That is just one of the first applications of AI inside the manufacturing world.
- The need for healthcare and social support: AI provides many opportunities to support an aging population: guaranteeing accessibility, quality and financial viability. An intelligent environment is a responsive and proactive environment that enables easy participation of the individual in their own healthcare management, enables remote monitoring of activity and physical well-being, e-Inclusion for people with physical disabilities and robotic helps.
- The need for security: AI has the potential to make an important contribution in all phases of the risk management cycle including: risk assessment and hazard identification involving remote sensing and in-situ intelligent surveillance to inform both the individual and public services; immediate response to perceived threats requiring new decision-support systems capable of processing in near real time huge amounts of data; and damage assessment mechanisms requiring the integration of very high-resolution data with cadastral data and decision support.
- The growing mobility of people and goods in a globalized economy: with AI all ‘actors’ on the move, whether people or goods, can be location-aware and communicate with each other. Intelligent objects and networks for logistics can be integrated with intelligent mobile systems. This will address both the physical fulfillment of e-commerce (through, for example, cargo-logistics) and the seamless services across networks and terminals for nomadic users, limiting the need to travel and optimising mobility. The White Paper, European Transport Policy for

2010: Time to Decide, places users' needs at the heart of the European transport strategy and recognises that "now is the time for less concrete and more intelligence in the transport system". On the roads, artificial intelligence and automaisation will improve the safety of the vehicle, its occupants and other road users with on-board driver assistance systems and improvements in traffic management, including a reduction in congestion. In the air, advances in surveillance and communication in air traffic technologies enable more efficient and reliable air traffic control.

Challenges

Yet, AI faces several barriers in its growth:

- Users' confidence: The development of artificial intelligence will require a heightened awareness of issues related to confidence and trust. With future domestic technologies like health at home or the growing online management of utilities and facilities (electricity, gas, water, etc.), the management of risks and of the security of this domestic infrastructure will increasingly become critical for the citizen. The anticipated benefits of artificial intelligence may be numerous but, given that artificial intelligence enabling technologies are also facilitating monitoring, surveillance, data searches and mining, it is likely to be of great concern to citizens, civil liberties groups, governments and industry. Moreover, in the physical world, domicile and residence are carefully developed and recognised concepts in terms of privacy and security protection in its broadest sense - legal, social, economic and technological. In contrast with the real world, there are few social and legal indicators of what constitutes a protected private space or an open public space in the virtual world. A comparable level of sophistication is needed in the future for people to feel at home within their smart homes, with their online activities, and facilitate the personalisation of their everyday environment in order to enhance their mobility.
- Learning is also a key factor and investment in learning can enable both public and private sector organisations to assimilate changes more rapidly. A shortfall in the skills and competency base may well slow down the diffusion process and reduce the economic impact of the investment.

- Industrial environment support: The ability of artificial intelligence to help solve socio-economic concerns will only happen if Europe has industries committed to innovative research and development and entrepreneurial companies. Regular monitoring of the potential of European industries will be necessary, as new social-economic challenges appear and existing priorities are reassessed.

2.1.3 COMPETITIVENESS OF EUROPE

Usage

The EU strengths in IT lie primarily in mobile and wireless systems, in consumer electronics, in sectors such as automotive or aerospace, that deploy embedded IT extensively, and in vertical application software for sectors such as banking and manufacturing. All those sectors are amongst the biggest potential users of AI.

Certain EU countries such as Germany are quite advanced in industrial equipments and robots, while others like France or the UK have one of the largest military industries in the World. These sectors already are using AI.

Production/R&D

Military industries, aerospace and university in France and in the UK have very advanced research on AI software. AI could give EU much more potential especially in front of certain well advanced countries such as Japan.

2.1.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

AI is the next frontier for IT. This new way to compute will push IT limits even further and will increase IT weight in the value creation for all sectors of the European economy. It is clearly an advantage over other regions for most industries. It is also a good help for the industry itself as it enables better software development automation, in a continent with high wages and without enough IT talents. The automation potential of the AI is therefore very interesting for European IT industry. Like in manufacturing industries, to keep its competitive stance with an expensive workforce, the software development industry in developed countries has to get “robotized”.

2.2 SEMANTIC WEB

The Semantic Web is for many people the next evolution of the Web and is commonly referred to as Web 3.0. It is a vision pioneered by Tim Berners-Lee, inventor of the World Wide Web, who actually mentioned the Semantic Web for the first time back in 1999.

Today, the vision of the Semantic Web is powering tremendous innovation and investment in new products and services. More broadly, the emergence of semantic technologies for consumer and enterprise applications, ranging from social networking and contextual awareness, through personal knowledge management and mobile semantics, are bringing many new opportunities for the software industry. The emerging semantic technologies have diverse application areas, such as health care and life sciences, finance, advertising and marketing, search, etc.

2.2.1 STATE-OF-THE ART

According to Tim Berners-Lee, the Semantic Web is an evolving development of the World Wide Web in which the meaning (semantics) of information and services on the web is defined, making it possible for the web to understand and satisfy the requests of people and machines to use the web content.

The Web we know today, made of networks of computers, is about documents and how these documents are stored, exchanged and displayed. Thanks to the HTTP communication protocol and the HTML language, both syntaxes understood by computers, Internet enables computers to talk to each other and exchange information. It also allows people to produce, store and retrieve any document they want. As a matter of fact, computers blindly retrieve and display information, but they don't understand the meaning, which is behind.

The Semantic Web goes further. Instead of simply being about documents, the Semantic Web is about people, places, events, music, movies, organisations, etc. The Semantic Web actually enables computers to process the meaning of things in order to help them understand the meaning behind a web page, in the way humans do. By letting computers know how these things are related to each other, the Semantic Web connects concepts to create knowledge.

As such, the Semantic Web will enable people and machines to connect, evolve, share and use knowledge on an unprecedented scale and in new ways that make their experience of the Internet better.

There are two main approaches to the Semantic Web:

- The bottom-up approach: it is the classic approach where the Semantic Web is considered as a layer on top of the current web that describes the concepts and relationships, following strict rules of logic.
- The top-down approach: this alternative approach leverages and analyses existing unstructured web information and builds on top of the current web as such by applying specific, vertical semantic knowledge.

Besides the classic hypertext web technologies such as URI, HTML or XML, the Semantic Web is based on four open standards from the W3C:

- RDF (Resource Description Framework): it is used to conceptually describe or model information.
- RDF Schema: it provides basic vocabulary for RDF.
- SPARQL: it is a RDF query language allowing agents, software applications and web applications to access and extract information from RDF graphs.
- OWL (Web Ontology Language): an ontology is a form of knowledge representation that shares vocabulary used to model an object or a concept and its properties and relations. OWL actually describes the semantics of RDF statements and brings the reasoning power to the Semantic Web.

RDF and OWL are the main standards pushed by academics. Both are powerful XML-based languages following a rigorous, mathematical approach.

To describe the attributes and relationships between things, RDF uses triples written as XML tags to express this information as a graph. The triples consist of a subject, a property (or predicate) and an object, all defined by a specific URI to avoid any misunderstanding. OWL, which describes the objects and how they relate to each other, is the most complex layer. Ontologies are indeed very difficult to create, implement and maintain, thus representing a challenge to the generalisation of the Semantic Web.

Microformats are another solution to provide machine-readable semantic data. They emerged as an alternative to the complexity of RDF/OWL:

- It is a web-based approach to semantic markup that seeks to re-use existing XHTML and HTML tags to convey metadata and other attributes.
- It is a simpler approach than RDF and OWL because microformats are embedded inside the actual HTML.

Microformats maximise the portability of data, such as contact information, geographic coordinates and calendar events, so that both humans and computers can access and manipulate the data efficiently. Popular microformats include hCard, hReview and hCalendar. Microformats are already used by several websites such as FlickR or LinkedIn. However, microformats are not meant to replace RDF and OWL, which are much more powerful tools.

The Semantic Web includes a broad range of applications and services:

- Semantic Web technologies are used across a variety of enterprise applications, databases and content repositories (to add contextual meaning, optimise search, etc.).
- The Semantic Web also includes semantic advertising, where semantic technologies apply to online advertising solutions to make advertising more relevant to consumers.
- Many consumer applications based on semantic technologies are already available on the web. The table below presents the main types of consumer applications.

Table 1 : Examples of Semantic Web applications

Type of application	Application name	Company	Country	Description
Search engines	Hakia True Knowledge	Hakia True Knowledge	USA UK	General purpose, natural language search engines

Type of application	Application name	Company	Country	Description
	Wolfran Alpha Spock UpTake Newssift	Wolfran Alpha Spock UpTake Financial Times	USA USA USA UK	Computational knowledge engine People search engine Travel search engine Business news search engine
Search agents	Headup	SemantiNet	Israel	Presents content related to objects and terms identified on web pages
	BlueOrganizer	Adaptive Blue	USA	Displays smart link widgets on websites like book recommendations
Smart applications	Zemanta	Zemanta	Slovenia	Plug-in tool that helps users add relevant content to posts in blogs, e-mail, etc.
	SEAmail	Stanford University	USA	Semantic e-mail system that helps users route email to the correct person or group without having to know their email address
Databases	DBpedia	DBpedia	Germany /USA	Extracts structured information from Wikipedia and make this information available on the Web
	Freebase	Metaweb Technologies	USA	Open and structured database covering over 4 million topics (60% more than English Wikipedia)
Aggregation tools	BooRah	BooRah	USA	Restaurant review site aggregating reviews from food blogs, Citysearch, Tripadvisor and other large review sites
	Twine	Radar Netwroks	USA	Website used to share knowledge and information
Personal information management	TripIt	TripIt	USA	Travel planning application used to organize and share travel plans
Professional applications	Talis Calais	Talis Thomson Reuters	UK USA	Platform focused on library management Toolkit of products that enable users to incorporate semantic functionality within their blog, content management system, website or application

Even though the technology is now mature, we are still in the early days of the Semantic Web. However, given the number of applications launched since 2008, the Semantic Web is becoming a reality, with most applications following the top-down approach. If most applications are still in beta, they are often updated with new features and many applications under development are also coming up: 2010- 2012 should see the rise of the Semantic Web.

The Semantic Web is an emerging market and is proving itself as a commercially competitive technology. In fact, the markets for semantic technologies in ICT are predicted to exceed 10 billion USD in the world by 2010.

The usual software business models apply to the Semantic Web: revenues come from online advertising for consumer websites (search, Web 2.0 applications using semantic technologies, etc.), licences for business applications and IT services for integration with information systems, as the Semantic Web may cover the full scope of the software industry. In fact, the Semantic Web is highly interdisciplinary as it combines aspects of artificial intelligence, markup languages, natural language processing, information retrieval, knowledge representation, intelligent agents and databases.

2.2.2 KEY DRIVERS AND CHALLENGES

Drivers

The Semantic Web benefits from the following drivers:

- The Semantic Web benefits from a very active community, trying to evangelise the entire developer community to semantic technologies.
- Semantic search is widely acknowledged as the next major trend in search technology. Niche search applications are emerging while major players are rapidly adding semantic enhancements to existing services to improve relevance, create new query services, improve ad targeting and provide more customisation options for users. The search field is full of innovation, competition and new investment, partly driven by the emergence of the Semantic Web.
- Since semantic technologies provide "meaning" to web-based content, they have the potential to change customer experience and the entire ecosystem of online interaction.
- With the rise of Web 2.0 services, hundreds of millions users can now access tens of billions documents on the Web, and billion more pages on corporate intranets and Web-accessible databases. As the amount of available data continues to grow rapidly, it is becoming increasingly difficult for users to find, organise, access, and maintain the information they require. The Semantic Web is an answer to help users get what they want when they want.
- Business and government organisations have been pioneering semantics in knowledge-based applications. Increasingly they are now combining Semantic

Web technologies to create even more powerful applications for data integration, SOA, collaboration and publishing.

- Specific vertical markets are looking at the data integration possibilities of the Semantic Web as one of the technologies that might offer significant help in solving their R&D problems:
  - Healthcare and life sciences (HCLS) organisations have embraced semantic technologies much earlier than most other industries so there is already a growing recognition in the HCLS community about the opportunities provided by semantic approaches. Applications range from knowledge discovery and representation for research and drug development, to large scale information sharing and analytics for medical records. The healthcare industry is pioneering a lot of work in the semantic field.
  - The Financial industries are also usually early adopters of promising new technologies and semantics are no exception. Within the financial sector, semantic technologies are being used in a wide range of contexts, from rapid news analysis to risk assessment, and from fraud detection to large-scale data integration.

Challenges

Although the Semantic Web is very promising, it seems that Semantic Web companies have difficulties "breaking-out". Indeed, the Semantic Web faces several challenges:

- The Semantic Web's technological complexity such as ontologies represents a high barrier to entry, compared to systems like AJAX (used in Web 2.0 applications), which are built up from simpler technologies that are easy to adopt.
- The Semantic Web technologies will not be really useful unless they are adopted and implemented on a large scale, but people are not willing to invest in implementing technologies unless they have been proven to be useful.
- Consumer applications based on semantic technologies may have difficulties to monetise their audience like Web 2.0 sites (new way to surf the Internet, find the appropriate advertising formats, privacy issues, etc.), so the return on investment may not be guaranteed.

- The Semantic Web vision is fundamentally predicated on philanthropy, and until some sort of “killer application” appears that exploits Semantic Web standards, there will be no economic incentive for organisations to share their metadata.

Finally, one could think that the Semantic Web could have a negative impact on the Web 2.0. However, a number of typical Web 2.0 demonstrations and applications emerge that, in the background, use Semantic Web tools combined with AJAX and other, leading to innovative user interface approaches. As a matter of fact, both approaches are complementary rather than competitive.

Nevertheless, applications based on semantic technologies could replace older Web 2.0 applications, by bringing an innovative user experience, being more useful to customers and thus gaining a larger audience.

2.2.3 COMPETITIVENESS OF EUROPE

Usage

Currently, North America leads the Semantic Web market with numerous American start-ups providing semantic technology R&D, services and products. North America also benefits from initiatives of Internet giants like Microsoft, Yahoo! and Google, which primarily focus on their domestic markets. Consequently, visible, publicly accessible deployments like Calais, Twine, and Yahoo! Searchmonkey mostly come from the US. Consumer adoption is thus higher in the US, where the Semantic Web is also increasingly used by small and large businesses, than in the rest of the world.

However, European start-ups are also investing the emerging field of the Semantic Web. Most of them are from the UK, but initiatives are also coming from Eastern Europe (Zemanta in Slovenia) and Middle East (Headup in Israel, a very active country in emerging technologies). In contrast to the European Semantic Web state, the Semantic Web in Asia is new and an emerging topic.

Production/R&D

As all innovative technologies, the Semantic Web underwent an evolution starting at research labs, being then picked up by the Open Source community, then by small and specialised start-ups and finally by business in general.

At present, both consumer-Internet and enterprise-oriented investments in the Semantic Web are being made in North America, Europe and Asia. Oracle, IBM, Adobe, Software AG, SAP, Cisco, Microsoft or Yahoo! are only some of the large corporations that have picked up this technology already and are selling tools as well as complete business solutions. Major telecommunication companies such as France Telecom, BT and Telefonica are also putting some R&D effort in semantic technologies.

Public sector investment is also significant and is growing in North America, Europe and Asia. Countries recognise the strategic importance of semantic technologies in the emerging global knowledge economy and are seeking competitive advantage through public sector investments.

In Europe, several initiatives related to the Semantic Web can be listed:

- The progress of the Semantic Web in the world is followed by the W3C as part of the project Semantic Web Advanced Deployment (SWAD). The European Research Consortium for Informatics and Mathematics (ERCIM) is the European host of the W3C and as such, closely follows the deployment of the Semantic Web.
- Insemtives, a European FP7-funded project, has the objective to bridge the gap between human and computational intelligence for the semantic content authoring. STI Innsbruck is one of the internationally leading research groups working on the Semantic Web, Semantic Web Services and Service Oriented Architectures, and it is acting as coordinator for this proposal. Consequently, it is the mission of STI Innsbruck to establish semantics as a core pillar of modern computer engineering.
- OpenPSI is a community effort to create UK government linked data service that supports research. It is a collaboration between the University of Southampton and the UK government, led by the Office of Public Sector Information at the National Archive and is supported by JISC funding.

2.2.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

Major impacts for the SSBS industry would be the following:

- Need for more education and training. Semantic web is a specific field of expertise in computer and software engineering and requires highly trained professionals

- Faster development without infrastructure constraints. Semantic solutions answer problems related to infrastructure scale, complexity and security. The Semantic Web impacts the way existing markets cope with exponentially data volume and complexity in horizontal fields. It requires less raw power than traditional approaches as it can look directly for appropriate content. It can then help to increase the speed of deployment of infrastructure-based services.
- Better knowledge of vertical industries. Semantic modelling is business rather than IT centric, flexible, less resource intense, and handles complex development faster. Players having a strong vertical understanding of other industries would develop faster.
- Development of advanced targeting technologies would boost all forms of advertising, but also e-commerce services through recommendations.
- Language as a barrier and as a protection. Semantic web will focus at first on a few languages, which could make it difficult for outsiders of the language. However, semantic solutions may also be developed rather by local players in case the local language has much specificity.

2.3 INFORMATION MANAGEMENT

Information systems are based on the manipulation and automated treatment of information. Information may be considered the raw material for any information system and is critical for the performance of this system. This immaterial capital often remains under-used by organisations. It is not optimised to reach its full potential and remains barely aligned with business processes. Nevertheless, more and more companies and governments begin to realize that IT is not just automation and a minimum data use, but the use of information as a strategic asset to improve business efficiency, to assess new businesses, to lower operational risk, to unleash the potential of a company, an industry, an economy…

Information management is a strategic segment, as the value and competitive advantage of countless businesses are based on their own processes (Services

Oriented Architecture, Business Process Management / Analysis and Optimisation tools) and on the leverage of their information assets through the increasing connectivity of most of today's personal and business devices. Companies need to channel all this distributed intelligence.

Finance and Telecommunication companies were front-runners in this space as their businesses are mostly based on information and data, but all other industries are now joining the fray, especially for their supply chain and their customer relationships processes.

According to the last IBM's CIO survey performed in 2009 (2,500 CIO interviewed face to face across the World), CIOs from the World's high growth areas are 61% more likely to craft data into actionable information than the rest of the CIOs. According to the same study, those CIOs from high growth companies are more likely to give relevant information and easy access to business users (by 31%) and to provide more reliable and secure information (by 23%) than other CIOs. And the survey to conclude that information management is a key enabler of productivity and as such a high growth IT market segment.

Additionally, in our increasingly distributed economies and distributed IT systems, with more and more regulations and rules, surging security risks, global information management and governance are a necessity. Data quality, information integration, data governance, information security are the next milestone for the EU to develop an efficient and trusted information society. Besides, Europe has some interesting research projects, startups and is even the leader for the business-oriented search engines segment.

2.3.1 STATE OF THE ART

Information Management is global management of all the information of the company and its environment. It includes and manages as one the following type of data:

- Data, or structured data, that comes from business applications such as ERP, SCM, CRM… This data is managed by BI tools such as data-warehousing, ETL (Extract Transfer, Load) or reporting ones.
- Information, or unstructured data, is the rest of the data, which represents between

80 and 90% of the total amount of data and information and which is expanding rapidly due to the Internet and the Web. Some tools already manage this type of data, such as Enterprise Content Management (ECM), search engines and text mining software.

Information management gets it value from the global management of all such information, but even more when the information is aligned with the business as well as relevant and easy to use for the business users. It gives everyone, at the point of impact, easy access to the information it needs to predict, react and act to business events, in the most efficient way.

Scope

The segment includes a broad range of market segments and acronyms. Information management derives its value from a global governance of all of these different segments.

- CPM (Corporate Performance Management) & BPM (Business Performance Management)
- Business Intelligence (BI), Business Insight and Reporting,
- Search engines
- Data Mining and Text Mining
- ECM (Enterprise Content Management) & PIM (Product Information Management)
- Data Integration, ETL (Extract, Transform, Load), MDM (Master Data Management)
- Data quality and data cleaning

Relationships with other segments

- **SOA**: it is the architecture that will give flexibility to business processes by intermediating with the technical IT systems. The relationship with Information Management is very important. The conjunction of SOA and information management is the foundation of the future agile and efficient IT systems. The reaction of business events channelled by this architecture and analysed by information management is how the enterprise can pro-activly manage its customers, its supply chain or its production centers. Metro and Carrefour, amongst the biggest retailers in World, use these types of systems to link their supply chain and theirs outlets to adapt nearly in real time their prices to the supply and the demand and to get both better margins as well as better customer satisfaction.

- **Security**: Information management implies a lot of connectivity, inside and outside the company. It holds major risks and as a result, security is an important enabler for information management
- **Interoperability and standards:** also an important enabler as the interoperable data formats are a booster for information management like 20 years ago when SQL language was standardised, the relational database market subsequently grew exponentially. Open and standardised data formats are a necessity.
- **Database:** data and information are stored in databases, a vital segment for Europe as the first bricks of information management. The unlimited access to this type of technology is critical to have a large diffusion of information management technologies.
- **Cloud Computing**: another important concept that allows for cost efficient datacenters. For a good number of regulations issues, interoperability and for the independence of Europe, it is also important that those datacenters be based in Europe and that they rely strongly on Open Source technologies.
- **Open Source** is important at various levels, but critical at the interoperability one. Information management will not be, and does not need to be open source, but certain points have to be, such as widely accepted open standards.
- **Semantic Web:** it is a fast growing and nearly unlimited source of content. Information management especially clicks well with top down approach on content aware search engines.
- **Mobility:** more and more objects in our world are intelligent and connected. If you are able to channel and correlate them and with your business needs, their intelligence, benefits could be huge.

2.3.2 KEY DRIVERS AND CHALLENGES

Information Management is composed of several sub-segments that have different dynamism, but overall, the growth is well above the market.

Drivers

- Exponential growth of information, mainly due to the usage of the Web. Semantic Web, M2M, the Internet of the Objects and mobility will even more increase this tendency.
- Web technologies open new opportunities around unstructured data (information) that will enforce the need of information management.
- SOA adoption stresses the data layer and businesses need to implement information management to fully reap the benefit of their SOA strategy.
- Standards and interoperability
- Regulations: Regulations such as Basel II for the banking sector or Solvency II for insurance encourage organisations to invest in information management to be compliant. Some countries oblige organisations to store their data on their national territory and keep them for a certain number of years. Compliance is a major incentive for investments in information management.
- Mobility will add a lot of device to the network and then a lot of information that will need management.

Challenges

- Lack of standards and interoperability.
- Country and industry regulation can sometime impede the full deployment of information management.
- The cultural barrier that still exists between “data/information” centric people and process people.
- IT legacy: specific developments existing in organisations’ software may be a barrier for information management projects as the setting may be more difficult and costly.
- Nearly no European company in the foundations of information management: database or storage
- Information management too “IT-centric” to be widely adopted by business stakeholders?

2.3.3 COMPETITIVENESS OF EUROPE

Usage

Information Management is at least as much developed in Europe than in other parts of the World, thanks to strong industry position in information intensive segments such as Finance, Telecoms, Retail or Aerospace. Military and civilian intelligence are developing fast, as well as the media and publishing industry.

Europe benefits also from its very strong telecom industry that is promoting mobility, one of the key drivers of information management. They are also key players in the M2M (machine to machine) space.

Due to its language diversity, Europe is a firm worldwide contender for semantic software, and Semantic web, one of the most high value parts of information management

However, Europe does not have a strong control over the most important information's creator, namely the Web, nor on its largest firms, the biggest advocates of "Public" cloud computing models, namely Google, Amazon, Salesforce.com or Microsoft.

Production/R&D

As for the rest of the middleware software layer, the European landscape is nearly a desert if one is looking for "traditional" software editors in the information management most generic and infrastructure related software such as databases or ETL tools. North American companies remain the biggest overall, with behemoths such as IBM, Oracle or Microsoft. Those companies are especially strong in the "legacy" information management, databases, ETL, ECM… However, in some segments, especially the emerging ones, European companies are having a good competitive stance:

1°) Global Business Intelligence (BI)

SAP is one of the leading BI leaders since its BO acquisition and now has a complete structured data offer, from reporting to ETL, CPM, data-warehousing, analytics, MDM… Other European companies have leading role on certain specific sub-segments, all experiencing good growth such as Talend for Open Source ETL, SpragoBI for Open Source reporting or Qliktech for user-centric in memory analytics and reporting tools.

2°) Search Engines

Search engines are based on pure algorithmic software, where some European research is very advanced. The result is that along the generic behemoth Google, several European companies managed to be relevant in the more lucrative (for small companies) search engine market for businesses. The leader in Europe and at the worldwide level is Autonomy, with competitors such as Exalead or Sinequa, all Europeans. Fast, acquired by Microsoft is another example. The expected growth in this promising light-weight integration market is very important.

3°) Text Mining

This market, quite closely linked to the search engines and Semantic web, to which it gives more “intelligence”, is full of European startup companies such as Temis or Polyspot. Their promise is to make business intelligence from unstructured content.

4°) Open Source communities

They are important in Europe, so providing a good R&D pool, on various information management technologies such as:

- Databases with strong competency on MySQL (a former European company) or PostGre
- ECM with a lot of competences on the various ECM projects and several dynamic companies such as Exoplatform, Nuxeo or Open CMS.
- BI

2.3.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

Europe has capacities in very different segments:

- Basic infrastructure, with OSS databases and ECM engines
- Mainstream packaged BI
- Search engines and their complementary text mining solutions

The first segment permits to deploy an infrastructure even if Europe does not have any sizable player on the field. The second places Europe as a front-runner in BI, a quite dynamic segment, with plenty added value. This inspiring position will drive innovation, create a lot of competencies with extended European based R&D centers and the creation of new start-ups. The last one represents the future of those technologies, with Europe as a good place to maintain and develop such technologies.

2.4 DIGITAL IDENTITY

Identity management in the online environment is seen as a key enabler for electronic business and electronic government because it facilitates the expansion of information systems and network boundaries and increases access points. It is also an issue at the crossroads of information security, privacy and trust.

2.4.1 STATE-OF-THE ART

Digital identity can be defined as the electronic representation of a real-world entity. The term usually means the online equivalent of an individual human being, which participates in electronic transactions on behalf of the person in question. However, a broader definition also assigns digital identities to organisations, companies and even individual electronic devices.

Online digital identity is usually fragmented among multiple websites. Indeed, it is often required to establish a user profile and provide various information to access websites, services, or to be part of online communities. As a result, each service or website owns a piece of personal information related to the user, which on the whole forms its digital identity. Such services and websites include:

- Services related to online traditional usage: communication (e-mail address, IM identifier), e-banking (account number, bank card data);
- Social networks: contacts, profile information, personal content (photos, videos, comments, rankings, etc.);

- E-commerce: e-mail address, personal address, personal data, bank card data;
- E-administration: identity card data, history of the relations with the administration, information related to income and taxes, medical data.

The current Internet model makes taking one's identification difficult from site to site. Unifying digital identities would allow users to use one ID that is transparent and flexible rather than using multiple username/passwords to register onto a website.

Consequently, the following concepts are closely related to digital identity:

- Digital identity management is a term related to how humans are identified and authorised across computer networks. It covers issues such as the way users are given an identity, the protection of that identity and the technologies supporting that protection such as network protocols, digital certificates, passwords and so on.
- Authentication is a key aspect of trust-based identity attribution, providing a codified assurance of the identity of one entity to another. Authentication methodologies include the presentation of a unique object such as a bank credit card, the provision of confidential information such as a password or the answer to a pre-arranged question, the confirmation of ownership of an e-mail address, and more robust but relatively costly solutions using encryption methodologies.

Many systems now deal with digital identity. Some of these systems may be regrouped into the following categories:

- Single sign-on (SSO): It is a mechanism whereby a single action of user authentication and authorisation can allow a user to access all applications where he has access permission, without the need to enter multiple passwords. The table below presents the main available single sign-on services related to consumer applications that can be found today on the web. Apart from the services provided by major Internet players, social networks, online retailers and telecommunication companies, the open source community is also involved in this area through the OpenID Foundation for example, and the development of a set of open protocols, mechanisms and APIs such as OpenID, oAuth and OpenSocial.
- Information Cards: Such cards are personal digital identities that people can use online. Visually, each Information Card has a card-shaped picture and a card

name associated with it that enables people to organise their digital identities and to easily select one they want to use for any given interaction. Information Cards are implemented by Identity Selectors such as Windows CardSpace.

- Electronic identity card (eID): This identity card has the format of a regular bankcard, with basic identity information in visual format, such as personal details and a photograph. It is an official electronic proof of one's identity, enabling the legal signature of electronic documents.
- Digital certificate: it is an electronic document, which uses a digital signature to bind together a public key with an identity. It is issued by a certificate authority (CA) and contains information such as the name, a serial number, expiration dates, etc. Many companies use Internet-based digital certificates for transactions and communications, including government interactions (for example to pay income taxes electronically).

Table 2 : Main single sign-on services available on the web

Company	Service name	Player type	Launch date	Description
Microsoft	Windows Live ID	Internet player	August 2007	Single sign-on service that allows users to log in to many websites using one account. Most of the websites and applications that use Windows Live ID are Microsoft sites, services, and properties such as Hotmail, MSN, Xbox 360's, Xbox Live, etc. but web developers can also integrate Windows Live ID into their websites.
Google	Google Account	Internet player	N/A	User account which provides access to Google applications and Google-owned services such as Blogger, YouTube, Picasa and Google Groups.
	Google Friend Connect		May 2008	Service that allows users to connect with their friends on different websites. It helps website owners grow traffic by enabling any website to easily provide social features. It uses many open standards, such as OpenID for sign-in, oAuth to control data, and Open Social for applications.
Yahoo!	Yahoo! ID	Internet player	N/A	User account which provides access to Yahoo! applications and Yahoo! owned services such as FlickR and Delicious.
	Yahoo!		March	

Company	Service name	Player type	Launch date	Description
	Updates		2009	Service that allows websites to syndicate user-generated actions (ratings, reviews, comments, favourites, uploads, etc.) to Yahoo!'s global distribution network. For users, Yahoo! Updates represents a way to share activities with their Yahoo! connections and with the world.
OpenID Foundation	OpenID	Open source	May 2005	Open, decentralized standard for authenticating users which can be used for access control, allowing users to log on to different services with the same digital identity where these services trust the authentication body.
Facebook	Facebook Connect	Social network	December 2008	Single sign-on service that enables Facebook users to login to affiliated sites using their Facebook account and share information from such sites with their Facebook friends.
MySpace	MySpace ID	Social network	June 2008	Formerly known as Data Availability, MySpaceID enables all global MySpace users to be in control of their social identity whenever they travel online. It allows users to: • Connect MySpace profile data to partner sites • Find MySpace friends on a partner site • Register on partner sites using their MySpace URL • Publish activities from partner sites to MySpace • Syndicate activities on MySpace to partner sites
Twitter	Sign in with Twitter	Social network	April 2009	Pattern of authentication that allows users to connect their Twitter account with third-party services.
Orange	S'identifier sur Orange.fr	TelCo	July 2004	Single sign-on service that allows mobile phone customers to securely access different websites and mobile services by logging in just once. In September 2007, Orange announced they would adopt the OpenID registration/identification standard.
Amazon	Amazon Checkout	E-commerce	July 2008	Complete checkout and payments solution that gives internet retailers the ability to provide an Amazon checkout experience on any website. Customers use shipping addresses and payment methods stored in their Amazon.com accounts to checkout on another website. The service includes tools for businesses to manage shipping charges, sales tax, promotions, and

Company	Service name	Player type	Launch date	Description
				post-sale activities including refunds, cancellations, and chargebacks.

The digital identity market is experiencing rapid growth:

- There are now over 55,000 websites that accept OpenID as a means of registration or login. This number is actually understated, as it counts umbrella sites like Blogger, LiveJournal, Get Satisfaction, UserVoice and KickApps as single sites, even though OpenID is enabled at thousands of individual sites using those services. In fact, there are now over 1.4 billion OpenID-enabled accounts including Yahoo! accounts, Windows Live IDs and MySpace user IDs.
- According to Facebook, more than 80,000 websites, devices and applications have implemented Facebook Connect since its general availability in December 2008, including most of the top websites in audience ranking.

2.4.2 KEY DRIVERS AND CHALLENGES

Drivers

As an enabler of web services, there is a growing interest around digital identity, fuelled by the following drivers:

- Enterprises increasingly seeking to deliver highly personalised services to increase revenue and increase customer loyalty. Those new services need obviously strong ID systems.
- Governments moving to e-administration and pushing to enable citizen-government interaction.
- Diffusion of social web and social graph. The social web, e.g. the usage of the web to support the social process, represents a space where people have the possibility to express and expose their identity in a social context, increasing the amount of personal information available on the web. As such, online users will increasingly expect tools to have access to this data anywhere on the web.
- The authentication of identities is an essential requirement in information security

solutions, and the efficient and secure management of identity information is a critical pre-requisite to enabling today's business demands for effective access control and provision management in IT systems.

- Solid identity management practices are essential for implementing social welfare (e.g., healthcare and e-government), enabling secure service offering (e.g., cloud computing and Software as a Service), personalising users' experiences (e.g., e-commerce and entertainment), and connecting people over networks (e.g., social networking and mobile communications).

Challenges

However, various complex questions of usability, privacy, ownership and security surround the issue of digital identity:

- In spite of a same type of service provided, many web users hold voluntary separate distinct identity (professional, personal, family, friends…).
- Although some people prefer to use their real names online, most Internet users prefer to be anonymous, identifying themselves by means of pseudonyms, which reveal varying amounts of personally identifiable information. Web users may even give wrong identity to access to Internet services without providing personal information.
- The two field “username” and “password” approach is so ingrained in the minds of users, that a lot of people are confused when presented with an OpenID login form (OpenID identifiers are in the form of a unique URL) and do not know how to proceed.
- There is some tension between the need for a secure identity credential system and the need for extreme ease-of-use by online users. Some methods, such as Windows CardSpace and OpenID, have definite ease-of-use advantages over traditional systems, but serious concerns exist about whether either system can support high levels of security.
- A number of identity solutions are being proposed, each taking different approaches with different goals. Existing solutions are not necessarily interoperable or complementary, and sometimes overlap. As a matter of fact, major Internet players develop their own identity managed solution to keep the

control on their data profile policy.

- Privacy is a major concern. Users are still afraid that such ID systems would link their identities or centralise all of their personal data. In many cases, it is unclear of how all this data would be used (especially for commercial purposes) by the provider of the ID system.
- Security in general is also a major concern. An attack on such systems may give access to all the digital data related to a person.
- While OpenID is gaining some traction in the market, there is still no real standards, which means that websites could have to support many different services.

2.4.3 COMPETITIVENESS OF EUROPE

Considering business applications, all major U.S. IT companies such as IBM, Oracle, Cisco and Sun Microsystems now propose identity management solutions dedicated to users of internal enterprise systems.

Regarding Internet identity management, multiple companies such as Facebook, Google, Yahoo! and PayPal have all expressed interest in becoming identity providers for the Internet. Certainly they have demonstrated the ability to provide highly performing systems at Internet scale. Some relying parties have begun to demonstrate acceptance of identity credentials from such identity providers, but clear winners have not emerged yet. For example, Facebook and Google both provide facilities for other online sites to accept their identity credentials, but the adoption by relying parties has been fairly limited so far.

As a matter of fact, the issue around personal data has generated a fierce battle between the number one social network Facebook and the Internet giant Google. Indeed, the challenge lies now in who owns the data and which platform will ultimately manage this information. While Facebook pushes its own proprietary approach, Google has chosen the open network approach, along with major players such as Yahoo! and MySpace. Unlike Google, Facebook has access to hundreds of millions of very detailed member profiles…, which explains its reluctance to share the data:

- Google and Facebook are supposed to collaborate within the Data Portability Working Group, but they are employing strategies that are in contradiction with the principles stated when they joined. Both have launched their own data portability service (Google Friend Connect and Facebook Connect) and Facebook even deliberately prevented Google from accessing its members' data through Google's Friend Connect application.
- However, Facebook joined the OpenID Foundation Board in February 2009, which includes Google. As a consequence, users can register for Facebook using their Gmail accounts. Existing and new users may also link their Facebook accounts with their Gmail accounts or with accounts from those OpenID providers that support automatic login. Once a user links his or her account with a Gmail address or an OpenID URL, logs in to that account, then goes to Facebook, that user will be already logged in to Facebook.

In fact, Google, Facebook, but also Yahoo!, MySpace and so on are ultimately competing with one another to become the branded single sign-on solution for the web.

Usage

As far as the consumer web is concerned, digital identity is related to all online services dealing with user identity such as communication (e-mail, instant messaging), social networks, e-retail, e-administration and online gaming. While consumer adoption of such services appears to be at the same level in Europe as in North America or Asia, most digital identity initiatives are coming from American players such as Facebook, MySpace, Google or Yahoo!, to name only a few.

The usage of federated ID systems is still very low on the Internet (less than 2% of users using it sometimes), but those consumer solutions are very recent.

Production/R&D

Research related to the management of identity covers a variety of disciplines and areas (such as technology, social sciences, the humanities and the law) and tries to investigate many different issues (technical, legal, societal, etc.).

While most working groups related to federated identity and identity-based Web services were born in the US such as the OpenID Foundation, the Data Portability Working Group and the Liberty Alliance Project, Europe is also working closely on such issues:

- The Future of Identity in the Information Society (FIDIS) is a large EU-sponsored Network of Excellence targeting various aspects of digital identity and privacy. The partners of the project are universities and companies working in areas related to digital identity. FIDIS areas of interest include new forms of ID cards, usage of identifiers in information systems, technologies used for citizen's identification and profiling. The activities of FIDIS officially ended with the closing event in May 2009.
- Within the Seventh Research Framework Programme of the European Union from 2007 to 2013, several new projects related to Identity Management started. PICOS will investigate and develop a state-of-the-art platform for providing trust, privacy and identity management in mobile communities. On the backdrop of an increased risk to privacy of the citizen in the Information Society, PrimeLife will develop concepts and technologies to help individuals protect their autonomy and retain control over personal information, irrespective of their activities. SWIFT focuses on extending identity functions and federation to the network while addressing usability and privacy concerns, and leverages identity technology as a key to integrate service and transport infrastructures for the benefit of users and the providers.

Furthermore, several government initiatives were taken in the US, but also in Europe, promoting either the electronic identity card or open standards:

- Electronic national identity cards are being planned and deployed on a large scale in Europe as well as worldwide. Belgium was one of the first countries to launch an electronic identity card (eID) in 2003, which is now used by over 8 million Belgians, corresponding to over 99% penetration rate. By the end of 2009, all Belgian people over 12 years old should own an eID card. The eID card can be used with over 400 applications available in the country: it may be used for healthcare transactions, fill taxes online, ask for a birth certificate or a building permit, etc. Belgium's private sector has also started integrating the eID card into various business environments, including the banking sector.

- In September 2009, the US federal government announced plans to accept OpenID and Information Cards technologies for login on specific agency websites, including those of the National Institute of Health, the US Department of Health and Human Services, and the Center for Information Technology. The announcement is an important part of the federal government's new Open Identity Initiative, which calls for greater citizen engagement and a government that is more transparent, collaborative and participatory.

In Europe, one of the major challenges will be to make interoperable the electronic-ID systems of different member states, to allow easy cross-border provisioning of services in the e-government and e-health areas, or wherever a strong authentication is needed.

2.4.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

Major impacts for the SSBS industry will the following:

- Development of the online advertising market. Websites using single sign-on services such as Facebook Connect, MySpaceID or OpenID may get direct benefits. Indeed, such tools facilitate the access to websites, which should in return experience a high traffic increase. Also, ID systems should help to build more advanced targeting solutions.
- Positive effects on e-commerce. Online retailers using solutions like Amazon Checkout may see an increase in their conversion rate and sales as Amazon Checkout is convenient for users and provides the familiar checkout experience available on Amazon.com. E-commerce websites may also benefit from targeting to enhance their recommendations and/or datamining systems. E-commerce players would then upgrade their systems to handle this new data.
- Need for new skills. Players should prepare, especially on the consumer markets, to deal with new issues not related to programming but rather to legal (data protection), privacy and security.
- Acceleration in the usage of the web 2.0 solutions, as they would be easier to use (no need to recreate a full profile)

2.5 STANDARD AND INTEROPERABILITY

2.5.1 STATE OF THE ART

“The term interoperability is used to describe the capability of different programmes to exchange data via a common set of exchange formats, to read and write the same file formats, and to use the same protocols. The lack of interoperability can be a consequence of a lack of attention to standardisation during the design of a programme. Indeed, interoperability is not taken for granted in the non-standards-based portion of the computing world »15.

Standards and interoperability are not a market segment, they are key enablers that are closely linked as interoperability needs standards to be effective. The other link is with patents, and that is why it is a difficult topic that needs a balanced approach. To summarize: standards are for a public use while patents are for a private use.

The importance of interoperability

In the software domain, interoperability implies and is achieved through different means/phases, including testing (to verify if the interoperability effectively works), engineering (to implement the standard into the product), partnerships, the use of a common technology, and a standard implementation.

However, if this definition focuses on the technical side of interoperability, the organisational side should not be neglected, when companies share their technology / data, for instance. If neglected, monopolies or market failures could occur, smothering any competition and subsequent innovation.

Examples of interoperability standards/organisations:

- CMIS (ECM): Content Management Interoperability Standard.
- OASIS: organisation aiming to promote interoperability between encryption systems and some enterprise applications (email, databases, etc.). OASIS has developed the OpenDocument format.

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15 Wikipedia

- SISO: organisation promoting the interoperability in the simulation field.
- SWIFT, for financial file exchanges
- XML, an IT exchange language
- SOAP, the web services invocation protocol
- …

In terms of organisational processes, Carnegie Mellon developed the LISI Model (Levels of Information Systems Interoperability), and the CMMI, both related to integration and interoperability between different business/organisations/production parts. The most widely used are the ISO standards such as ISO 27001 for security

Numerous standards exist at industry and country or regional level, like Basel 2 for European Banks. Those standards can have an important effect on the IT: Basel 2 impedes banks to have global European wide Clouds Computing as their client files have to stay in their country of origin.

Interoperability embraces technical (e.g. a programme could be the user of an other programme) and organisational/business issues. It is the central pillar of an open-system-based economy, which means greatly enhanced communications between different kinds of programmes (OS, middleware, applications), organisations (e.g; between administration and companies) and hardwares/devices (e.g. M2M).

Open standards

IT needs interoperability with open standards, standards that are not patented. That does not mean open source, but standards that are free and owned by no one, just like SOAP for web services, which was developed by Microsoft and then given to the community.

Supporters of the Open Source Software (OSS) movement, on the other hand, claim that software patents favour established players and aim at increasing profits, rather than spreading innovation and knowledge.

Based on standardised platforms, open innovation is costless and enables interoperability with a strong market acceptance, all the more if the standardisation comes from governments. Standardisation is a means to unify a market around a common technology and then ensuring the growth of this market (clear marketplace, reversibility, clear value-added of each competitor, etc.). Besides, innovation is typically issued from competition and external challenges rather than from the sole internal R&D department.

On the contrary, a patented and vertically integrated technology market is more based on value-added provided to customers and a faster go-to-market, but favours monopolistic companies with huge repeatable business across a whole continent such as North America. It increases the dependence on big players, with weak possibilities of reversibility and strong lock-in risks.

Open-systems are a structural driver for future SSBS growth. However, open-systems enforcement depends on interoperability capacities reached by either the customers or the providers. It also depends on the level of standardisation and therefore maturity reached by the market.

Intellectual property

Intellectual property is considered as the backbone of the IT industry, in Western countries as in the developing ones. Companies are more and more valued on their intangible assets, which represent today almost 80% of their value (according to the US Federal Reserve). IP is central for IT value creation and many companies, especially the smallest, need IP protection to develop their activities. IPR is used by SMEs to obtain access to finance by attracting investors.

In this respect, patent should be enforced at European level, with a unitary and continental value according to the European Patent Conference of Munich and with the European Patent Office (EPO) as its operational arm. This will lower cost for doing business in Europe, promote European integration as stated in the 2009 Malmö Conference.

This protection will be a necessity to foster innovation, especially within SSBS SMEs, and also to get a continent wide adoption of such strategic technologies as Cloud Computing

In this sense, open source could not be the only model and the Open Source Software licensing should not be viral like the GPL3 licence.

A balanced approach

Innovation comes and will come more and more from increased collaboration between different stakeholders. An enforcement of open standards in the whole IT system could therefore bring significant benefits to the rest of the economy, reinforce competition and lower entry barriers...

In this environment, a key challenge faced by the SSBS industry is to rightly balance the mix between proprietary solutions and open collaboration (e.g. OSS, cross-licensing…), what we call "Blended Source"

And then, if solving customer problems and creating innovation are boosted by an open community of knowledge in which information is widely diffused, how will SSBS companies be able to generate incomes and royalties?

Moreover, should a free flow of intellectual property happen, it would severely weaken the position of European SMEs in the ICT services industry with respect to obtaining finance.

2.5.2 KEY DRIVERS AND BARRIERS

Standardisation could be driven by:

- Enforcement of standardisation by governments/EU: for instance, the European Interoperability Framework (EIF) provides guidelines to ensure integrated European public services. In the UK the e-GIF initiative was created to provide an interoperability framework for the e-government. Similar initiatives exist in France and in Germany.
- Civil associations/groups acting for the development of a technology. The Internet Engineering Task Force (IETF) pushes Internet standards in particular about TCP/IP.
- Business associations
- ISO
- Of course, the strongest pressure/incentive to standardisation comes from regulation/legislation.
- EU regulations and standards for OSS and Cloud licensing will greatly help to structure and develop those markets. Current licences are not adapted to the

distributed nature of the Cloud computing. In addition, OSS licences are often not adapted to some business needs, being more tailored for research organisations

Interoperability could be pushed by:

- Increased needs for mobility and best-of-breeds
- Broad adoption of standards
- Business reorganisation towards global integrated players (IBM, Micosoft, HP) or vertical-integrated ecosystems (e.g. a hardware provider with software vendors)
- SOA, Cloud Computing and OSS are strong forces on the market for standardisation.

Several facts account for barriers for standardisation and interoperability:

- Competitors struggling to impose their own technology/standard, as it could give them an edge on the marketplace
- Few big players with monopolistic positions, protecting their royalties.
- One-stop-shop packages could be cheaper than best-of-breeds, and you need one single point of entry if problems intervene.

2.5.3 COMPETITIVENESS OF EUROPE

Europe is naturally a continent that needs more standards and interoperability than other continents due to its political, cultural and economic fragmentation. This already explains why European Software industry is still a dwarf compared to the US software industry. European harmonisation as performed for transportation or energy is vital for the European IT industry.

Europe is at the crossroads of these trends and should choose an astute direction to build a successful software industry. The EU has to set standards to ensure that its needs are fulfilled and to boost new markets where the EU has a competitive edge to develop.

2.5.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

The importance of IPR for SMEs in the SSBS industry is generally recognised. As an example, E-business Watch (2008) conducted a survey and distinguished between the use of IPR excluding patents and including patents. Approximately 34 % of the respondents answered that they saw IPR as very important in the company‘s business model‘, and 41 % stated that they saw a somewhat important role in the company‘s business model‘ for IPR.

The survey also showed that the majority of SMEs in the ICT services use IPR mainly to exploit innovation, to launch new products and services. Other important reasons included to attract investors, foster collaborations, and as a source of revenue. In the end, the use of IPR mostly appears to be proactive (innovation and gain funding), and not defensive, as blocking competitors was mentioned significantly less often.

In trying to establish a causal link between the use of IPR and profitability, E-business Watch (2008) compared market shares, turnover figures and number of employees between SMEs in ICT services that do and do not currently own IPR. All variables indicated that SMEs benefited from owning IPR.

In the end, Europe needs to have a balanced approach to IPR and open standards:

- Without depending on platforms built in the U.S., Europe could develop a common pan-European IT platform and strengthen a sustainable software ecosystem on top of it. It could foster cooperation on this shared platform, and promote differentiation & competition on value-added domains. Some projects like NESSI are already launched in this sense.
- European software providers are performing better on the upper software layers (business processes, complex processes), and a neutral/public input (e.g. the creation of a public platform, like a public cloud) could allow them to lessen their dependability on US platform providers.
- Defining common standards in the EU is a strong means of unification of this area economically speaking, and to create a single marketplace. It is also a means to increase the use of IT, through a range of vendors with different price points, functionalities, and services supports
- To sum up the study team’s point of view, as there is no global player in Europe to enforce its own standards, EU institutions should provide this needed regulation (on a more neutral basis) by creating a strong framework in which a dynamic ecosystem could thrive.

2.6 RFID

2.6.1 STATE-OF-THE-ART

RFID (Radio Frequency IDentification) is an automatic data capture method, based on the transmission of the 'identity' of an object or a person over radio frequencies. Along with barcodes, which RFIDs may eventually replace, they are one of several automatic identification (Auto-ID) technologies available.

While it now enjoys considerable media attention, the principle of RFID is not new, and in fact dates back to World War II. At that time, it was used to identify Allied and enemy planes. It was in the 1970s, however, that the first RFID systems were first used for controlling access to secured or theft-protected buildings (basic 1-bit system). Since 2003, however, new technical and economic developments, along with standardisation have revived industry interest in this technology.

From a technical standpoint, an RFID system is made up of three components and includes:

- A transponder (generally a silicon chip) which is programmed electronically to contain unique data on an object (or a person), such as a serial number, thus making it possible to identify an object or to locate it.
- A transmitter/receiver (transceiver) which is generally integrated into a dedicated reader (scanner or RFID reader). This system component can be used to connect to the Internet.
- A radio antenna (two antennae, in fact: one on the transponder, and the other on the reader) which ensures the automatic link between the transponder and the transceiver.
- Multiple standards coexist. The most popular standard is the EPCGlobal Gen-2 aims to resolve all interoperability issues, and reduce the cost of producing RFID tags. It is challenged by the international ISO standard and other proprietary standards.
- Two different types of tags exist:

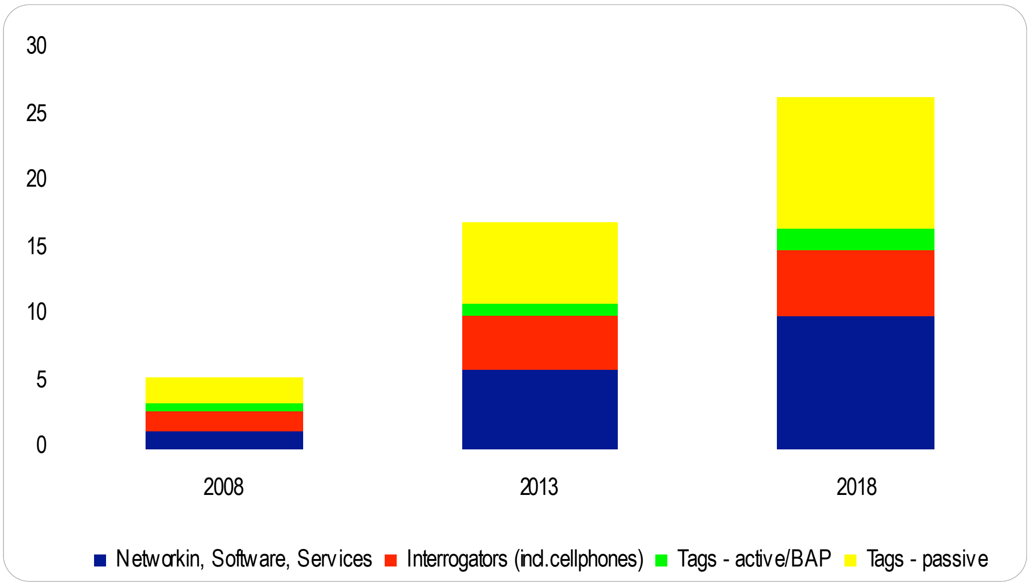
- Active tags are powered by an internal battery (or an outside energy source such as solar power), and the data they contain can be modified over time.
- And, secondly passive tags which do not require an outside energy source (they are in fact powered by the energy of the reader whose waves they reflect), and the data stored on them is generally limited to an ID number.

Main applications reside in identification usage:

- RFID rollout is heavily linked to the successful substitution of existing barcodes resulting from the different advantages of RFID.
- Moreover, Near Field Communication (NFC) is currently the major consumer application based on RFID.
- It could also be used in conjunction with other technologies like sensors for trigger action and location system technology for location tracking features.

2.6.2 MARKET DATA

Figure 1: Total RFID Market Projections (billion USD)



Source: IDTechEx

2.6.3 DRIVERS AND BARRIERS

The main driver for RFID is and will remain its capacity to deliver ROI for business processes.

- Much of the value of RFID compared to other identification technologies comes from four main RFID characteristics:
    - Higher potential for automation (longer reading range, no line of sight)
    - Simultaneous reading of a very large number of tags
    - Real time interrogation and modification (read/write capabilities on some technologies)
    - Higher granularity for information (identification can be made using a wide range of attributes and help to better define complex objects, as the tag has embedded memory and/or can store long ID number linked with enhanced information into remote databases).
- RFID will therefore be able to enhance business operations in industries which have to handle a very large number of products (especially if they have very different characteristics). RFID can also be of great assistance if used to automate processes, but only if it can outperform existing automation techniques. Finally, RFID is also well suited to processes requiring regular updates like stock inventory.
- Automation is a huge ROI driver, as RFID rollout leads to reduced labour requirements (wage benefits) which is not a marginal parameter for industrial companies. This point is actually one of the most crucial but top management is understandably shy about communicating on this advantage.
- Some applications lead to huge cost savings linked to business improvement like inventory management enhancement. Even without a reduction in manual scanning the system speeds up inventory and users can benefit from it by reducing periods of store closure for stock taking.
- If most applications aim to reduce the cost of the system, other applications could generate new business revenues, but maybe over the long term. RFID could help design applications that were not technically or economically possible before.

Other major key elements that should help the development of the market are:

- Diffusion of NFC technologies in mobile phones, as consumers would then have a form of RFID reader.

- Regulations and mandates, even though players having to meet these obligations will invest as little as possible.
- Technology breakthroughs improving technological performance, and also reducing the cost of the tag (eg: chipless tag).

RFID still faces major structural technical and business challenges:

- Technical limitations of RFID tags, which require specific initiatives/workarounds (metal and water environment issues that impact reading rates, reading rates reliant on the density of tags, the placement of tags, the speed of moving objects, non directionality, spectrum constraints)
- The technical ecosystem is complex and still in progress, which leads to fragmented offerings and limited visibility (proprietary air interfaces, lack of full compatibility between tags and readers, but numerous very small RFID integrators which are not big enough).
- Security is still not guaranteed, as RFID can be subject to numerous attacks (eavesdropping during information transmission without potential blocking of emission in certain directions). IOT, as a parallel web for items and things, will also be under numerous threats like identity theft, DoS attacks, and unauthorised access queries. Key information will be stored in IOT databases and could be stolen if left unprotected.
- Unsolved issues with IT systems (no clear scalability of projects, current information systems only handle categories of products, not unique products).
- And above all, a lack of viable business models (still high value of tag, competition with existing automated infrastructures, lack of proof of ROI for some applications, limited value sharing between players located at the end of the supply chain, who benefit the most, and other players).
- The key challenge will be to promote cooperation between the industry players. On the technical side, players have to work on common technologies and standards to bring the cost down. On the business side, players operating in open loops need to find ROI for their own operations. Otherwise, the tag will be put only at the end

of the supply chain by the retailer or remain in closed loops. They will also have to share data through IOT services, which they are not used to doing.

2.6.4 COMPETITIVENESS OF EUROPE

Usage/sales

North America is well ahead of Europe in the RFID technology. Many heavyweights in industries use RFID like retailers (Wal-Mart), and aim at compelling suppliers/clients to adopt the technology, reinforcing the usage. Mandates from DoD also encourage usage.

Europe saw only few deployments for processes optimisation in the production plants (automotive, aeronautical industries).

Telcos are also involved in the RFID technology as service integrators especially with an eye on the future Internet of Things. In that space, European players are leading clearly the market with specific offerings like BT (food market) and Telekom Austria in (textile industry). France Telecom is also positioned on the technology.

Moreover, EPCGlobal, the RFID numbering standard is also a US-based standard. It is challenged by the (international) ISO standard.

Spectrum aspects are one of the main issues for RFID market take-off. Actually, European regulation is more restrictive than the US one. European regulations introduced a LBT rule, which is a technique used in radio communications whereby radio transmitters first sense their radio environment before beginning to transmit. LBT thus requires more complex technical solutions, which implies higher equipment costs and is clearly a strong disadvantage for European RFID usage take-off. In the US, regulators opted for a FHSS technique (Frequency Hopping Spread Spectrum), which is a method of widening the used spectrum by quick frequency changes. European implementations also have lower power limits and subsequently shorter reading ranges.

Production/R&D

The RFID technology is mainly developed and produced in the North America.

Key players on this market are mainly US-based. Leading players include Alien

Technology, Texas Instruments, Imping, Avery Dennison, and UPM Raflatac which are all US companies with US-based R&D centers. Only Tagsys (French player) and NXP (ex-Philips) could be assimilated to European players.

In the software space, the situation is very similar, as most of the players are coming from the US. A lot of them were already positioned in the supply chain management (like Manhattan Associates or OAT Systems) or in ERP (Oracle) and are extending to new business. SAP is still a key player from outside Europe.

2.6.5 QUALITATIVE IMPACTS ON THE SOFTWARE INDUSTRY

Major impacts for the SSBS industry will be the following:

- Development of IOT markets. RFID is the key enabler for this market, which could also develop with other technologies (2D bar code), but this is very unlikely.
- Strong needs for more infrastructure. This infrastructure would involve huge databases (with lots of data coming from the RFID) and would have to operate as a dedicated cloud-like infrastructure.
- Faster developments in areas with fewer restrictions on RFID (spectrum, privacy, etc…). Main industry players may emerge first from those countries, as they would previously test their domestic markets.
- Needs for more interoperability. Interoperability between RFID software (but also between RFID tags and readers) is required to facilitate integration into IT systems for stronger technology take-off.
- Needs for vertical expertise. Players will be able to design efficiently the different RFID software handling huge volumes of data if they have a better understanding of the final markets.

2.7 UBIQUITOUS NETWORKS

2.7.1 STATE-OF-THE-ART

Related key networks technologies are:

- Long range cellular networking technologies, especially involving IP data in packet mode, without having to use a dedicated channel, on 2.5G and later cellular network systems (such as GPRS and EDGE), and on data paging networks (Mobitex).
  2.5 G and 3G technologies have a differentiated asset: the ‘always on’ ability, which could revolutionise real-time use. However, at this point, the 3G footprint is still small, especially in rural areas and emerging countries.
  3GPP is currently working on changes to HSDPA. The project is called LTE (Long Term Evolution). The main specifications for releases from the LTE project were published in early 2008 (release 8). Corresponding releases are expected in 2009. Commercial service for standards aligned by this project is expected in 2011/2012. A standard from the LTE project will be proposed to be integrated into the IMT-Advanced family, successor to the IMT-2000 family. LTE will systematically integrate OFDMA modulation downstream and SC-FDMA upstream. Nevertheless, some equipment suppliers could introduce these modulation schemes as soon as HSPA Release 7. In addition, LTE will also usher in the end of the transition from circuit switching to packet switching.
  In this case, the development of the technology will be pushed by both network equipment vendors and mobile Telecom operators.
- Satellite technologies will continue to face sharp competition from terrestrial systems and are unlikely to play a big role in bandwidth provisioning. The main reason is the price of the communication, which remains an important drawback. The tariff per minute for a satellite call (voice communication) is at least twice as expensive as a conventional cellular one. The large footprint of a satellite allows it to be connected to any spot on the Earth (isolated or not). Most of the time, the use of satellite communications is marginal, except for coverage in cellular ‘white spaces’. Nevertheless, it could be considered as a contributing network.

- Wireless medium range technologies allow users to take advantage of the many developments in wireless local area networks (WLAN) for businesses (particularly at production sites and in warehouses) and, to a lesser extent, in homes. Depending on the version, Wi-Fi (IEEE 802.11) offers bitrates of between 11 and 54 Mbps and with a maximum range of close to 300 metres, which is enough for most uses with a well meshed network. Some versions, ratified in 2004 or in coming years, focus more on certain features such as security (802.11i) or quality of service (802.11 e).
- WiMAX, short for Worldwide Interoperability for Microwave Access, is a telecommunications technology that provides wireless transmission of data using a variety of transmission modes, from point-to-multipoint links to portable and fully mobile Internet access. WiBro is the South Korean version of WiMAX. The technology provides up to 10 Mbits/s broadband speeds. In many countries, WiMAX aims at covering the white spaces of the DSL. Globally, Wimax development remains limited.

2.7.2 MARKET DATA

Penetration (mobile density) estimates and forecasts

	2007	2008	2009F	2010F	2011F	2012F
North America	82,8%	87,0%	90,4%	93,5%	96,4%	99,1%
Europe	100,8%	106,0%	109,3%	111,7%	113,8%	113,8%
Asia Pacific	38,1%	47,5%	55,5%	61,9%	67,3%	71,3%
Latin America	66,9%	78,3%	85,8%	91,9%	97,1%	101,6%
Africa & Middle East	35,9%	46,6%	55,9%	62,7%	68,4%	72,9%
Total	41,3%	46,5%	50,8%	54,4%	57,5%	57,5%

Source: IDATE

Mobile handsets Market (in million EUR)

	2006	2007	2008	2009	2010
Western Europe	23 465	24 152	24 581	22 990	23 351
North America	23 166	25 257	25 247	22 936	23 728
Asia Pacific	44 946	45 750	46 243	45 740	47 773
Central and Eastern Europe	7 669	8 169	7 964	6 902	7 109
Worldwide	105 948	118 267	119 960	108 126	115 034

Source: IDATE

Last update: June 2009

Mobile subscribers estimates and forecasts (in thousands)

	2007	2008	2009F	2010F	2011F	2012F
North America	277 045	293 682	307 838	321 085	333 891	346 253
Europe						
Asia Pacific	893 336	951 511	973 304	1 002 501	1 025 328	1 042 343
Latin America	1 378 540	1 733 647	2 048 319	2 309 733	2 535 268	2 716 606
Africa & Middle East	368 844	436 362	483 911	524 020	559 769	591 762
Total	3 295 400	3 916 032	4 425 347	4 858 706	5 233 704	5 545 010

Source: IDATE

2.7.3 KEY DRIVERS AND CHALLENGES

The key drivers for mobile market development are:

- Large footprint coverage, even global by combination of wireless technologies (roaming or satellite complementary). The wireless solutions can enable large scale deployment with fewer constraints than wired technologies. Wireless is also often the first and only form of network technologies in some areas (like emerging countries). The deployment can also be done more easily to reach remote areas in developed countries.

- Large penetration of mobile handsets worldwide (with also huge growth in the emerging countries) is clearly a positive point for the mobile development.
- Technology improvement in all mobile segments (LTE is coming with growing data rate, equivalent with current wired-based technologies, improvement of OS software and innovative embedded hardware components) making it easier to use.
- Need for mobility. The evolution of the lifestyle, for both private and professional usages, is involving more and more nomadic activities. Wireless technologies enable to remain connected everywhere and have access to data from critical information in real time to entertainment to kill time while waiting.
- Added value of connecting machines. Connecting objects and machines to the Internet is hard to implement without wireless technologies, as most machines are either moving or located on third party premises. Machines can then communicate data to optimise their usage, around cost savings or development of new services.

However, there are still some major issues on how to ensure the development of mobile networks to all users:

- Performances in some areas (especially rural) are still limited. Data rates are not equal and depend on the location. For instance, 3G data rates are mainly available in urban areas and not in rural ones. Even in dense areas, actual speed is often too limited.
- Multiple standards (CDMA vs. GSM vs. TD-SCDMA) are a real brake for innovation and for the market in general. They imply additional costs when rolling out a new technology.
- Spectrum is also a main barrier. Resources are obviously limited and many players are competing for the best spectrum in the 800-900 MHz range (better performance).
- Technical issues when roaming (QoS depends on multiple operators). From a technical viewpoint, operational feedbacks reveal some issues when changing of

networks (communication failure for instance).

- Expensive network costs, due to both equipment and spectrum licences. This leads to expensive retail prices for wireless access technologies and associated services, especially when compared to most wired technologies.
- High-energy consuming technologies. For certain, it is the main drawback of mobile technologies. Lifetime of batteries (of a handset) does not exceed a week for a low usage and even less for high usage.

2.7.4 COMPETITIVENESS OF EUROPE

Market

Europe has major penetration rates for mobile use in the world (over 100%). This is due to multi-equipment (private and professional lines for several subscribers). However, mobile usage (through mobile services like mobile payment for instance) is definitely more developed in Asia, particularly in Japan and in Korea. Asia Pacific is therefore the leading region regarding mobility, for both applications and connectivity.

On the regulation segment, the GSM standard remains the strong cooperative success for Europe which facilitated roaming and other services based on these networks (M2M for instance), in comparison with coexisting (and incompatible) 2G standards in the US (CDMA and GSM). While the 3G WCDMA has seen a new competitor from China (TD-SCDMA), the worldwide 4G networking technology (LTE) could resolve multiple issues on that segment. Commercial service for standards aligned by this project is expected in 2011/2012.

Production/R&D

The leading players in the networks equipment market are led by Ericsson and Nokia/Siemens, both European players, with 56% market share in 2008. However, they face a huge competition from the emerging countries providing low cost offerings like Chinese players Huawei and ZTE.

On the handset market, Nokia is a clear worldwide leader with 40% market share, even though this market share is declining slowly. On the Smartphone market, Nokia is highly challenged by the popular iPhone and its innovative business model. Then, Asian players like HTC, Samsung and LG try to get a bigger share of the pie.

On the services side, most of the mobile telcos (operating in Europe) are Europe-based players, except few players like Hutchison (with “3” brand, operating in several countries). Moreover, many European mobile operators (Orange, Telefonica, Deutsche Telekom, etc) try to go beyond the European borders as they acquired mobile licences in emerging countries, allowing them to generate new revenues streams, as the domestic markets tend to be mature.

2.7.5 QUALITATIVE IMPACTS ON THE SOFTWARE INDUSTRY

Major impacts for the SSBS industry will be the following:

- Development of mobile applications and M2M markets. With good level of performances for connectivity (speed, coverage and quality of services), users will more and more turn to mobile devices to extend their desktop-based usages. Machines will also benefit from the wireless connectivity. SSBS players will therefore need to develop mobile extensions, plug-ins or add-ons that can be bundled with their traditional offerings.
- Need for new skills. Some applications requiring strong QoS will imply a better understanding of network operations and of the underlying hardware (clearly less advanced than a PC). This could also be done by turning to specialists mastering those skills. New major players could therefore emerge directly on the mobile, even though most of the dominant players in the mobile software space will most likely be traditional players.
- Increasing role of telcos (and to a lesser extent, of device manufacturers) as enablers. On wireless networks, QoS is harder to offer than on wired networks, which implies additional network services.
- Acceleration of the shift towards cloud computing. Wireless technologies are strong promoters of cloud computing, as they will allow being always on and connected.
- Faster development in countries with fewer constraints in deployments of new networks (spectrum, regulation, etc…).

2.8 SECURITY

It has become common knowledge that the “World is flat”. It implies global potential but also global risks as companies are global:

- Natural disasters
- Geopolitical turmoil
- Criminality

Businesses are increasingly opening their processes to partners, clients or suppliers. Ecosystems span the World and information has to flow like never before. Those worldwide value chains rely on their weakest link and are weaknesses for most companies.

As IT has become a major production tool and a critical backbone for many organisations, IT security has also become a growing topic for software editors and service providers. New concepts like SOA or Cloud computing are also changing the way IT is delivered, in a more open manner. This is endangering most companies and governments that have raised strongly their concerns about security issues.

IT has also become a weapon of choice for criminal organisations, state agencies and competitors that are often using it to gain money, to wreak havoc or to steal intelligence.

Security is now an issue that is taken into account in every project whether it is about architecture, software development or endpoint management. Security is the critical enabling factor for the development of most of the new the concepts: Cloud Computing (where security is the first worry for IT managers), SOA, Open Source Software (OSS), Mobility, M2M, Semantic Web…

Governments and regulators are more and more serious about security with new compliance rules. A good number of those standards are a necessity for several businesses

2.8.1 STATE OF THE ART

IT security is vast and often implies security measures that are out of the IT field. For this techno-enabler, we will focus solely on Information Security

Definition

"Information security means protecting information and information systems from unauthorised access, use, disclosure, disruption, modification or destruction. The terms information security, computer security and information assurance are frequently incorrectly used interchangeably. These fields are often interrelated and share the common goals of protecting the confidentiality, integrity and availability of information; however, there are some subtle differences between them"16

Those differences concerns privacy rules that applies to personal data, while the rest of the IT security concern the IT Systems and how security flaws could affect the activities of the targeted organisations.

Privacy rules are also important for certain IT segments as it will be explained further.

Scope

The segment includes a broad range of applications and services. IT security encompasses the following levels:

- Network
- Desktop
- Server
- Applications
- Continuity of services & disaster recovery
- IT Security has three levels of action: human workflow, logical (software) and physical (hardware). Privacy rules are rules that protect individuals.

Relationships with other segments

IT Security is pervasive inside IT systems, so all segments are affected by security, the most open being the most affected. As an example, mainframes are extremely secure platforms, while Internet browsers tend to be prone to threats. Security is

16 From Wikipedia

never absolute, so companies have to balance risk with the type of processes, applications, data and hardware they will secure, knowing that security impedes greatly performances and usability.

IT Security is a governance level concept that has to be dealt with at the highest management level of the company. As a main architecture foundation, security has deepened its links with ID Management and to a certain extent, with IT management platforms, application development and governance tools.

2.8.2 KEY DRIVERS AND CHALLENGES

Security is a growing market, which attracts new players on a regular basis. It has reached about 40 billion Euros in 2008 in the world and should continue to grow on average by more than 10% per year in the next few years. It is driven by security software but the future growth may come from security services and security appliances, which grow even faster.

Drivers

IT security is a growing market due to the following drivers:

- **Internet:** Every IT system is now connected to the Internet, an open, public network, which has created a gate into companies. Therefore corporate networks need protection from external threats such as viruses or hacking.
- **Mobility:** The increasing number of mobile devices have forced companies to find ways to prevent their data from being stolen or lost. As these devices also have connections with the company network, companies also need secured remote access to companies' data. The more new devices are launched and used by organisations, the more complicated it is to develop new security solutions quickly.
- **Data**: Information tends to be more and more important and companies' data have become a strategic issue for an increasing number of sectors. In the beginning, IT security concerned the Defence industry, then the Finance industry, then progressively all sectors where information may be crucial, as for example customer data, R & D data, etc.
- Increasing **regulations** on both security risk assessments and privacy rules from Basel 2 to the different local privacy rules, including ISO 27001.

- **Global security approach** with perimetric security, being more and more integrated with identity management and cryptology.
- For example, the Internet-based Cloud computing, especially its “Public part” could be badly impeded if the security risks and compliance but also the privacy concerns are not addressed.

Challenges

Several facts account for barriers to the growth of the Security market:

- Companies’ awareness: According to CISOs (Chief Information Security Officers) IT departments must increase general management’s awareness of the security issue as GM rarely realizes the possible threats on their IT system and the potential of damage on their companies’ production and corporate image.
- User behaviour:
- Negligence: All surveys of employees and interviews with CIOs show that there is still a significant unawareness of security issues among employees. Security rules are considered as rather constraints than guarantees of safety.
- Personal devices: With mobile phones being progressively replaced by “smartphones” – meaning they also have access to Internet, mailbox, etc. –, employees want to use them at their workplaces as well as to access their professional data.
- Social networks: Social networks on the Internet have become a major reason for web-surfing for employees and some of these social networks may account for un-secured entries into organisations’ IT systems.

2.8.3 COMPETITIVENESS OF EUROPE

Usage

Europeans use security as most of the other people or companies in the rest of the world: firewall, anti-spam, anti virus, both at client and server side. They have the same level of adoption of SSO and ID management. But, they have a bigger tendency to use appliances such as UTM and open source.

Security is widely used in Europe and has a strong national flavour especially concerning cryptology, security regulations and privacy rules. Some norms such as ISO 27001 or some frameworks are unifying the security landscape.

Security begins to be integrated at the inception of projects, at application, middleware, system and network level. Some parts such as the development of secure code in the design stage are gaining traction on the market.

Production/R&D

The market giants are not European companies, especially for the generic needs such as anti-viruses or anti spam and global platforms. Those companies are American of course but a good number of them are of Israeli origin.

As stated before, due to the strong local flavour, some parts of security, such as cryptology (a strategic part) are still well in the hands of European companies. With this favourable environment, numerous software and services specialists have blossomed in their local market then slowly expanded at continental level, like for example Arkoon, in the UTM space or Panda Security for the anti-virus or anti-spam. Those local companies, coupled with strong governmental backed R&D as well as important university led research, made Europe a competitive place for R&D.

2.8.4 QUALITATIVE IMPACT ON THE SOFTWARE INDUSTRY

- Service and application development is becoming more secure, and is boosting the testing market.
- Data management is changing also, improving more and more the security in their products.
- Network: there is a growing relationship with this sector as telco-players tend to offer packaged solutions including network, hosting and security for small and medium businesses. Network providers also break into the security market offering similar solutions.
- Storage: As the quantity of data increases and regulations compell companies to store it, storage is a growing segment. Stored data require security solutions and some security software editors invest into storage solutions.
- IT architecture: IT system architectures have to be redesigned to take security

issues into account, all the more that these are increasingly service-oriented architectures with highly distributed, barely coupled systems.

2.9 DATACENTERS

2.9.1 STATE-OF-THE-ART

A datacenter is a facility used to house computer systems and associated components, such as telecommunications (routers and switches) and storage systems (servers). Routers and switches aim to transport traffic between servers and the outside world. Hence, the datacenter is commonly described as the first step of the content delivery chain. The lifetime of a datacenter is around 20 years.

A datacenter combines two major types of operations and worlds that are really different:

- facility types, related to the building itself and its major concerns like temperature, physical security (for both external intrusion but also prevention of floods or fires), and power consumption. Real time is generally operated in less than 5 seconds.
- IT types, related to computing operations and its major concerns like availability or computing power. Real time for IT is closer to 1 to 5 minutes.
- For security reasons, the facility admits multiple features such as:
- High protection, both physical (non intrusion systems, video surveillance) and virtual (firewall and other protocols)
- Connection with several Tier1 Telecom operators (connectivity providers)
- Secured electric power source
- Air conditioning (or cooling system) in order to control temperature (especially for servers), which represents around 37% of the total energetic expenditures.
- The most important source of cost resides in the electricity consumption, which represents 20% of the total cost (of a datacenter).
- The datacenter facility deals with multiple types of players:
- hosting services providers: those players operate the facilities for themselves or for tier companies (data storage)

- Network operators for the connectivity
- Software developers, websites editors or applications providers
- Data providers (banks, hospitals …) which have to manage a high volume of data.
- Datacenters development enables a new range of applications including the most promising Cloud computing and online content distribution (especially video).

The current major stake for datacenter is PUE (Power Usage Effectiveness), which is the ratio between the power of the whole datacenter divided by the power of the IT system within the datacenter (the rest being the power of the cooling systems).

The standard PUE ranges from 2.1 to 2.5, while most efficient players have already reached 1.6. Players using free cooling systems (natural cooling from a river for instance) for private cloud can even get a PUE of 1.1 to 1.2. All players have now to improve their PUE and their operations as they can not anymore oversize their datacenters.

Major techniques to reduce overall consumption include:

- Advanced urbanisation (zones, curtails, limited volumes of air, etc …)
- Recent UPS (universal power supply) that generally consume less
- Virtualisation also helps to consume less of the IT system
- Layout of machines/servers within a room

2.9.2 KEY DRIVERS AND BARRIERS

The market for datacenters is currently growing very fast, pushed by both traditional IT players offering cloud computing to their customers and major Internet players developing their own cloud to enable their services.

Drivers

The key drivers for datacenters market development are:

- Externalisation trend. Servers TCO and IT costs in general are very high for small businesses and larger firms as well, which turn to outsourcing to reduce their operations by sharing costs within a datacenter.
- Online content (especially video) consumption growth: the demand for datacenters

is skyrocketing as the overall traffic across all social platforms explodes as well. For instance, Facebook admits 2 billion photos are uploaded on its datacenters each month.

- SaaS applications trend: the SaaS applications popularity will conduct to the datacenter facility development
- New advanced IT servers able to handle massive computer power (more than 100 processors)
- New energy sources providing some free cooling, with the energy coming from waves (Google has a patent in that area), submarine areas, etc …
- Certifications (like Uptime) help to get a clearer vision of the capacities of a datacenter

Challenges

However some major issues still exist to ensure the development of datacenters to all users

- Energy will be more and more expensive and rare. Players clearly need to improve PUE. Managing costs (electricity bill) is a clear issue for hosting providers, because of energetic price increase
- Security issues, especially for strategic personal data. Despite several security systems implementations (firewalls, video surveillance), security issues remains the main hurdle to technology development.
- Datacenter location. Many potential customers do not want their data to be hosted in other countries, in which local regulations may allow local authorities to access the data.
- Green regulation could limit the development of datacenters, that already represent 2% of the worldwide consumption of energy (equivalent to the airline industry), while being only at early stage of development.
- Combination of skills of facility and IT. Industry players have so far limited solutions and limited expertise to really handle both types of operations.

2.9.3 COMPETITIVENESS OF EUROPE

Usage/sales

Most datacenters are for now located in the US. Main content is produced in the US (music, video…) and moreover main content storage (and sharing) platforms are also for most of them based in the US. Those are Flickr, Google Picasa for pictures contents and obviously Youtube for video content.

Furthermore, Internet giants (Google, Yahoo, Amazon, and Microsoft) are US-based. Hence, their datacenters are located within or near their headquarters. The social networking platforms like Facebook or Myspace multiply datacenters acquisitions in order to support their customers' profiles (and personal content such as photos).

Therefore, major cloud providers are US-based including Internet giants; hence their servers are located in the US.

In Europe, the main datacenters are located in Amsterdam, Paris and London (or Frankfurt), especially for broadband interconnection (GIX). Other datacenters in the world are also used for back-up and content replication.

Production/R&D

Most of the traditional software vendors are positioned on datacenters or are currently tackling to this enabler for their future business. Even some of them are building datacenters. In opposition, most IT services players are not positioned on datacenter facilities construction. They benefit from the diffusion of datacenters but usually have no role in their definition or prescription.

Major datacenters makers are from the US such as Rackable servers expert. Others like Google prefer to build themselves their own servers. Other equipment like switches and routers are also provided by players like Cisco, Juniper (both US players).

Telcos do not build datacenters. Telcos are providers of datacenter access services while traditional equipment vendors are those developing the technology. From mid 2009, they have launched some services based on datacenters, such as Cloud services.

Except a few small players on their domestic market, European players do not play a decisive role in this segment yet.

2.9.4 QUALITATIVE IMPACTS ON THE SOFTWARE INDUSTRY

The major impacts for the SSBS industry will be the following:

- Development of the cloud computing market. Datacenters are key elements for reliable and flexible development of cloud.
- New skills required. Expertise in non-IT aspects, regarding facility operations and energy savings, will become core competencies to operate a datacenter efficiently and offer IaaS services.
- Potential geographical shift. Like cloud computing in general, datacenter development could reshuffle the balance between the main regions. This should remain limited anyway due to current local and business regulation for data usage, storage and handling.

2.10 BROADBAND WIRED TECHNOLOGIES

2.10.1 STATE-OF-THE-ART

Broadband relates to multiple networking technologies, offering more than 512 Kbits per second for data transmission (the threshold is sometimes set lower than 512 Kbits, eg. 256 Kbits). There is no upper limit for broadband, with fibre-optic cable allowing now up to 100Mbps downlink for each user. Above 20 Mbits, we generally talk of ultra-broadband or very high speed broadband.

- The most widely used broadband technology, ADSL has spread rapidly in a great many countries. Faced with a demand for ever increasing speeds, several technologies have been developed, varying the bitrates on the copper pair. ADSL2 and ADSL2+ enable substantially higher speeds than ADSL: up to 10 Mbps for ADSL2, up to 20 and even 25 Mbps for ADSL2+. In Europe, ADSL is now the standard for broadband, but is already a very mature technology which is being either completed by VDSL or replaced by FTTx. Moreover, Data Over Cable Service Interface Specification (DOCSIS), defines the communications and operation support interface requirements for a data over cable system. It enables the addition of high-speed data transfer to an existing Cable TV (CATV) system. It is employed by many cable television operators to provide Internet access over their existing hybrid fiber coaxial (HFC) infrastructure. Indeed, operators feel less attractiveness to DSL nowadays and focus more on Fiber-To-The-Home roll out while cablecos concerns are DOCSIS 3.0 launches.

- VDSL (Very high bit rate Digital Subscriber Line) and VDSL2 make it possible to achieve even faster speeds: up to 50 Mbps for VDSL and 100 Mbps for VDSL2. But they also involve considerable rollout restrictions due to their short range. The distance over which the signal can travel unimpaired by crosstalk and other forms of interference on the copper pair is particularly short. Beyond 300 metres from the DSLAM, speeds drop dramatically. Technologies thus lose their appeal, and only deliver speeds comparable to those supplied by ADSL2+, i.e. around 25 Mbps theoretical. This is why VDSL is often used only in the last mile, in tandem with optical fibre. By guaranteeing bitrates, architectures for deploying VDSL are thus a combination of FTTC or FTTN optical networks then VDSL to the subscriber premises.
- Fibre: theoretical bitrates can vary in P2M configurations depending on the standards employed and the number of users, as bandwidth is shared between the users on the same tree (up to 32 users per tree, and up to 64 on a GPON). The BPON (Broadband PON) standard, based on the ATM protocol, makes it possible to deliver video with a dedicated frequency band. It supplies bitrates that can reach 622 Mbps and up to 1.2 Gbps downstream and 155 to 622 Mbps upstream, with a theoretical range of 20km. EPON (Ethernet PON) technology, using Ethernet packet transmission, enables theoretical symmetrical speeds of up to 1.25 Gbps with a theoretical range of 20km. And, finally GPON (Gigabit capable PON) is the fastest passive optical network architecture, in addition to having the longest range, delivering speeds of 1.2 to 2.4 Gbps downstream and 155 Mbps to 2.4 Gbps upstream, over a distance of around 60km.

2.10.2 MARKET DATA

Penetration of ultra-broadband in EU27 in 2008

Geographical areas	% of FTTH/B in total Broadband (Number of Subscribers)
Western Europe	1.5%
Eastern & Central Europe	2%
North America	2%
Latin America	4%
Asia	1%
Middle East & Africa	0%

Source: IDATE, 2009

Share of Broadband in Internet

	2007	2008	2009F	2010F	2011F	2012F
North America	75,8%	82,0%	86,9%	90,5%	92,8%	94,4%
Europe	75,3%	81,1%	84,8%	87,8%	90,3%	92,4%
Asia Pacific	65,9%	70,9%	76,0%	80,4%	83,4%	85,0%
Latin America	59,1%	70,8%	79,0%	78,4%	82,0%	84,3%
Africa & Middle East	21,5%	21,2%	24,2%	28,1%	30,9%	32,1%
Total	67,8%	72,5%	76,7%	80,0%	82,7%	84,1%

Source: IDATE

FTTx subscribers estimates and forecasts

	2008	2009	2010	2011	2012	2013	2014
WESTERN EUROPE	1 512 960	2 320 500	3 725 000	5 980 000	8 760 000	11 370 000	14 620 000
EASTERN & CENTRAL EUROPE	778 940	1 130 300	1 675 200	2 221 800	2 810 700	3 598 500	4 475 000
NORTH AMERICA	3 992 000	5 571 000	7 401 100	9 118 800	11 438 300	13 403 600	16 114 500
ASIA / PACIFIC	22 717 500	26 109 000	32 778 000	40 457 000	50 888 000	63 578 000	79 115 000
MIDDLE EAST & AFRICA	15 000	18 000	21 700	26 100	30 900	36 000	41 700
TOTAL WORLD	**29 016 400**	**35 148 800**	**45 601 000**	**57 803 700**	**73 927 900**	**91 986 100**	**114 366 200**

Source: IDATE, 2009

Broadband subscribers estimates and forecasts (in thousands)

	2007	2008	2009F	2010F	2011F	2012F
North America	77 951	88 698	99 181	108 078	114 844	120 124
Europe	111 012	130 038	144 398	160 397	176 592	191 566
Asia Pacific	117 792	146 366	197 120	281 555	383 226	487 770
Latin America	18 985	27 073	36 622	47 447	59 488	72 630
Africa & Middle East	6 099	8 346	11 347	14 633	18 174	21 784
Total	**331 839**	**400 521**	**488 668**	**612 110**	**752 325**	**893 873**

Source: IDATE

2.10.3 KEY DRIVERS AND CHALLENGES FOR BROADBAND

The broadband market is developing especially in Europe thanks to the following drivers:

- Companies and consumers requiring better performances especially in terms of bitrates as the Internet enables services needing more and more bandwidth (video SaaS etc…)
- Vertical markets moving to the Internet. Numerous activities that were traditionally only available can now be done online like communication search commerce or entertainment. The web has become a repository for digital knowledge giving high incentives for people to connect. Citizen activities can also more and more be done on the web.
- Packaged offering around triple play at cheap pricing (eg 30 EUR in France) in which telcos offer more and more additional services for free or at low cost. Broadband is also generally priced as “always on”.
- New broadband technologies offering additional performances and/or features like more upload limited latency additional quality of service for critical applications and additional security levels.

But there are still some major challenges to ensure the development of broadband to all end-users:

- Poor performances of some technologies depending on the customer environment. Major issue remains that bitrates depend on the distance between the central office and the customer premises, which is obviously a key challenge in rural areas or even in some parts of the suburbs.

- Very costly next-gen networks deployment whose rollouts require to make public works and to dig into the streets and buildings to install fiber cables. To address this issue many regulators try to find incentives to increase collaboration between Telcos through infrastructure sharing policies as way to reduce costs of deployments for instance. However, some of them are reluctant to mutualising investments efforts.
- Network congestion risk due to the exponential growth rate of the Internet traffic. Providing more bandwidth at the access level might not be sufficient if the core networks or metro networks get saturated as investments remain limited in those two areas.
- Asymmetric traffic getting more and more important as video is expected to represent 50% of all traffic in 2010. The broadband economics could have to be reconsidered especially around peering. Net neutrality concept could also be challenged beyond video with discrimination of quality of service depending on the type of applications or the type of players providing the applications.

2.10.4 COMPETITIVENESS OF EUROPE

Market

Europe has one of the major penetration rates for Internet usage in the world (around 80%). These high penetration rates are due to the quality of copper line generalised in Europe. Moreover, they are also linked to the popular triple play offerings especially in Western Europe. Finally, the Western Europe also leads this type of offerings thanks to the modest cost for such services.

Broadband is more developed in Europe than in North America or Asia Pacific even though Japan and South Korea are the most advanced countries regarding fibre. FTTx deployments (FTTH or FTTB) are also numerous in Europe especially in the Scandinavian area and Northern Europe (Sweden, Finland, Netherlands etc). However, cohesion and collaboration seem to lack. In the USA, major operators engaged a rough battle for fibre implementation. In Asia, especially in Japan FTTH is already a reality. Besides telcos, cable operators engaged a reflexion on the fibre implementation.

European telcos are the dominant players in Europe for broadband and control the broadband retail market. There are no significant telcos with stakeholders from outside Europe. Most of the activities of European telcos are performed within Europe for broadband, even though telcos might leverage their activities in mobile in Africa, India, and Latin America, to expand.

Production/R&D

The leading players in the networks equipment market are led by Cisco – a US-based player with 56% market share in 2008 (aggregated carrier and enterprise markets). Europe is also present with Alcatel but it faces a strong competition from the emerging countries providing low cost offerings like Chinese players Huawei and ZTE, which are being adopted by developed countries including countries in Europe.

A significant part of the R&D and production is therefore carried out outside Europe, even for equipment being sold in Europe. This is also true for set-top boxes generally manufactured in South East Asia.

Deployments of broadband and ultra-broadband networks are obviously performed locally and therefore involve local teams of engineers from both telecom carriers and equipment vendors (plus construction workers).

2.10.5 QUALITATIVE IMPACTS ON THE SOFTWARE INDUSTRY

Major impacts for the SSBS will be the following:

- Faster market development. The software industry should definitively benefit from broadband and ultra-broadband deployments to accelerate its development around Online delivery of software (either download of the full software or usage in the cloud) especially for delivering games in the cloud, but also from data-driven applications that are combining data coming from multiple data sources (internal or external databases on the web).
- Potential geography shift. With the ability to offer applications on the Internet directly to end user, the software industry may reorganise as applications could be

provided from any country (inside or outside Europe) unless restrictions apply on the (virtual) localisation of the data. Applications might therefore be developed outside Europe but could still be deployed within Europe. Except for very small companies, sales should mostly remain local, as customers will still need local support and advice to integrate with their legacy IT system which will only slowly shift towards the cloud.

- Requirements for advanced cloud infrastructure. Moving to the cloud will require players of the software industry to make sure they can handle sufficient availability and quality of service within the network. They will therefore need to develop or buy network resources to ensure strong performance of their services.

2.11 WHAT DOES THIS ALL MEAN?

Numerous technology trends could have a major impact on the development of SSBS and SBIS in the coming years. Depending on their availability on time, their cost and their level of adoption by end users (niche or mass market), they could help or not to accelerate the growth of the overall SBSS market and especially its Internet of Service part. They can therefore have a major influence in the development of the market, and need to be taken in account for prospective scenarios.

In the table below, we present how we have taken in account all those major drivers into our scenarios (baseline and theme scenarios). Some technology drivers have been directly integrated fully in the baseline scenario, especially for technologies with limited interaction with the theme scenario. Other technologies are already included in the baseline scenario, but not to their full extent. They are indeed either the leading driver of one of the scenario, or offer some additional leverage on one or two theme scenario.

Technology driver	Main market segments impacted	Scenario in which the impacts are integrated	Scenario without direct additional impacts (compared to baseline)
Artificial Intelligence	- Major potential impact on IT Services segments, and software development in particular. Human capital is replaced by software capital. - Impact on SBIS segments including: cloud infrastructure, Web 2.0 SOA and Semantic Web.	- The baseline scenario embeds this driver. Although the impact is expected to remain weak over the period of analysis. - In the loud computing scenario the AI impact is more important: it is part of the key drivers of the cloud models.	- Offshore scenario: AI goes against the offshore model by replacing human capital with software.
Semantic Web	- Major impacts on search engines therefore on online (SBIS) and mobile advertising (consumer search engines rely heavily on revenues coming from sponsored links) - Moderate impacts on Web 2.0 (whose revenues also come from advertising) - But other software markets should also be concerned, especially within some vertical industries handling large databases	- Baseline scenario	- Offshore scenario - Cloud scenario to a lesser extent (semantic web can help to develop without advanced infrastructure)

Technology driver	Main market segments impacted	Scenario in which the impacts are integrated	Scenario without direct additional impacts (compared to baseline)
Information Management	- A important enabler at the infrastructure level for most SBIS segments: Cloud computing, Semantic Web, SOA… - Information management is also an important growth driver of licences and IT services segments as a key enabler of the Smart-x innovations. - Internet of Things will be impacted due to huge amount of data generated by these technologies	- Baseline scenario - Cloud scenario to a lesser extent.	- Offshore scenario
Security	- An important enabler and driver of adoption of most SSBS (and in particular SBIS) segments: Cloud Computing, Semantic Web, Web 2.0, IoT, M2M, Mobility…	- Baseline scenario - Cloud scenario: security is a key driver of a faster adoption of the cloud models. - Mobility scenario	- Offshore scenario
Interoperability / standards	- Major positive impacts on all SSBS segments - Major impacts on cloud infrastructure platforms and on the SBIS segment as a whole.	- Open Source Scenario - Cloud computing scenario	- Offshore scenario

Technology driver	Main market segments impacted	Scenario in which the impacts are integrated	Scenario without direct additional impacts (compared to baseline)
Virtualization	- Major SBIS impact: virtualization is an intermediary step to build private clouds potentially leading to public clouds.	- Baseline scenario - Major impact in the cloud scenario. - Open Source and offshore scenario to some extent.	-
Datacenter	- Major impacts on cloud infrastructure (IaaS) and therefore on other cloud segments like PaaS and SaaS - Key enabler for most of SBIS segments (Web, mobile, online games) - Internet of Things will be impacted due to huge amount of data generated by these technologies	- Cloud scenario (some effects already included in the baseline scenario) - Some impacts into the offshore scenario	- Open source (except for web servers that could be open source) - Mobility scenario

Technology driver	Main market segments impacted	Scenario in which the impacts are integrated	Scenario without direct additional impacts (compared to baseline)
Digital Identity	- Major impacts on web 2.0 and advertising (more targeting, more social graph interactions). - Some spillovers in the e-commerce and for citizen services, leading to higher consumption of cloud services - Some impacts in mobility, with both software-based solutions and hardware-based solutions (ID card, biometrics)	- Baseline scenario (some additional limited effects in the cloud and mobility scenarios)	- Offshore scenario
Ubiquituous Networks	- Major impacts on mobility applications (paid or ad-funded, online or offline) and to a lesser extent on M2M	- Mobility scenario (some effects already included in the baseline scenario) - Some impacts in the cloud scenario as indirect spillovers from mobility	- Offshore scenario

Technology driver	Main market segments impacted	Scenario in which the impacts are integrated	Scenario without direct additional impacts (compared to baseline)
Ultra-Broadband	- Major impacts on Paid-Web Based in general, especially for cloud applications - Strong impact also on advertising as higher speeds enable more web usage	- Cloud scenario (some effects already included in the baseline scenario). - To a lesser extent, offshore scenario.	- Mobility scenario
RFID	- Moderate impact on the M2M and mostly on Internet of things market segments. But the impact for all SSBS market will remain small as other key infrastructure elements are also required (spectrum, IT infrastructure) and will not be available for business models reasons. - Some spillovers on mobility applications and services	- Baseline scenario (some additional limited effects in the mobility scenario)	- Offshore scenario - Open source scenario

CHAPTER 3

EMERGING MARKETS AND THEIR POTENTIAL IMPACTS ON THE SBIS INDUSTRY

The objective of this part is to present eight SSBS key market sub-segments and their estimated evolutions over the 2007-2020 period. Each sub-segment related part presents the market figures and details qualitatively the expected evolutions (market penetration in 2013 and in 2015, drivers, and barriers), as well as the main assumptions retained for the forecast exercise. It also presents an analysis of the players in each segment and how their positioning should evolve with the future development of the segment.

For the quantitative analysis part of each segment, the consortium has chosen to focus only on the division by revenue model rather than by software types. Chapter 5.1.1 has shown that SSBS breakdown by software type should merely change in the next few years. Rather, most changes are expected to occur on the revenue model breakdown (cf. chapter 5.1.2).

3.1 MOBILE APPLICATIONS

3.1.1 MARKET FIGURES 2008-2020

Market size in million EUR

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU27	5529	6585	7087	8460	10286	12552	15076	17622	20050	22393	24707	26894	29078	31338
AsiaPac	6433	7783	8628	10391	12763	15192	17701	20442	23089	25819	28569	31301	33978	36428
NA	6345	7466	7883	9320	11234	13595	16215	18916	21641	24441	27271	30051	32824	35530
ROW	1675	1782	1630	1690	2172	2826	3687	4710	5747	6887	8031	9014	10068	11266
World	19982	23617	25227	29862	36456	44164	52680	61691	70527	79540	88579	97260	105948	114562

Revenue breakdown in million EUR (worldwide)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	5608	6261	6194	6846	7697	8552	9346	10232	11119	11986	12922	13791	14733	15615
IT Services	11929	13439	13536	15294	17445	19701	21878	24218	26603	28965	31539	34017	36710	39281
Paid web-based	1527	2414	3459	4798	6933	9183	11608	14153	16631	19334	22013	24698	27370	30283
Advertising	917	1503	2038	2924	4381	6729	9848	13088	16175	19255	22104	24754	27135	29383
Total	19982	23617	25227	29862	36456	44164	52680	61691	70527	79540	88579	97260	105948	114562

Revenue breakdown in million EUR in EU27

EU27	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	1578	1800	1835	2081	2342	2616	2861	3124	3402	3676	3962	4230	4518	4788
IT Services	3610	4116	4215	4833	5519	6253	6951	7688	8456	9221	10042	10836	11697	12518
Paid web-based	253	513	816	1221	1883	2694	3661	4610	5492	6346	7152	7878	8562	9332
Advertising	89	156	221	324	542	989	1602	2200	2700	3150	3550	3950	4300	4700
Total	5529	6585	7087	8460	10286	12552	15076	17622	20050	22393	24707	26894	29078	31338

3.1.2 MOBILE APPLICATIONS - MARKET TRENDS

Segment	**Mobile applications**
Drivers	• Development of mobile Internet (more than 200 million active users in 2013, more than 325 million active users in 2020 for EU27) • Adoption of smartphones by professional users and part of the consumer market • Mobile gaming for the consumer paid web-based market • Extension of applications towards the mobile handset with dedicated mobile interfaces (leveraging cloud infrastructure)
Barriers	• Commoditisation of infrastructure software products like operating systems (loss in value) • Bundle with desktop applications and mobile applications offered in some cases as a free/included extension (no additional value)
Market penetration in 2013	5.3 % of total SSBS market in EU27 - A key sub-segment of the SSBS with huge potential for growth - Asia-Pacific to be the dominant region thanks to its early leadership and development in Japan and to a less extent in Korea. Market mostly oriented towards consumers. North America trailing Asia-Pacific thanks to fast development in enterprise applications and mobile Internet advertising. Europe

Segment	Mobile applications
	as strong contender. - Growth coming mostly from paid-web based applications (enterprise apps, consumer apps) rather than mobile advertising remaining very low compared to other forms of digital advertising
Market penetration in 2020	8 % of total SSBS market in EU27 - A significant share of the SSBS market, which should continue to grow - Asia-Pacific still in the lead, thanks to developments in China and India, but North America closing the gap. Europe as a challenger. - Growth coming mostly from paid-web based applications rather than advertising (while mobile advertising would be predominant in emerging countries reaching Internet first through mobile rather than PCs)
Main assumptions for the Baseline Scenario	- Very limited growth of shipments of new phones in EU27 - rising share of smartphones in shipments of new phones (reaching more than 50% in 2020) - ARPU x3 for consumer paid applications in 2020 compared to 2009 - Major growth phase from 2008 to 2014 (except Japan or Korea already more advanced) with the first developments of mobile Internet, then lower significant growth - Mobile advertising becoming significant by 2011 in EU27, due to usual latency between usage development and allocations of budget - Mobility still restricted to only a few people, especially business-wise (below 20% of employees) - Mobile cloud computing becoming significant from 2015, with growth accelerating afterwards. Similar development to SaaS in general but with some lag.

3.1.3 MOBILE APPLICATIONS - POSITIONNING OF SSBS PLAYERS

Mobile applications	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- Large ISVs are all providing some form of extensions/plug-ins of their traditional applications on the mobile devices. It is often provided within a bundle. - A few additional players have emerged in the tools software segments (like Opera for browsers) - In the infrastructure space open source platforms are much more developed than on the PC devices. Major initiatives are coming from the U.S. (Android / Google, Moblin / Intel, Chrome OS / Google). Major initiative in Europe with Symbian / Nokia.	- All types of EU players could benefit from additional growth from this market extension - All developers have therefore to be able to address those different platforms, generally not interoperable, to benefit from the mobile software market. To benefit from it, they will need to make sure they are supporting the key mobile operating systems and distribution platforms (which are numerous). Players that can have access faster access to APIs and SDKs associated of those platforms may have some advantage.
IT Services Providers	- IT services providers offer typical integration and porting services, in complement of their PC-based activities. - Some first initiatives in the area of mobile payments.	- IT services providers should prepare to even more porting of applications on mobile handsets, but also of the integration of additional data coming from mobile phones in the traditional IT systems. - Mobile devices as a new communication / distribution channel for companies of all sectors. Major opportunity for IT Services companies that will help companies adapt their customer related processes to this platform (in the m-commerce / mobile payments domains in particular).
Telecom	- Except in Japan, telcos have had so far limited impact on mobile	- European telcos still have major assets to benefit from the mobile SBSS

Mobile applications	Current positioning	Future Positioning
Operators	applications. They offer only a few applications and used to control Internet usage through their portals, but most of the traffic is now going off-portal. - Telcos are trying to get positioned as software distributors through the recently announced association of 24 telcos and device manufacturers - They have also already opened to third parties developers to organize a legitimate ecosystem around their own platforms and accelerate innovation and software production	market. They have some strong control of the handsets (that they sell with subsidies) and can preinstall many applications for easier usage. They have the necessary skills to manage the most challenging services that will require strong knowledge of network, software and hardware (sensors). They can also design network-centric applications (LBS, identity management) and tools (audience measurement for advertising) leveraging the nature of the network.
Internet Players	- Internet players are leading the transition from PC-based to mobile-based Internet for consumer with applications and more recently infrastructure software (operating systems). - No major role from EU Internet players in the market. But all usual EU Internet players offer extensions of their PC-based services on the mobile handsets.	- For EU players, the mobile services are at least an extension of their current software offerings that can be monetized through additional paid services and/or mobile advertising. They could even create new applications for mobile, by leveraging domains in which EU has some technology advance (3D) or market advance (device penetration). - They will need a faster development of the mobile advertising market, which can be obtained with more ad standards for format, pricing and performance measurement.
Others	- Major device manufacturers are trying to offer software in complement of their devices. Apple is the clear leader in that segment with the AppStore. Nokia	- Like on the web, many players from other vertical industries will also develop their own software-based services on mobile. They would most

Mobile applications	Current positioning	Future Positioning
	is also trying to follow the same path with numerous initiatives and/or acquisitions (Symbian, Ovi, Navteq, Advertising, etc…). Other device manufacturers are also replicating to a lesser extent this approach. Device manufacturers could have a major impact (as Apple has already) around the distribution of software-based services. - A few pure players have emerged directly as mobile software developers. Most of them have had little impact except for content (out of the scope)	likely turn to software providers, which would lead to market growth in value and additional usage (market growth in volume). - Device manufacturers could have negative impacts on the industry growth by either embedding or promoting some of their own software. For regular users, it would be hard to change settings/parameters and would lead to limited choices. - Like telcos, device manufacturers could develop mobile-centric services optimizing the usage of their own hardware and providing major differentiation with PC-based mobile adaptations.

3.2 WEB 2.0

3.2.1 MARKET FIGURES 2008-2020

Geographical breakdown

Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU 27	320	567	884	1392	2041	2745	3680	4705	5751	6719	7779	8696	9550	10497
North America	1413	1916	2541	3168	3896	4651	5600	6607	7430	8204	8875	9685	10326	11228
Asia Pacific	746	1232	1704	2200	2673	3169	3627	4138	4361	4852	5253	5650	6110	6615
ROW	10	37	51	111	194	301	365	443	528	657	806	994	1193	1414
Total World	2489	3752	5179	6871	8805	10866	13273	15893	18069	20432	22712	25025	27178	29755

Revenue-type breakdown (World)

WORLD	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	313	517	850	1299	1850	2489	3162	3910	4658	5474	6290	7140	7956	8840
IT Services	469	714	1082	1525	2004	2401	3162	4236	5046	5930	6679	7582	8281	9201
Paid web-based	769	1136	1606	2200	2850	3600	4286	4800	5100	5300	5400	5300	5150	5000
Advertising	938	1385	1641	1848	2101	2376	2663	2947	3265	3728	4343	5003	5791	6714
Total	2489	3752	5179	6871	8805	10866	13273	15893	18069	20432	22712	25025	27178	29755

Revenue-type breakdown (EU27)

WEB 2.0	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	45	90	168	314	510	755	1050	1371	1717	2066	2434	2745	3077	3391
IT Services	68	124	214	368	553	729	1050	1485	1860	2238	2584	2915	3203	3530
Paid web-based	71	114	177	264	399	540	696	816	969	1007	1080	1113	1030	1000
Advertising	136	240	325	446	579	721	884	1033	1204	1407	1681	1923	2240	2576
Total	**320**	**567**	**884**	**1392**	**2041**	**2745**	**3680**	**4705**	**5751**	**6719**	**7779**	**8696**	**9550**	**10497**

3.2.2 WEB 2.0 – MARKET TRENDS

Segment	**Web 2.0**
Drivers	- Increasing number of users of social networking services (growth in value) and associated intensity of usage - Purchases of virtual items and objects to personalise profiles (similar to logos/ringtones purchases in the mobile space) - Advertising revenues, especially on big social networking services becoming major entry points of traffic on the web - Spillovers of web 2.0 to the enterprise side
Barriers	- Commoditisation of major building blocks technologies of Web 2.0 (loss in value) - Low-key technologies requiring minimal integration and IT services - Mostly additional features to existing applications rather than standalone applications (therefore limited additional value) - Privacy policies restricting the use of data for targeting
Market penetration in 2013	**1.3 % of total SSBS market in EU27** - A very small share of the total SSBS market in EU27, due to difficulties to monetize enterprise apps (limited value added, collaborative tools segment is already a developed market)

Segment	Web 2.0
	- North America as the leading region thanks to better diffusion of enterprise apps towards SMBs and stronger social networks able to generate significant revenues through advertising. Europe catching up on AsiaPacific, which was more advanced thanks to virtual purchases on social networks like Cyworld and QQ. - Low adoption of virtual purchases in EU27 compared to advertising revenues (the situation is opposite worldwide). Advertising and paid-web based almost at the same level.
Market penetration in 2020	**2.7% of total SSBS market in EU27** - Still a minor market overall, but a significant share of the online advertising market moving towards more targeting - North America still the leading region, but Europe closely trailing behind and catching up on both advertising and enterprise applications. - Decline of virtual purchases while advertising still growing (users still use virtual items but find a way to bypass stores, by creating them themselves), especially through the exploitation of the large databases.
Main assumptions for the Baseline Scenario	- Strong growth of virtual purchases until 2014 (users find more and more ways to still use those items without paying for them or even create them themselves). Decline from 2016 to 2018 depending on the regions - Introduction of efficient semantic and targeting/datamining technologies by 2012/2013 to leverage profile databases, leading to additional growth for online advertising from 2015 - Growth of Web 2.0 in 2 phases in EU27 : mostly between 2008 and 2012 for existing services and from 2015 for impacts of semantic technologies

3.2.3 WEB 2.0 – POSITIONNING OF SSBS PLAYERS

WEB 2.0	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- All types of ISVs are offering some Web 2.0 features within their software, as Web 2.0 has become mainstream. Major players impacted are the ones from the collaboration and communication tools market (like Microsoft Sharepoint) and to a lesser extent intranet and extranet players. - Like for enterprise software in general, the US is the leading market and is dominated by US-based players.	- There are no clear potential opportunity for EU players, except adding Web 2.0 features to their existing products. There should be more opportunities with semantic web (see below) on which no leadership is established yet.
IT Services Providers	- IT service providers are both in charge of integration of simple tools within current applications and custom developments for enterprises (both for internal and external uses). Although market opportunity remains small. - They can often compete with ISVs as developing from scratch may be faster (on open source bricks). Innovative aspects on the Web 2.0, from a technological point of view, are moderate and can be easily mastered by IT service providers (ajax, RSS, wiki, etc…)	- IT service providers are very likely to offer Web 2.0 integration at low-cost to sell bigger projects (collaboration, PLM, progreassive manufacturing…). They could therefore contribute to the acceleration of the commoditization of the market. - The pure Web 2.0 market potential for these players should nonetheless remain limited.
Telecom Operators	- Telcos are not really positioned on this segment for consumer aspects, except for blogs (replacing home page publishing). A few of them have been offering copies of popular Web 2.0 services, but without success. Other provide aggregating services of third	- Telecoms have numerous options to develop in this segment, which represents anyway limited opportunities in value. Major options are enhanced communication tools mixing traditional communication services (voice, SMS, etc..) and new

WEB 2.0	Current positioning	Future Positioning
	party social networks, especially on mobile. Most of those services are free, with limited advertising revenues. - Web 2.0 features are integrated within telcos collaborative tools for professional, but without clear value added.	Web 2.0 tools, advanced digital ID system combined with social graph (telcos having big assets with SIM number, IP address and call data records) and to a lesser extent advanced advertising (datamining, targeting). Finally, they could offer specific APIs based on network features. - If they do not develop in this segment, they could be negatively impacted, as many web 2.0 services could at least partly cannibalize their services, especially for communication.
Internet Players	- Internet players are obviously the leading players of Web 2.0. It should be noted that most of the major developments in Web 2.0 have come from mostly new players (MySpace, Facebook or more recently Twitter) rather than existing Internet giants (Google, Yahoo!, etc…), which have been trying to catch up (Wave, Buzz), but have mostly failed so far unless they acquire a flagship Web 2.0 product (FlickR, YouTube, Blogger) - Major Web 2.0 players, both in the consumer and professional are US-based like for the Web. But a few EU players stand out, especially on the professional or semi-professional offerings (Xwiki, etc …)	- Like for telcos, major opportunities are around communication tools, social graph and datamining. On the first aspect, EU could advance faster than other regions, especially with the advance on VoIP (both on boxes and softphones). On the second aspect, cultural aspects could come into play, even though leading consumer Web 2.0 players in Europe are US-based. Mashups are another way to create value and could be accelerated by policies favoring user-generated innovation. - There may be more opportunities for EU in Web 3.0, especially Semantic Web. The technology should bring more value added. EU has also more opportunities, as this technology is more related to language aspects and semantics in which EU is a leading

WEB 2.0	Current positioning	Future Positioning
		region.
Others	- All vertical industries are trying to develop their social networks on their own, but do not generate any revenues (the service is positioned as free complement to their traditional services like air transportation). They do not represent a threat yet for incumbent players, as those networks remain small	- Vertical industries players should not represent real threats for the software industry players as most developments would remain internal. But they could have a negative impact in terms of value by developing it on their own without buying any products (many of them have open source versions)

3.3 INTERNET OF THINGS

3.3.1 MARKET FIGURES 2008-2020

Geographical breakdown

million EUR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU27	150	200	250	450	825	1250	1510	1650	1820	2000	2180	2320	2460	2530
NA	300	420	525	810	1150	1500	1800	2050	2250	2400	2570	2700	2820	2870
ASIA/PAC	250	300	340	410	600	825	1075	1300	1450	1550	1650	1750	1820	1900
ROW	50	80	105	130	225	325	365	400	430	450	500	580	670	800
WORLD	750	1000	1220	1800	2800	3900	4750	5400	5950	6400	6900	7350	7770	8100

Revenue-type breakdown (World)

WORLD	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	300	350	403	540	812	992	1078	1172	1234	1241	1269	1282	1271	1237
IT Services	450	650	817	1260	1988	2808	3373	3703	3971	4229	4527	4794	5034	5214
Paid web-based	0	0	0	0	0	100	200	345	475	600	720	850	1000	1150
Advertising	0	0	0	0	0	0	100	180	270	330	385	425	465	500
Total	750	1000	1220	1800	2800	3900	4750	5400	5950	6400	6900	7350	7770	8100

Revenue-type breakdown (EU27)

EU 27	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	60	75	85	140	240	335	405	425	440	440	425	410	400	380
IT Services	90	125	165	310	585	905	1065	1140	1230	1320	1420	1490	1570	1600
Paid web-based	0	0	0	0	0	10	30	60	105	160	220	270	330	375
Advertising	0	0	0	0	0	0	10	25	45	80	115	150	160	175
Total	150	200	250	450	825	1250	1510	1650	1820	2000	2180	2320	2460	2530

3.3.2 IOT – MARKET TRENDS

Segment	**Internet of Things**
Drivers	- Ongoing improvements of RFID technologies and processes to handle most of the vertical environments - Development of NFC mobile phones, which would still represent only a small share of mobile phones but would significantly increase the volume of RFID readers - Business models providing clear ROI within a few vertical industries (like textile, cultural goods, automotive for now) for cost optimisation and subsequently for development of additional services
Barriers	- Development of a new infrastructure in parallel to the Web (readers, software, platforms) mostly from scratch, which requires huge set-up costs - RFID tag cost not adapted to some applications and/or vertical markets - Privacy restrictions making it difficult to use RFID for customer-facing applications and for return logistics - Unclear business models in most of the vertical industries, especially for RFID costs sharing in the supply chain - Governance of new platforms in charge of Internet of things - Market very dependent on the economic growth of vertical sectors like retail.
Market penetration in 2013	**0.53% of total SSBS market in EU27** - A very limited part of the SBSS market, as most of the market remains offline, and closed-loop deployments (ID cards and access badges). Developments limited to only a few vertical markets developing their own platforms.

Segment	Internet of Things
	- North America as the leading region, but Europe close behind. Europe benefits from several specific regulations (spectrum, privacy, standards, vertical organisation). - Most of the market coming from extensions of existing ERP, SCM and CRM software and custom integration of larger databases to manage products as individual items rather than categories.
Market penetration in 2020	**0.65% of total SSBS market** - Still a very small part of the SSBS market, even though first IOT services are being offered within a few vertical industries. IOT services are mostly B2B services for the supply chain within semi-open loops. - No real leading region. All markets developing very independently. - Around 20% of the market coming from IOT services. Advertising remaining low, as most of services are B2B-oriented. A lot of consumer services developed around IOT are also offered for free to encourage the purchase of some products.
Main assumptions for the Baseline Scenario	- No public infrastructure, but developments of shared infrastructure within some vertical markets, mostly for B2B processes - Strong growth from 2008-2013 with adoption of RFID within industries that have adequate ROI - Development of first IOT services by 2012/2013, mostly in B2B environments

3.3.3 IOT - POSITIONNING OF SSBS PLAYERS

IoT	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- Large ISVs are positioned in those segments, especially those from SCM (supply chain management) like Manhattan Associates – or in the Maintenance Repair Overhaul (MRO) with IBM in particular. But all major enterprise software players (ERP, CRM to a lesser extent) are also concerned and offering some software to integrate in their systems the new data coming from IOT. - A few small ISVs have appeared specially in this field (like OAT Systems). Many applications are extensions of the usual vertical applications. - New players have emerged around middleware to manage locally data collected on-site from RFID hardware. The middleware is in charge of interfacing with enterprise applications. - Like for enterprise software in general, US-based are leading the market.	- EU players may be able to develop efficient middleware and vertical apps for the open loops scenario. The closed loop scenario is merely an extension of current systems, while the future IOT will require new paradigms to handle loads of data into information systems. Those systems will need some intelligence. - They will also have to adapt to local and vertical regulations, for which EU players may be better positioned. - Strong ties in between R&D labs and the industry are also required in Europe to create the future players in this field.
IT Services Providers	- IT services providers help users extend their IT systems in order to feed more data into existing apps. They continue to be mostly positioned at the horizontal or vertical application level (with or without IOT), and more and more at the middleware level. - Some of them have made huge investments in the RFID space like	- IT Service s providers will develop more middleware solutions to efficiently manage the new data. They will also be key to integrate the different technologies as well as help companies to develop some of the business models that will leverage these technologies to provide innovative services to external

IoT	Current positioning	Future Positioning
	IBM, and are therefore key in the IOT software space.	consumers (open loops). - They will also have to adapt existing IT systems and may be redesign them to handle all the IOT data. - IT is important to note that IoT should remain a small market over the forecasted period. - European IT Services providers will be key to bring the technological as well as functional domain expertise that are required for such complex projects
Telecom Operators	- Most telcos (BT, FT, Telekom Austria…) are currently positioned on IoT as IT integrators on closed loop solutions, competing with traditional IT services providers. Initiatives are of small scale compared to those of IT service providers - Orange is also managing the ONS for Europe, which is the only real IOT service discussed so far.	- Telcos will try to leverage their network connectivity activities (and also their indirect sales of mobile devices) to offer next gen IOT services (database management, identification of objects, discovery of services) requiring remote connections and the associated platforms to handle the data. Europe's leading telcos could become flagship players in this domain, which requires in open loops good skills in both software and network. Their positioning on these markets should be very close to the ones they adopted for EDI (Electronic Data Interchange).
Internet Players	- Major Internet players are not really positioned yet in that market, which is too far from their traditional services and business models. This could be closer to e-commerce providers, but no player want really to finance the necessary investments. - First initiative from Google with its	- The development in this segment is clearly hampered by unclear business models. Internet players could get involved, especially with their data-mining solutions helping to make correlations between data. But they will wait for the IOT infrastructure to be developed at first.

IoT	Current positioning	Future Positioning
	partnership with Withings (connected scale).	
Others	- Retailers around major distributors (Wal-Mart, Metro) and EPC are setting the tone for IOT in closed and open loops, regarding all aspects from tags to IT integration. They are the key players, as they could handle billions of things everyday. All those players are used to implement major internal software developments, but they also rely heavily on traditional SSBS players. This is in fact more an opportunity to make sure this market will develop faster. - RFID tags providers are also providing some software applications and tools. But their offering is limited and they do not have enough resources and skills to handle it. The threat is minor for SSBS players. - There are even very small providers bundling hardware and software for consumer products (Violet, Withings, etc…)	- Retailers, directly or through EPC, are expected to increase their presence into the main software specifications for product manufacturers to exchange with them. Manufacturing, logistics and transportation companies will also play a major role. No clear standardization is expected for closed loop solutions, but will be developed for true IOT services in open loop. - The involvement of retailers and other big players (like DoD) giving purchase orders can accelerate the market development.

3.4 WIRELESS MACHINE-TO-MACHINE (M2M)

3.4.1 MARKET FIGURES 2008-2020

Geographical breakdown

million EUR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU27	2168	2700	3000	4000	5150	6400	7680	8986	10333	11573	12731	13749	14712	15594
NA	1735	2100	2200	2900	3850	5000	6350	7874	9449	11055	12603	13989	15388	16773
ASIA/PAC	1054	1250	1450	1800	2350	3200	4256	5405	6594	7781	8948	10022	11024	12017
ROW	506	835	1060	1700	2298	2808	3370	3976	4573	5121	5736	6481	7454	8646
WORLD	5463	6885	7710	10400	13648	17408	21656	26241	30949	35531	40018	44242	48578	53030

Revenue-type breakdown (million EUR)

WORLD	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	1495	1785	2050	2570	3350	4300	5400	6588	7774	8784	9663	10436	11062	11615
IT Services	3968	5100	5550	7620	9900	12500	15250	17626	19957	22117	24247	26005	27804	29705
Paid web-based	0	0	110	210	398	608	1146	1983	3132	4479	5868	7452	9241	11089
Advertising	0	0	0	0	0	0	20	44	86	150	240	348	470	621
Total	5463	6885	7710	10400	13648	17408	21656	26241	30949	35531	40018	44242	48578	53030

Revenue-type breakdown in EU27 (million EUR)

EU27 M2M	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Licenses	550	670	770	980	1270	1560	1955	2200	2500	2770	2965	3120	3250	3310
IT Services	1618	2030	2190	2935	3700	4590	5373	6151	6823	7368	7951	8383	8799	9196
Paid web-based	0	0	40	85	180	250	345	620	980	1385	1740	2145	2530	2920
Advertising	0	0	0	0	0	0	7	15	30	50	75	101	133	168
Total	2168	2700	3000	4000	5150	6400	7680	8986	10333	11573	12731	13749	14712	15594

3.4.2 M2M – MARKET TRENDS

Segment	**M2M**
Drivers	- Savings generated through M2M, mostly around travel costs, bad data recording and reduced machine downtime - Vertical players, either machine manufacturers or service providers, developing subscription-based business models beyond traditional one-shot sales - Telcos providing specific M2M pricing and organising the ecosystem

Segment	M2M
	- Reuse of mature technologies, especially wireless/cellular solutions for moderate costs - Public policies and regulations requiring more frequent monitoring, for which M2M is an answer - Spillovers of B2B developments in the B2C markets (especially around cars and meters and/or alarms for domotics)
Barriers	- Mostly fixed costs for M2M projects, especially for software. This makes it harder to extend M2M beyond huge scale projects, which are by nature slow to develop (they require huge commitments) - Fragmented value chain, as many big players are just entering the M2M field. Many small players do not have the appropriate resources to handle big projects. - Commoditisation of M2M modules has led to exits of major device manufacturers. New hardware players may have more limited software interfaces, which are key to articulate with legacy IT systems. - Market very dependent on the economic growth of vertical sectors like utilities or automotive.
Market penetration in 2013	**2.7% of total SSBS market in EU27** - An emerging market enjoying strong growth, but with a clear gap between growth in volume (35%) and in value (25%) - Europe as the leading market thanks to early development and encouraging of local regulations in major vertical markets (regulations are not related to M2M, but are imposing automation) - Most of the software revenues coming from offline developments (extension of traditional business software plus integration of new data collected within IT systems). M2M developing mostly for B2B usages.
Market penetration in 2020	**4% of total SSBS market in EU27** - A growing market in volume, but experiencing more limited growth in value (in line with the software industry) - Europe not anymore the leading market, but very close to North America, which is taking the lead through better adoption of IT by vertical

Segment	M2M
	markets. - First major developments in the B2C markets using connectivity already in place in key machines like cars or home equipment. Advertising remaining very low, as many applications will be offered for free by the equipment vendors, while paid-web based services getting really popular and getting a share of the licences market through SaaS interfaces.
Main assumptions for the Baseline Scenario	- Revenue per unit dropping significantly as the M2M market reaches devices with low value per unit or with limited connectivity needs, like smart meters or security alarms. - Successful developments beyond fleet management and security within other vertical markets like utilities, consumer devices and home automation - Peak of growth early on in 2010 with first smart grid initiatives, which represent the bulk of the market in volumes.

3.4.3 M2M – POSITIONNING OF SSBS PLAYERS

M2M	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- Most of the ISVs in this space specializing in M2M are small players. While there are a great many vertical solution suppliers in Europe, there are only a few horizontal M2M software infrastructure specialists from Europe, unlike the US market, which is gradually taking shape. Main software players like SensorLogic and Nphase are US-based, but are generally too small to address the markets and need strong partnerships. Many of them have acquired by bigger players like Qualcomm for NPhase (this is also true in Europe with Anyware by	- As the EU market is more advanced, there are many opportunities to further develop in that market, especially by specializing on a vertical market (electrical equipment, aerospace…). - Development has been pushed in Europe by many vertical regulations favoring automated monitoring and tracking of equipments or of data. Pushing further in that direction would encourage even more M2M development and associated software spending. - Strong ties in between R&D labs and

M2M	Current positioning	Future Positioning
	Wavecom, which is now Canada-based Sierra Wireless). - Traditional vertical software ISVs are also positioned in this segment, even though M2M is marginal for them.	the industry are also required in Europe to create the future players in this field.
IT Services Providers	- IT integrators in the M2M space encompass both small providers and traditional IT powerhouses like IBM, giving so far no clear competitiveness advantage for Europe. - They are mostly in charge of custom developments, which address very specific specifications by vertical industry.	- IT service providers will handle many upcoming projects, as the market is vertically-driven and requires therefore a lot of customization and IT tweaking. - European IT Services providers will be key to bring the technological as well as functional domain expertise that are required for such complex projects
Telecom Operators	- Telcos are key players of the M2M market, with traditional carriers (mostly incumbents) and small MVNOs offering advanced telecom services. European telcos, especially Telenor, France Telecom, Vodafone and Telefonica are also among the dominant players in terms of volume for cellular M2M. - But their offering is so far mainly about module and network connectivity, with limited software-related aspects. All telcos have M2M SIM management platforms that help to activate products. A few telcos are trying to offer their own development platform, but most of them focus their efforts on either pure network solutions (they only sell SIM cards) or fully packaged vertical solutions (they bundle the machine with the service). The middleware they provide is therefore generally very basic.	- Telcos should definitely play a key role in the future of the software for M2M, as they will more and more offer directly or by combination with other players from the ecosystem full solutions integrating software (FT has acquired Silicomp an ITS firm with a strong M2M positioning in France). - As major module vendors have progressively disappeared, telcos are now the players with the most resources to organize and centralize the market. Europe could then benefit from the telcos advanced positioning to leverage a stronger position in the software industry. - They could also develop more efficiently by targeting a few vertical industries.

M2M	Current positioning	Future Positioning
Internet Players	- Internet players have almost not entered this market, which is mostly developing around professional solutions rather than consumer solutions. A few players are just offering software to connect M2M data with web interfaces like Google with smart meters. Some of their APIs can also be used in combination with M2M data like Google Maps, but the mashup is generally operated by a third party. The impact on the market remains marginal. - There are no real significant EU players in this market.	- The opportunity is limited for all Internet players in the short term. Most likely, they could offer data management solutions for M2M consumer products, helping people manage their connected products from a central web interface, integrated in profiles in Facebook or in widget galleries of Google or Yahoo!. - This could happen more easily with standard and interoperable solutions, which not very likely to be developed by product manufacturers, unless a clear partnership is established.
Others	- Module manufacturers of M2M have been key players in this market, with leaders in Europe like Wavecom (recently acquired by Canada-based Sierra Wireless), Telit or Cinterion (spin off from Siemens). But those players are of small scale and all major equipment providers have gotten out of this market with spin-offs or acquisition (Nokia, Siemens, Sony-Ericsonn, Kyocera, etc…) and are now being challenged by Chinese players like Simcom. They will offer less and less software directly, except for the software embedded in their modules. - There is therefore no threat for incumbent players, except potentially from Chinese players, which focus mostly on low-cost hardware anyway.	- Vertical players from outside the SSBS could also enter this market. But they will most likely either turn to software providers (service players) or develop solutions for their internal usage (machine manufacturers). - There should be no major consequences for SSBS players, except limited cannibalization coming from internal developments.

3.5 ONLINE ADVERTISING

(Reminder: online advertising takes into account only what can be accounted as software; overall, online advertising including Internet content-based services is bigger).

3.5.1 MARKET FIGURES 2008-2020

Geographical breakdown 2008-2020 (Millions Euros)

Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU 27	4100	5475	6647	7897	9537	11995	14698	17700	20500	23700	27700	31500	35700	39000
North America	6657	7890	8843	10088	11955	14585	17768	21000	25200	31100	37000	42500	47500	51500
Asia Pacific	4353	5374	5828	6755	7579	8679	10394	12900	16500	20200	23900	29000	35800	42500
ROW	467	580	1122	1862	2875	3918	5297	6700	8100	9500	10800	12000	14500	18500
Total World	15577	19319	22440	26603	31946	39176	48158	58300	70300	84500	99400	115000	133500	151500

Revenue-type breakdowns

Online advertising revenues are 100% in the Advertising revenue model.

3.5.2 ONLINE ADVERTISING – MARKET TRENDS

Segment	**Online advertising**
Drivers	- Growth of the number of Internet users and of time spent on the Internet - Broadband development allowing for services consuming a lot of data - New web services that can help to collect more data and subsequently offer more targeting -Improvements in targeting technologies, especially with solutions like semantic technologies, leading to better performance and therefore better price - Transfers of advertising budget from offline to online and from above-the-line to below-the-line services, as the web allows for more performance and ROI

Segment	**Online advertising**
Barriers	- Privacy restrictions on the usage of data which limit the performance of targeting - Difficulty to extend to new supports (like print, radio, TV)
Market penetration in 2013	**5.2% of total SSBS market in EU27** **-** Already a major segment of the software-based industry, still beneficial mostly to players like Google - North America as the leading region, with Europe closing the gap. North America emerging from both a bigger offline advertising market in general and the innovations developed first by US-based players.
Market penetration in 2020	**Around 10% of total SSBS market in EU27** - A major market beneficial mostly to Internet/Web companies, as usages for almost any type of services (communication, practical, commerce, etc…) shift progressively to online - North America strengthening its leadership through faster adoptions of new technologies like semantic web and through lower restrictions on data privacy allowing for targeting. Asia - Pacific will also catch-up with Europe, benefiting from the development of markets first in China and then in India and other Asian countries.
Main assumptions for the Baseline Scenario	- A more mature market than other emerging segments in the last part of the S-curve, except if new technologies are being introduced - Online advertising performing better than overall advertising, which is generally in line with GDP growth - Growth of mobile Internet usage allowing web players to collect more data which will improve monetisation of PC-based services by 2011/2012 - Impact of semantic technologies being felt by 2015/2016, leading to additional growth for this maturing market

3.5.3 POSITIONNING OF SSBS PLAYERS

Online Advertising	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- Traditional ISVs have no real positioning regarding online ad. A few players have copied the freemium model from the Internet giants. But this can only be really applied to low-cost software with mass potential, so mostly tools for small businesses and entrepreneurs / SOHO. Most of the small ISVs cannot really accommodate with that model. - A few ISVs have emerged to offer tools related to web analytics, with online ad measurement, tracking and statistics. They benefit indirectly from the growth of the online ad market. - Most advanced players in this area are coming from the USA, due to bigger online ad market but also to less restrictive privacy policies.	- There are good opportunities within the web analytics market for EU players, with upcoming behavioural targeting solutions. Major improvements could be made to existing solutions through advanced datamining approaches and also semantic web. -
IT Services Providers	- IT service providers have very limited role regarding online ad. Like ISVs, they can develop custom solutions related to web analytics.	- IT service providers are mostly likely to help with custom developments for their customers requiring specific metrics and additional performance measurement from stronger integration with information system (correlation between ad campains and sales – part of the CRM domain).
Telecom Operators	- Major telcos, especially leading players on wireline access and wireless access all offer some online advertising through their portals. They generally	- Telcos could take a more significant role in the online advertising by leveraging their network assets to offer advanced advertising tools (targeting

Online Advertising	Current positioning	Future Positioning
	offer mostly display-based advertising, plus some form of SMS-based advertising on mobile handsets. - Their relative weight on the online ad market is still relatively small, as they represent only a small audience and as they generate limited revenues from search advertising which is the main form of revenues.	and tracking for all browsing of a same subscriber, more precise measurement and metrics). This would lead to a more attractive online ad network in terms of performance. This could be even more interesting with cooperation between ISPs. - Telcos could also differentiate the same way on mobile services, on which metrics have yet to be clarified, especially on future mobile-centric services (like LBS) they could be the first to introduce with a potential to develop very fast into mass market.
Internet Players	- Internet players are the obvious leaders of the online ad market, for all formats (display, search, email, video, etc…) and all devices (PCs, mobile handsets) - US-based players, especially Google, dominate this market. But there also key EU players on their domestic markets, especially for very localized services (yellow pages, maps, weather, content, news, etc…), although they are outside of the scope of this study.	- EU players can still benefit from localized services, but to become really competitive they will have to offer more performance-based advertising services. Turning early on to semantic web could be a way to improve both services offered to consumers but also to improve efficiency. Customers will turn to the systems with highest performances. As a new market, semantic web is far from being pre-empted.
Others	- Like mentioned previously in the mobile section, device manufacturers are positioning on mobile ad market (Apple bought for instance a company in that space in late 2009) - This is a threat for incumbent players,	- There are no other players expected to enter this market.

Online Advertising	Current positioning	Future Positioning
	even though the control of data for online ad is not really on the device but in the cloud. The threat could become higher if they take some revenue sharing on ads (like they do for mobile applications) for applications coming from their appstores.	

3.6 SERVICE ORIENTED ARCHITECTURE (SOA)

3.6.1 MARKET FIGURES 2008-2020

Geographical breakdown

Area	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU 27	3 534	4 838	6 678	8 808	11 002	13 238	15 355	17 359	19 228	20 992	22 696	24 219	25 616
North America	6 204	7 918	10 269	12 806	15 362	18 180	20 840	23 352	25 658	27 577	29 176	30 467	31 668
Asia Pacific	1 441	2 062	3 015	4 282	5 702	7 428	9 187	10 991	12 806	14 587	16 385	18 182	20 116
RoW	450	674	1 051	1 718	2 529	3 587	4 728	5 968	7 272	8 619	10 031	11 506	13 156
Total World	11 629	15 491	21 014	27 614	34 595	42 434	50 111	57 670	64 963	71 775	78 288	84 374	90 556

Revenue-type breakdown (million EUR)

World	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
License & Maintenance	3 842	4 176	4 716	5 758	6 955	8 333	9 743	11 201	12 658	14 083	15 462	16 834	18 251
Associated IT Services	7 787	11 315	16 297	21 856	27 640	34 101	40 368	46 469	52 306	57 693	62 826	67 540	72 305
PWB	-	-	-	-	-	-	-	-	-	-	-	-	-
Advertising	-	-	-	-	-	-	-	-	-	-	-	-	-
Total World	11 629	15 491	21 014	27 614	34 595	42 434	50 111	57 670	64 963	71 775	78 288	84 374	90 556

Revenue-type breakdown EU 27 (million EUR)

EU27	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
License & Maintenance	1 141	1 262	1 437	1 748	2 088	2 435	2 774	3 106	3 423	3 734	4 033	4 316	4 578
Associated IT Services	2 394	3 575	5 241	7 060	8 913	10 803	12 582	14 253	15 805	17 259	18 663	19 903	21 038
PWB	-	-	-	-	-	-	-	-	-	-	-	-	-
Advertising	-	-	-	-	-	-	-	-	-	-	-	-	-
Total EU27	3 534	4 838	6 678	8 808	11 002	13 238	15 355	17 359	19 228	20 992	22 696	24 219	25 616

3.6.2 SOA – MARKET TRENDS

Segment	Service Oriented Architecture (SOA)
Drivers	- Increased need from companies to align their information systems (infrastructure and applications) with their business processes in order to gain in flexibility, agility (integration, up scale / down scale) and to reduce maintenance costs. - Automation of software development and software reuse - Heterogeneous systems becoming too costly to maintain and too complex to integrate. - Cloud computing – the exponential growth of these new service delivery models raise integration issue with the legacy information systems. - Current and future convergence economies (manufacturing and services, retail and telecom…) - Process-driven enterprise architectures
Barriers	- Increased complexity - Needs for high-end skills combining both technological expertise as well as business and domain know-how. - Lack of standards
Market penetration in 2013	**4,7% of the total SSBS market in 2013** - Already a major segment of the SSBS market, as part of the Tools software type. - Main enterprise application vendors (such as Oracle and SAP) will have totally migrated their applications to SOA platforms by 2013 - SOA technologies are slowly but surely replacing other integration platform technologies - IT Services providers strongly benefit from this market that enables them to move up the value chain towards higher value-added integration services - Business proximity and complexity make leveraging offshore models less relevant.

Segment	Service Oriented Architecture (SOA)
Market penetration in 2020	**6,7% of the total SSBS market in 2020** - Market share has gone up almost by 50% since 2013. CAGR is more than +11% over the period. - ITS SOA market share has gone from 6.2% in 2013 to 10.2% in 2020. - Some maturation of the SOA market in the last year of the period (post inflexion point of the S-curve). Most large companies have migrated their application stacks to Service Oriented Architectures.
Main assumptions for the Baseline Scenario	- Strong growth of the adoption rate during the 2010-2015 period, somewhat limited by shortages in high-end competencies combining high level of abstraction and business expertise. - The 2015-2020 period is characterised by a more abundant pool of competencies also from offshore locations. - New project methodologies have been employed to improve productivity and success rates on these complex projects.

3.6.3 SOA – POSITIONNING OF SSBS PLAYERS

Player	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- The SOA wave has not been very favorable to European ISVs so far. - Few EU ISV are well positioned there: Software AG, Axway, Casewise… OSS companies are beginning to emerge. - The leaders of the high end of the SOA market (Enterprise Architecture, Business Process Modeling and Optimization) are European companies: Software AG, Casewise and Mega. - Application generalists such as SAP, Sage and to a lesser extend, Oracle, are still struggling to convert their huge application software stacks to SOA. - US middleware power houses such as IBM, Microsoft or Oracle are currently benefiting from SOA as well as US infrastructure generalist like CA, HP or Symantec - Specialist application ISVs are quickly adopting SOA either trough partnerships with US ISVs or by leveraging OSS components. It provides them a competitive advantage in front of the generalists as they improve their agility and their integration capabilities.	- By to 2014, SAP, Sage and Oracle should be SOA ready. But they will be late compared to smaller players. ISVs have to be SOA ready or they will out of the market. - Two companies are leading the way for SOA middleware: Software AG and Axway. They are leaders in their respective markets, with worldwide reach - The rest of the middleware companies are quite small and are focusing on country markets niches especially around BPM. - OSS will continue to develop in the SOA space, especially for very customized applications and for specific middleware needs. - European wide regulations will be very important to unify the market and boost the reach of local ISVs to an European wide market.
IT Services Providers	- SOA is a key concept for IT services companies. - It is a new architecture that promote optimization and agility, two key concepts for businesses today. They need the integration capabilities and	- IT Services companies that are strongly supporting SOA will be key players for the business transformation of their clients - It will also open them OSS and Cloud

IT Services Providers	- SOA is a key concept for IT services companies. - It is a new architecture that promote optimization and agility, two key concepts for businesses today. They need the integration capabilities and the technological know how of ITS firms. - SOA helps align business processes with IT. such projects require high end competencies that are local, and that business savvy.	- IT Services companies that are strongly supporting SOA will be key players for the business transformation of their clients - It will also open them OSS and Cloud Computing markets - They will become trusted innovation partners for their clients. They will master the IT relationship with their clients - Software companies will normally be depending a lot on them for selling their projects.
Telecom Operators	- Telecom operators are enjoying extended data exchanges on their networks thanks to SOA - They are not key operators for SOA, but key enablers are their network is critical either inside or outside the company.	- Some operators will stay as network operators and SOA will not have a huge effect on them except for the increasing data traffic. - With the development of the cloud computing models some Telcos that already have extended IT services (Deutsche Telekom, OBS, Telefonica…) will try to climb the value added ladder. But it seems that at middle term they will not be able to plan, build and run entire SOA systems.
Internet Players	- The large majority of internet players are now based on service oriented architectures - SOAs are not in their positioning but are key for them to integrate deeper and deeper into the information systems.	- SOA being a key enabler for them and the Cloud computing, Internet players will be shipping more and more SOA tools such as Force.com from Salesforce.com. - Most of these tools being still proprietary, regulations and OSS will be important for Europeans to keep their independence
Others	- Some players from other industries are	- Some of those players in IT intensive

3.7 OPEN SOURCE SOFTWARE (OSS)

3.7.1 MARKET FIGURES 2008-2020

Geographical breakdown (million EUR)

Area	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU 27	3 487	5 125	7 384	9 621	12 058	14 284	16 350	18 224	19 788	20 950	21 648	22 058	22 277
North America	2 497	3 648	5 426	7 085	8 886	10 745	12 481	14 081	15 391	16 195	16 427	16 393	16 313
Asia Pacific	1 167	1 589	2 316	3 053	3 920	4 908	5 889	6 853	7 725	8 393	8 813	9 124	9 442
RoW	774	1 247	2 071	2 883	3 852	4 986	6 102	7 182	8 118	8 755	9 042	9 172	9 294
Total World	7 924	11 609	17 197	22 641	28 716	34 923	40 822	46 340	51 022	54 292	55 930	56 746	57 326

Revenue-type breakdown World (million EUR)

World	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
License & Maintenance	378	533	781	1 017	1 275	1 573	1 864	2 146	2 397	2 587	2 703	2 782	2 852
Associated IT Services	7 546	11 075	16 416	21 625	27 441	33 350	38 958	44 194	48 624	51 705	53 226	53 963	54 473
PWB	-	-	-	-	-	-	-	-	-	-	-	-	-
Advertising	-	-	-	-	-	-	-	-	-	-	-	-	-
Total World	7 924	11 609	17 197	22 641	28 716	34 923	40 822	46 340	51 022	54 292	55 930	56 746	57 326

Revenue-type breakdown EU27 (million EUR)

EU27	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
License & Maintenance	152	215	306	394	488	585	678	764	840	901	943	974	996
Associated IT Services	3 335	4 910	7 078	9 226	11 570	13 699	15 672	17 460	18 947	20 049	20 704	21 084	21 281
PWB	-	-	-	-	-	-	-	-	-	-	-	-	-
Advertising	-	-	-	-	-	-	-	-	-	-	-	-	-
Total EU27	3 487	5 125	7 384	9 621	12 058	14 284	16 350	18 224	19 788	20 950	21 648	22 058	22 277

3.7.2 OSS – MARKET TRENDS

Segment	Open Source Software (OSS)
Drivers	- Commoditisation of software technologies, of which OSS is a major factor along with cloud computing. This is true especially in markets where competition has faded off. - Cost reduction being the first goal of any IT shop during the current crisis - Custom development, as the enterprise's main generic functions and processes have been covered by packaged software; enterprises now look at custom software development to bring differentiating elements to their information systems. - Code sharing for collaborative innovations, especially in the industrial, embedded and technical IT and across different vertical sectors (automotive

Segment	Open Source Software (OSS)
	and aerospace for instance). - Adoption of open standards - Migration to mobile platforms based on open source operating systems
Barriers	- Low adoption in the consumer space on the PC market for both operating systems and office productivity software. - Community-driven development is not adapted to all business and IT segments (highly competitive and value added segments). - Not viable in the core of the packaged software application market - Lack of business and process culture - Major software product vendors - Cloud computing software companies could also be a threat to the development of the OSS market as they bring an interesting value proposition covering the entire software stack from operating systems to the application layer.
Market penetration in 2013	**OSS represents 5.1% of the European market in 2013** - OSS continues its dynamic growth, favoured in 2010-2011 by the economic crisis. It is especially the case in Europe where there are few middleware product providers but a good supply of OSS competences.
Market penetration in 2020	**OSS represents 5.8% of the European market in 2013** - OSS will continue to strongly penetrate simple infrastructure and middleware markets, where competition is scarce. - Automation, offshore as well as cloud computing (to some extent) will limit the growth of the OSS related IT Services segment in the 2015-2020 period. - On the other hand, a widely deployed European cloud computing infrastructure could act as a new growth engine.
Main assumptions for the Baseline Scenario	- Market conditions remain the same with some push across Europe from the governments and the EU Commission. - Open Source development communities are thriving. - Education and training continue to create skilled competencies at similar

Segment	Open Source Software (OSS)
	rates to those witnessed in recent years. - OSS will be one of the best faring market segments during the 2008-2013 timeframe. It has close ties with the cloud computing and SOA segments, all of them being representative of the IT industrial revolution . - During the 2015-2020 period, its growth will be limited to market factors such as cloud computing and offshore, which negatively impact the growth of its main sub-segments: project services and system integration in particular.

3.7.3 OSS – POSITIONNING OF SSBS PLAYERS

OSS	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- The majority of large ISVs in the OSS are Americans, fuelled by strong funds from venture capitalists. So far only one of them, the largest, Red Hat, is profitable. - OSS models give a strong premium on the market leader. - The third and the fourth ISVs in this field, Alfresco (UK) and Talend (France) are nearly break-even. - The smaller European OSS niche players are mostly profitable and are growing strongly. - “Traditional” ISVs are using more and more OSS to build their infrastructure layers. - Some of them are also putting part of their code in OSS to attract more developers or potential customers on their platforms.	- With the competitive pressure from the OSS, traditional ISVs will suffer from: - Commoditization of low value added software products in their portfolio of products - Competition against custom development, which is strengthened by the availability of OSS components and the enabling capacities of SOA - ISVs will have to position themselves more and more on added value segments close to the businesse processes of the client - A strong European OSS ecosystem exist with two differentiated positioning: - High end OSS for critical custom applications - Commoditized software

IT Services Providers	- Currently ITS providers are the ones who are reaping most benefits from the OSS movement. - A vast majority of the ITS players in Continental Europe are positioned on these market - Some companies, especially the specialists are tempted to become software editors due to the recurring revenues, but the transformation is not easy.	- After years where OSS business models between IT Services companies and software editors where a bit blurred, the distinction between IT Services companies and software products editors (OSS ISVs) is back to normal.
Telecom Operators	- Telecom operators are currently using OSS to build offers that they deliver through their networks, some of them being cloud based - They use OSS when it allows them to seize bigger chunks of the added value - They are active participants in OSS communities	- Their positioning does not evolve much in time regarding OSS. They are still strongly involved in communities and leverage OSS components on which they can base value added offerings. - Basic commoditized software will be more and more distributed through their networks .
Internet Players	- Nearly all Internet players are heavy users of OSS components to build and manage their IT systems. - As they derive most of their revenues from the monetization of their IT systems they prefer to ship their own "proprietary" OSS, to get some lock-in phenomenon with the end-users. - They are important contributors to OSS communities.	- Like the telecom operators, they will increase their investments in the OSS, both in the communities and in the via software-based Internet services they will provide to their customers.
Others	- Some of them (National Post Offices) have already built SBIS offerings based on OSS components. Julst like SOA, OSS permits non SBSS	- Not a lot of change. Non SSBS companies increasingly enter industry and provide SBIS based on OSS components.

	companies to enter the SBSS market	

3.8 CLOUD COMPUTING

3.8.1 MARKET FIGURES 2008-2020

Geographical breakdown (million EUR)

Area	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU 27	3 525	4 421	5 696	7 381	9 542	12 258	15 603	19 533	23 937	28 831	34 210	40 128	46 502
North America	7 800	9 553	11 655	14 568	17 831	21 393	25 270	29 503	34 158	39 330	45 150	51 785	59 453
Asia Pacific	1 150	1 418	1 795	2 308	2 933	3 686	4 585	5 643	6 877	8 332	9 964	11 826	13 934
RoW	80	112	141	181	227	281	343	428	541	693	909	1 177	1 508
Total World	12 555	15 504	19 286	24 438	30 533	37 619	45 801	55 108	65 513	77 186	90 233	104 917	121 397

Revenue-type breakdowns

Cloud Computing revenues are 100% in the Paid Web Based revenue model.

3.8.2 CLOUD COMPUTING – MARKET TRENDS

Segment	**Cloud Computing**
Drivers	- Commoditisation of software products, of which cloud computing is one of the major factors along with OSS. - Crises-related topics : cloud computing models offer interesting value propositions such as cost reduction, move from CAPEX to OPEX, flexibility, simplicity… - Cloud computing provides similar value proposition as infrastructure or application outsourcing, just in a more efficient way. - Industrialisation of the IT industry, which is becoming a more capital intensive industry – due to important infrastructure needs – in similar fashion as the telecom or utility industries - Further adoption of Services Oriented Architecture: SOAs are key enablers of the SaaS and PaaS models.
Barriers	- The magnitude of the data centers investments - Open standards - Data security and privacy – enterprises are worried about these issues.

Segment	Cloud Computing
	- US cloud computing software companies - Scarcity of bandwidth and computing power. The growth of cloud computing might at some point be limited by the pace at which telecom operators and IT infrastructure providers make the adequate Telecom and IT infrastructures available to cloud providers and customers. - Change management: changing enterprise investment habits takes time.
Market penetration in 2013	**In 2013, Cloud Computing represents 4.3% of the share of total SSBS market.** - During the 2008-2013 timeframe, enterprises tend to use the cloud concept in its "private" form, via the virtualisation of their infrastructure. Towards the middle of the period (2011), data privacy and security issues are well addressed by cloud providers using more sophisticated SLAs that reassure customers, who then increasingly migrate their private cloud infrastructure to public clouds. - Investments remain important and take time to deploy. European public cloud computing centers begin to emerge mostly with telecom operators and U.S. IT companies. - The market is still largely in the hand of small-scale European former ASP players and US SaaS giants.
Market penetration in 2020	**In 2020, Cloud Computing represents 12.1% of the SSBS market** and is the largest of the segments described in this section. - Cloud computing is the main IT architecture leveraged by European enterprises (both private and public architectures). - The market has structured itself around 5 U.S. giants and 2 European former telecoms companies - Standardisation is ongoing.
Main assumptions for the Baseline Scenario	- European cloud computing infrastructure only benefits from rather feeble funds provided by the European Commission and national governments. - Companies invest strongly in private clouds in the 2010-2013 timeframe. Starting 2013, they begin to heavily use public clouds. - Some bottlenecks to be expected in 2013-2015 on the availability of

Segment	Cloud Computing
	computing resources in the form of datacenters, and more importantly, communication bandwidth, as enterprises and consumers rapidly move their data on the Internet, into the cloud.

3.8.3 CLOUD COMPUTING – POSITIONNING OF SSBS PLAYERS

Cloud Computing	Current positioning	Future Positioning
Independent Software Vendors (ISVs)	- Very few ISVs are positioned on this market and even large North Americans players (Microsoft, IBM, Oracle…) are just new . - As with "traditional" software products, cloud infrastructure and middleware players are mostly Americans. But cloud offers based on OSS - where Europeans are world leaders - are already a strong trend in the market - In the SaaS field a good number of smaller players, already positioned on Application Service Provisioning (ASP), are moving quickly towards Cloud Computing, either by their own means, or with the help of players such as Salesforce.com or IBM (cloud enablers), and/or hosting services and telecom operators, such as Colt or OBS. - Cloud computing could offer a European-wide and even worldwide reach for European ISVs, thus removing one of their main barriers to growth, the fragmentation of the	- In five years, a very significant part of the front offices software products (CRM, office software, mail, collaboration…) have migrated to the cloud along with storage systems for SMEs, prototyping or development environments - At the same time main Cloud Computing trends for larger companies will focus mostly on private clouds as main architectural choice, backed by SOA - Enabling and enabled software will be in high demand over the next half decade - Due to the scarcity of the enabling software providers in Europe, European based standards and regulations will be critical. - OSS middleware technologies will also be critical for Europe to maintain its control of the Cloud Computing infrastructure. - Cloud computing will need a sizable market in Europe as it gets its

	European markets.	advantage from economies of scale

IT Services Providers	- Cloud computing is benefiting IT services companies: strong demand for services around consolidation, virtualisation, datacenter overhaul, SOA, data management…
	- But increasingly the drastic changes that Cloud computing models imply are endangering certain service offerings:
	  - Run based services such as hosting, storage management for SMB, database management, mail management…
	  - Integration services around packages and between are being lowered with SaaS integrations
		- IT Services companies will have to assess where they stand in regards to Cloud Computing models:
		  - Either benefiting from some revenue streams from the plan and build phases of the clouds (public or private)…
		  - … or from the run their own very automated (autonomic?) datacenters…
		  - … or from pushing their own IaaS (or even PaaS and SaaS) offerings to the market?
		- In most case they will have to change their business models, in front of more aggressive competition from ISVs and Telecom operators.
		- But cloud could also allow them (smaller ITS firms) to do less offshoring and to be more competitive in front of Indian incumbents.

Telecom Operators	- Cloud computing is for most European Telecos a way for them to finally get financial value from the "e-business age". A large part of their data networks being valorized so far by other companies such as Apple or Google. - Making high volume with limited margins is the basic business model of a telecom operator.	- Most operators, especially the ones with a strong IT arm (Deutsch Telekom, Telefonica, Orange, BT…) will ship cloud or "quasi" cloud offers - The European cloud infrastructure market will structure itself around them as they have the network, and the investment capabilities the cloud infrastructure requires. - A strong public (national and European) commitment is also required around standards,

		regulations but also infrastructure investments and tax cuts. - As far as application related cloud computing is concerned, Telcos could several strategies: - Application software distribution model, leveraging their own infrastructure and billing models - Direct SaaS model – although today they lack the application software expertise
Internet Players	- Google dominates this market globally, while other players in Asia are beginning to emerge. - Numerous Internet players in Europe are subsidiaries / spin off of Telecom operators and their strategy around cloud will be closely linked to the one of their mother company	- Google will remain a strong leader of this market but with less might than today as competition from Microsoft, Apple, Salesforce.com, Amazon and European telecom operators will stiffen. - With strong public investments, many European Internet start-ups could become important players in this field
Others	- Apple and Amazon are cloud computing leaders already. - Other companies such as e-Bay and certain retailers could compete also there.	- Other European companies could leverage the cloud models to push their own software solutions to market (for instance Nokia)

3.9 SYNTHESIS

In this third chapter, the Consortium has presented 8 SSBS sub-segments which hold major growth opportunities in the future. The positioning of the SSBS players will differentiate strongly from one segment to the other as presented above.

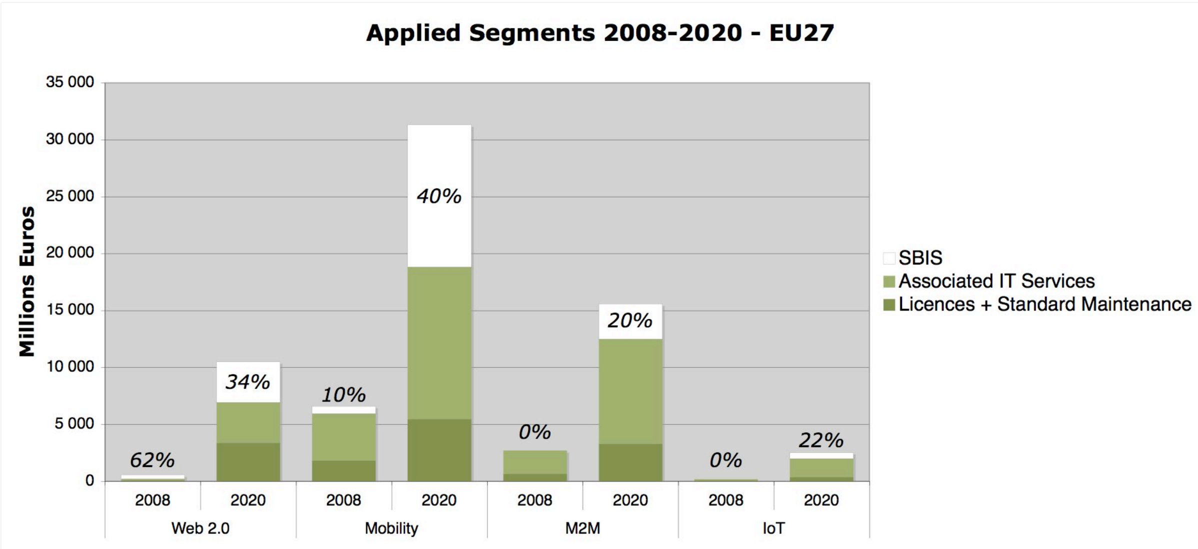
In addition, we can group these segments in three categories: Applied, Enablers and

SBIS segments.

Applied segments

This category regroups Web 2.0, Mobility, M2M and Internet of Things segments which are associated with specific usages of software (collaboration and social networking, nomadic usage, communications…).

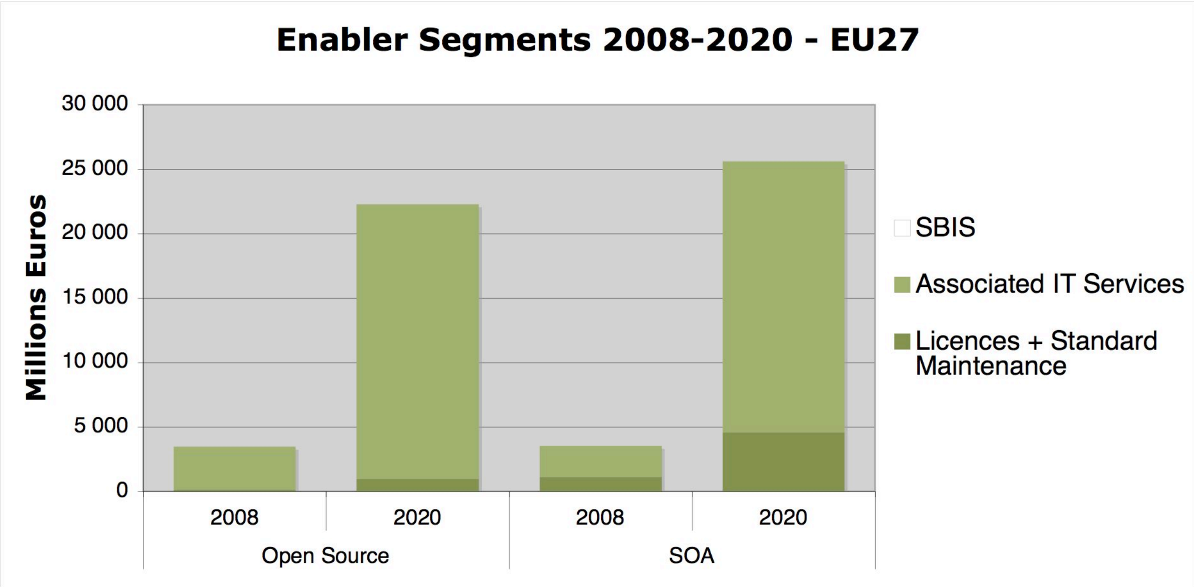
The following graph compares the expected impact of SBIS on the different segments:



The percentage show the weight of the SBIS revenue model for each selected segment. The mobility segment will therefore be much more impacted by the Internet of Services evolution than – for instance – the M2M segment.

Enabler segments

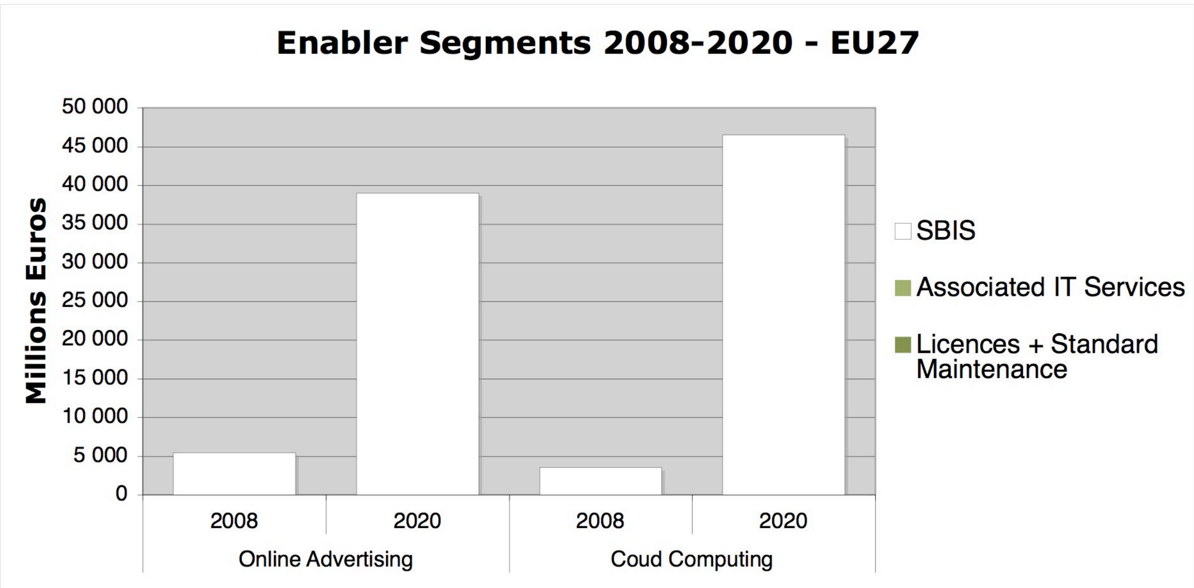
While these segments are not impacted by the Internet of Services per say (SBIS revenues in these segments are non existent), they are nonetheless very important enablers of the IoS and therefore of the SBIS.



Most revenues in these segments will be generated from the provisioning of IT services that are key to the development and integration of these technologies into the end-users' information systems.

<u>SBIS segments</u>

Obviously the most important segments within the context of the Internet of Services are the SBIS segments, the two main of which are Cloud Computing and Online Advertising. The following graph presents the compared expected evolution of these two segments over the next ten years.



Finally, while these segments are not orthogonal one from the other, it is nonetheless interesting to compare their respective expected pace of growth in the next ten years as well as their respective weight in the overall SSBS market in 2020.

	Web 2.0	Mobility	M2M	Internet of Things	Open Source	SOA	Cloud computing	Online advertising
Share of SSBS 08	0.2%	2.9%	1.2%	0.1%	1.5%	1.5%	1.5%	2.4%
Share of SSBS 2020	2.7%	8.2%	4.1%	0.7%	5.8%	6.7%	12.1%	10.2%
CAGR 08/20	27.5%	13.9%	15.7%	23.5%	16.7%	17.9%	24.0%	17.8%

SSBS players

All these emerging segments are growth opportunities for SSBS players in Europe. They will obviously have different impacts on the different types of SSBS players.

We have summarized in the following table which type of SSBS player might benefit more from the development of each emerging segment in the next ten years:

Emerging Segment	ISVs	ITS Providers	Telcos	Internet players	Others
Mobile applications	++	++	++	++	+
Web 2.0	+	+	++	+++	/
Internet of Things	+	+	+	+	+
M2M	+	++	++	+	+
Online Advertising	+	+	++	++	/
SOA	++	+++	+	+++	+
OSS	++	++	++	++	+
Cloud Computing	+++	++	++	+++	+

The Winners: Internet players

Internet players will benefit the most from the evolution and development of the different emerging segments presented above. In theory, they are the best positioned to benefit from the development of SBIS and the impact of Internet of Services on the SSBS industry. Most players are from origins outside of Europe. There are European players in this category (cf. the definition of this category of industry players in Chp. 1.3.4.2) with OpenPortal, RunMyProcess, Sidetrade, EtapOnline, Oodrive, Synertrade, Datev, Onventis, Talentsoft… – which are born with the Internet and rely mostly on paid-web based solutions – although their number is small and they currently lack a strong visibility on the market. They should grow rapidly in the next few years.

The Challenged: ITS and ISVs.

The incumbent players are facing major shifts in the market: shifts in demand, shifts in the competition with new types of players entering the market. Not surprisingly, they – especially the larger players – are against this flow of change, which can represent a real threat to their business models and the recurring revenues that they have in place in the run and maintenance of their clients information systems. They today represent the vast majority of players in the industry. They will have to evolve though in the coming few years and reposition their activities in a renewed SSBS ecosystem.

The Challengers: Telcos

These players are positioned to benefit strongly from the evolution of the SSBS industry within the context of the Internet of Services. They are a crucial piece of new software delivery models as they own part of the infrastructure. Their role in the strengthening of the European SBIS industry could be critical in this space. Whether or not they can embrace the SBIS models at the application level remains to be clarified, though.

Others

Emerging models (OSS, Cloud…) enable them to enter the SSBS industry. This raise the difficult question of identifying these new players in industry statistics.

CHAPTER 4

SSBS INDUSTRY COMPETITIVENESS

In this section we look at the main determinants and patterns of European SSBS competitiveness from a sectoral perspective so that the findings can be used to corroborate the lessons found in other parts of the report, and be used for drawing competitiveness-enhancing policies in the SSBS sector in Europe.

Our analysis is based on a standard competitiveness framework, where market and industry factors are analysed to make a strategic assessment of the competitive position of suppliers in a given market. We use the Diamond Model (Porter, 1990) proposed earlier (Capgemini, 2006) as a starting point, which, in simplified form, identifies four determinants of the competitiveness of the software industry:

A) Demand conditions (which describe the amount of products and services requested by customers).
B) Factor conditions of production (human resources, capital, infrastructure, etc.).
C) Related and supporting industry (which refers to the environment for conducting business).
D) Industry strategy, structure and rivalry (characterised by the market size and growth, the market power of suppliers and buyers and the threat of substitutes and new entrants).

In this context, governments can influence the four determinants through specific public intervention.

The relevant industry is constituted by the players in the previously-identified markets. The geographical supply is EU27 including potential competitors from US, India, China, and Japan (such countries are included where possible, subject to data availability).

As the demand conditions have already been described in previous sections, in this section we will review the remaining three determinants. In the next paragraphs the factor conditions; the related and supporting industry; and the industry strategy, are described in turn.

In the absence of specific figures for the software industry we use published figures on ICT as a proxy of SSBS, and data from the Economist Intelligence Unit for IT benchmarking and the World Economic Forum on the Global Competitiveness Report.

Figures on ICT include, software but also a number of similar and related sectors of different characteristics. It is therefore a broader classification but it is often used as an approximation for a number of reasons. The Computer Services and Software represents a substantial share of the value added (more than 40%) and turnover (more than 30%) generated in the ICT sector[17] and these shares are growing. Its share of business expenditure on R&D (BERD) is somewhat less, but very important at more than 20%, and most of the BERD growth in ICT in the EU in recent years is due to the computer services and software sub-sectors. This means that in most OECD countries, a majority of ICT investments were made in software[18]. Finally, software developers work mostly in teams, and need of a range of different skills, excellent communication, and task allocation and work integration all of which may be found in a broader ICT profile.

The IT benchmarking data from the Economist Intelligence Unit is based on a model that scores individual countries on the key attributes of a competitive IT sector. The score is based on quantitative data or qualitative assessment made by Economist Intelligence Unit analysts and the resulting indicator is strongly correlated with a proxy variable for competitiveness (IT labour productivity).

The assessment of Europe's competitiveness by the World Economic Forum is based on publicly available hard data (such as Internet penetration rates, unemployment rates, etc.) and data from the WEF's Executive Opinion Survey (EOS).[19]

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[17] *Taken together, Telecom Services and Computer Services and Software add up to about two thirds of the turnover and an even larger share of the value added of the total ICT sector (Lindmark, S., Turlea G. and Ulbrich M., 2008, Mapping R&D Investment by the European ICT Business Sector, IPTS).*

[18] *See OECD (2009), innovation in the software sector.*

[19] *A survey of business leaders, conducted annually in over 130 countries, and provides data for a variety of qualitative issues for which hard data sources are scarce or frequently nonexistent (e.g. the*

It should be noted that the EIU and WEF data are based on qualitative judgments and perceptions, which could not necessary be related to the different determinants being analyzed. Albeit these indicators are from reputed sources and have been widely used this should be born in mind when drawing conclusions. In any case, since the indicators are elaborated using figures, and intelligence from stakeholders, CEOs and top executives in each of the countries under analysis, they represent the business community's perspective on these countries' relative performances, and such perceptions are relevant for the decisions being made by business leaders in each of these economies

4.1 FACTOR CONDITIONS

Production factors are the inputs required to create the product and services supplied by the industry. We have identified the following as most relevant:

- Human capital,
- Labour costs,
- R&D,
- Innovation,
- Access to capital and finance.

Human capital

Software represents an important source of employment across different economies. Figure 2 illustrates the share of employment of ICT specialists and intensive users of ICT[20], for different countries in 2007.

Overall, the US has a larger share of ICT specialists than the EU and Australia (3.74,

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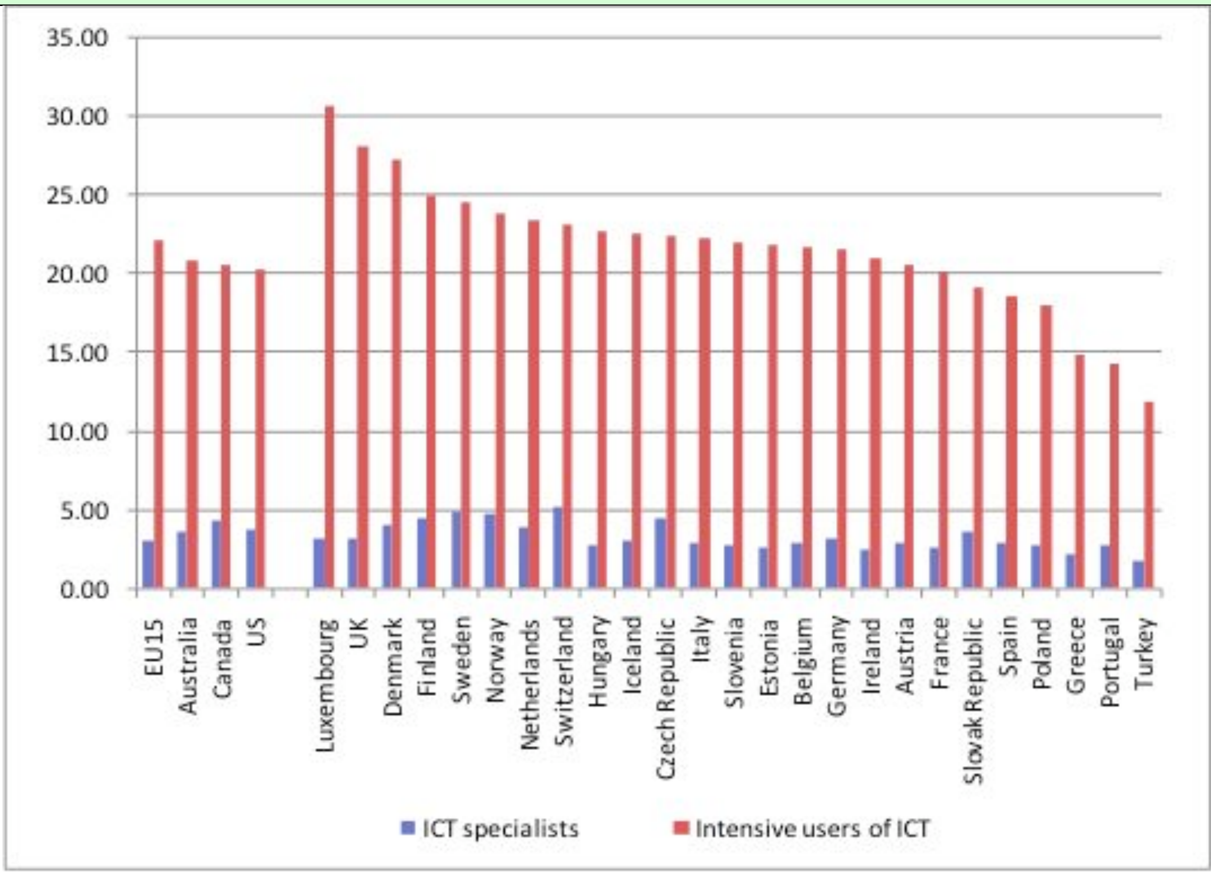
quality of the educational system, the government's prioritization of information and communications technologies, etc.).

20 The definitions are based on the methodology described in van Welsum and Vickery (2005). ICT specialists refers to those who have the ability to develop, operate and maintain ICT systems (e.g. programmers, software developers but also cable layers). ICTs constitute the main part of their job – they develop and put in place the ICT tools for others. Intensive users also include advanced users (competent users of advanced, and often sector-specific, software tools, where ICTs are not the main job but a tool) and basic users (competent users of generic tools needed for the information society, e-government and working life).

compared to 3.06 and 3.62) but less than Canada (4.24). However, within Europe there are few countries with a larger share of specialists than the US (Denmark, Finland, Sweden, Norway, Netherlands, Switzerland and the Czech Republic). It is interesting to note that in terms of intensive ICT users, most countries show a larger share than in the US. This is an indication of the relatively more ICT educated labour force in the EU compared to the US.

Figure 2: Share of ICT-related occupations in the total economy (2007)



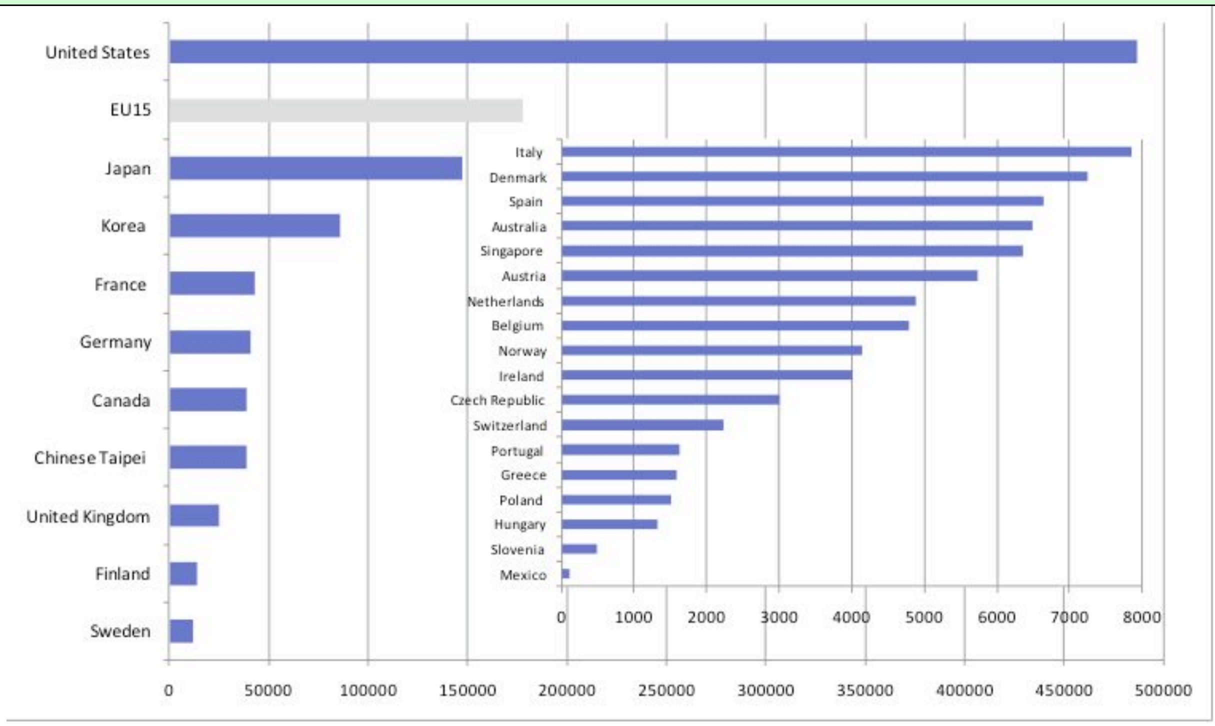
Note: ICT specialists refers to those who have the ability to develop, operate and maintain ICT systems. Intensive users also include advanced users and basic users (the definitions are based on the methodology described in van Welsum and Vickery, 2005).

Source: London Economics elaboration based on OECD Key ICT Indicators (2008).

By its intangible nature and based on intellectual processes, the software sector is particularly dependent on its human capital, and in particular, on a highly skilled labour force. We analyse the stock of human capital in R&D research in the ICT sector (which includes software) as a proxy of the qualified research personnel and skilled employees (Figure 3). In 2006, the US had the largest stock of ICT researchers (487,000), which is almost three times the number in the EU15 (177,741). Within the EU, the leading countries are France (43,240), Germany

(40,766) and the United Kingdom (25,000), followed by Finland (14,006) and Sweden (12,108). Outside the EU, it is noticeable the large number of ICT researchers for Japan (147,000) and Korea (86,000).

Figure 3: ICT R&D researchers, 2006



Note: data refers to 2006 or latest available year (full time equivalents). EU15 excludes Luxembourg.

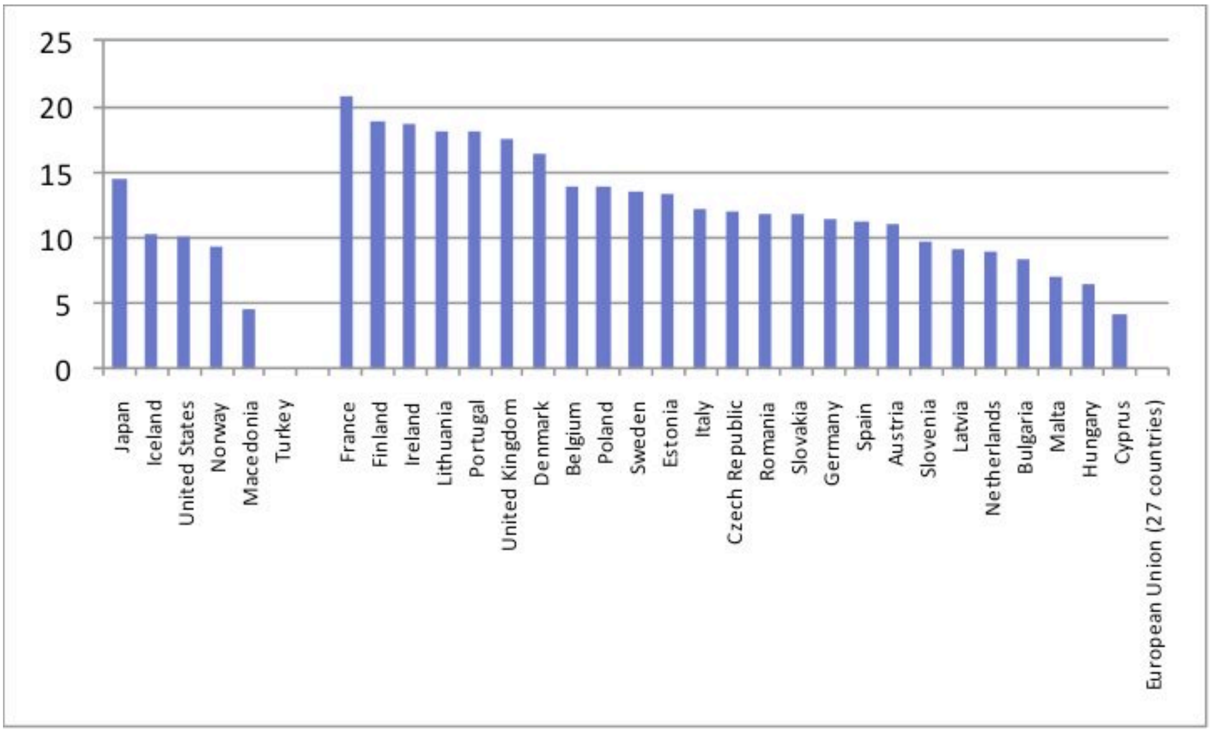
Source: OECD Information Technology Outlook: 2008.

Labour market

As the software sector depends on a highly qualified work force, the availability of scientists and engineers is a crucial element in driving its competitiveness. We investigate this by looking at the graduates with scientific degrees and the perception on the availability of scientists and engineers.

In 2007 the proportion of the graduates with scientific degrees per 1000 inhabitants was highest in France (20.7), Finland (18.8), and Ireland (18.7). Lithuania, Portugal, the United Kingdom and Denmark also show figures significantly above Japan (15) and the US (10). Noticeably, most of the EU countries outperformed the US according to this measure.

Figure 4: Graduates in mathematics, science and technology, 2007

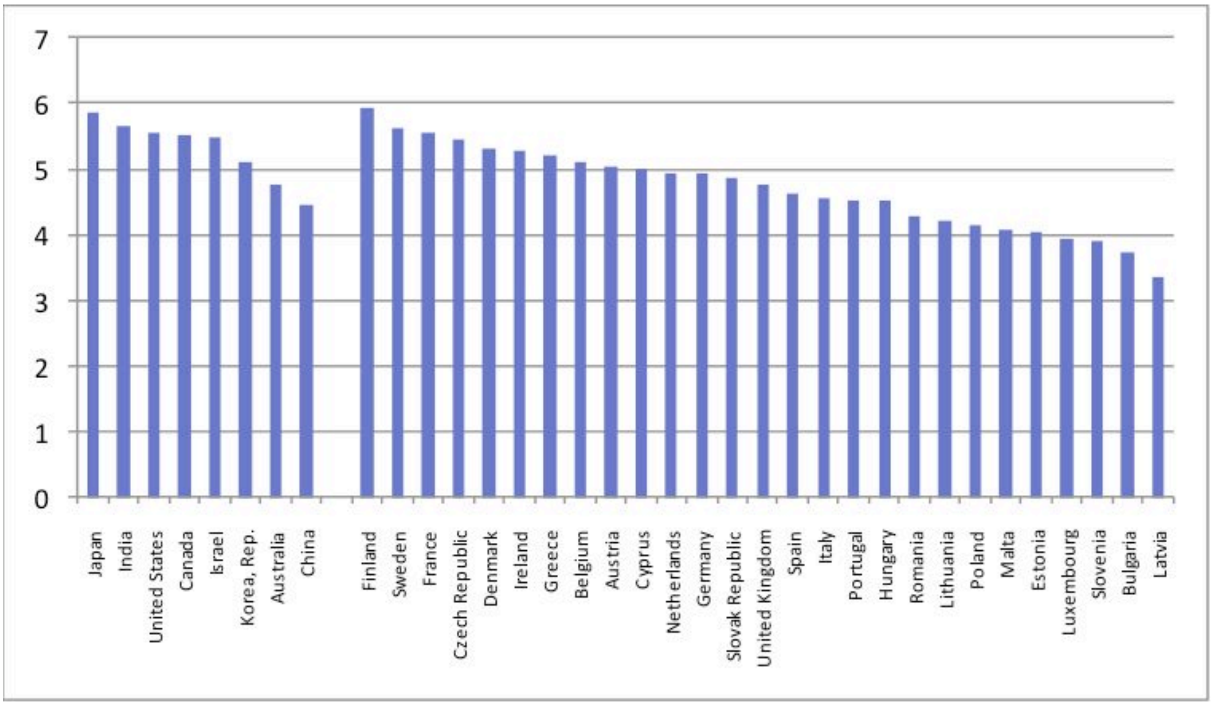


Note: Number graduates with mathematics, science and technology degrees per 1000 inhabitants; Data for Turkey is unavailable.

Source: Science and technology graduates by gender in 2007, Eurostat, 2009.

The World Economic Forum provides statistics on the level of perception among individuals, entrepreneurs and governmental officials on the availability of scientists and engineers in their respective countries. Because of the importance of these skilled professionals in the production and development of new software services, figures on the availability of scientists and engineers will give an indication of the potential of software development in each country. The highest score is reported in an EU Member State, Finland (5.93), followed by Japan (5.86), US (5.55), and India (5.67). Besides Finland, there are a few EU Member States also with a high score. Sweden and France have scores of 5.62 and 5.55, which rank slightly above Canada (5.53), Figure 5.

Figure 5: Perception on the availability of Scientists and Engineers

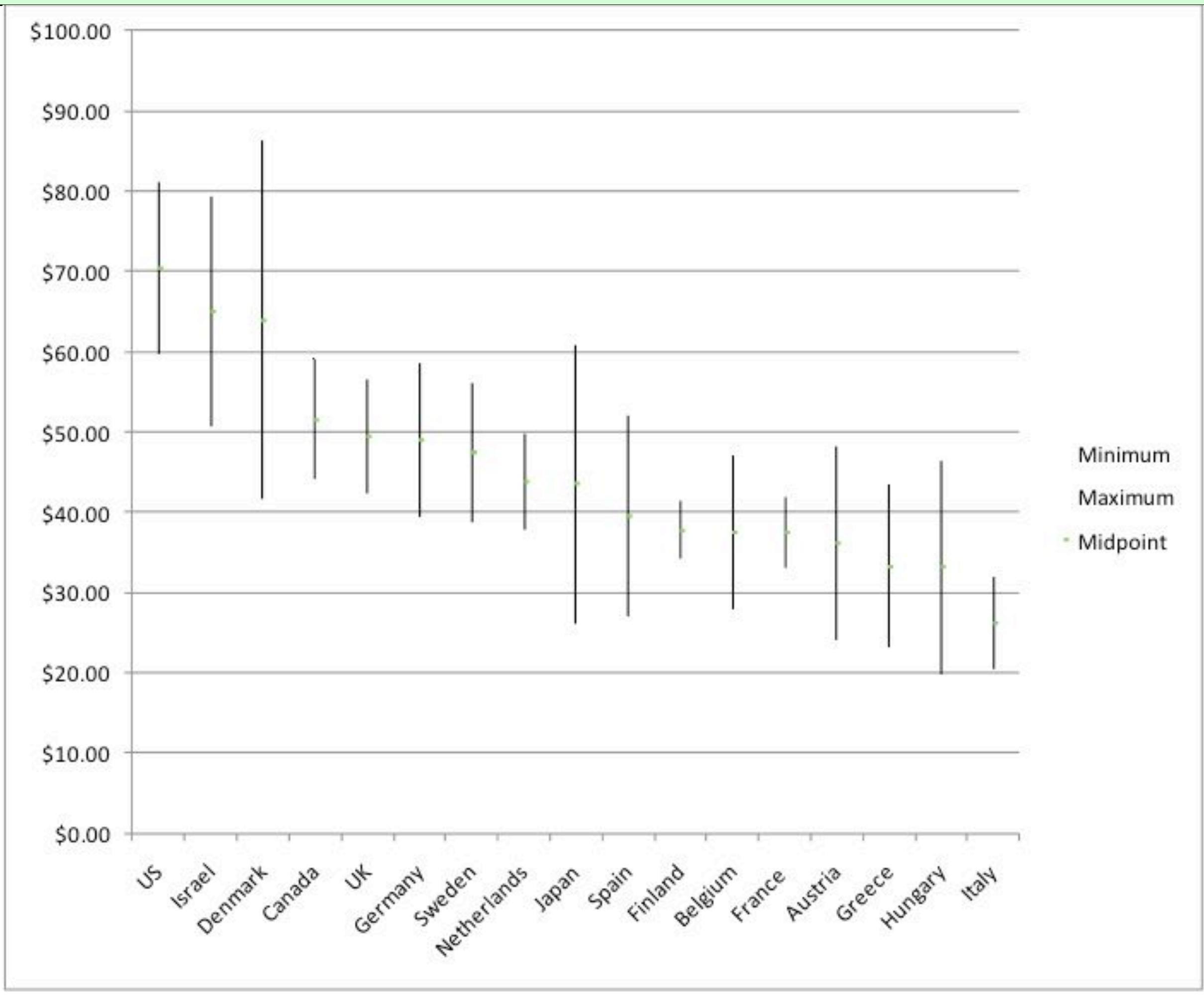


Note: Scientists and engineers in your country are (1 = nonexistent or rare, 7 = widely available)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

In order to attract qualified skilled work force, Europe should be in a position to offer competitive salary packages. Figure 6 illustrates wage intervals for software engineers, developers and programmers with five to nine years of experience in a selection of countries. Data is based on a self-reporting salary database (PayScale, Salary database) and has been expressed in USD using IMF's PPP exchange rates. The highest annual salaries are paid on average in the US, followed by Israel and Denmark. The remaining EU countries show wages noticeably lower that the US (around USD 50,000 or lower).

Figure 6: Median Salary Range: Software Engineer / Developer / Programmer 5-9 years experience (USD in PPP)



Note: Individuals Reporting: France 87; UK 1,560; Austria 41; Belgium 37; Canada 2,092; Denmark 44; Finland 180; Germany 185; Greece 39; Hungary 32; Israel 68; Italy 112; Japan 56; Netherlands 101; Spain 76; Sweden 64; US 11990.

Source: London Economics based on PayScale, Salary database, 2009, and IMF (for PPP).

R&D

R&D is particularly important for the development and expansion of the software sector. Existing data at the firm level illustrate the large scale and intensity of software-related R&D activity. Looking at the R&D investment of the top 2,000 companies in the world we find that the sector (defined as software and computer services) ranks fourth largest investor among the ICB[21] sectors represented by such companies, although lying significantly behind the three first sectors

[21] *Industry Classification Benchmark (ICB).*

(pharmaceuticals and biotechnology; technology hardware & equipment and automobiles & parts). Interestingly, the software and computer services takes about 7% of all R&D investment in the database (**Erreur ! Source du renvoi introuvable.**).

Table 3: R&D investments by top 6 sectors, 2008

Industry	R&D investment (€million and share of total)
457 Pharmaceuticals and Biotechnology	81,006 (19%)
957 Technology hardware & equipment	74,235 (17%)
335 Automobiles & parts	72,643 (175)
953 Software, Internet and Computer services	30,985 (7%)
273 Electronic and electrical equipment	29,677 (7%)
Total	**430,857 (100%)**

Source: London Economics calculations based on the 2009 EU Industrial R&D Investment Scoreboard.

Firm-level data of the 10 leading firms in the subsectors of software, internet and computer services shows a huge disparity in R&D investment volumes between the largest companies and the rest (**Erreur ! Source du renvoi introuvable.**). The leading software company (Microsoft) spends as much as twenty times the amount of any of the two smallest companies in the top 10. The differences in R&D investment between the largest and smallest companies in this top 10 list is even more apparent for the internet and computer services sub-sectors, where the largest companies (Google and IBM) spend more than 40 times the amount of the smallest company.

Such discrepancies are a reflection of the differences in scale between the companies. In fact, when looking at the relative R&D expenditure (per employee and as % of sales) the differences are smaller, especially for the software sub-sector (last two columns of **Erreur ! Source du renvoi introuvable.**).

Table 4: R&D investments by top 6 sectors, 2008

Company	Country	R&D investment (€million)	R&D per employee (€000)	R&D (% sales)
Software				
Microsoft	US	6482	69.7	15.4
Oracle	US	1991	23.2	11.9
SAP	DE	1627	31.5	14.1
Symantec	US	633	36.4	14.3
Adobe Systems	US	476	64.9	18.5
Intuit	US	468	57.1	21.2
CA	US	447	33.9	14.5
Autodesk	US	414	53.1	24.8
Cadence Design Systems	US	341	69.6	45.6
UBIsoft Entertainment	FR	304	73.8	32.8
Internet				
Google	US	2010	99.4	12.8
Yahoo!	US	986	72.5	19
Check Point Software Technologies	IL	66	35	11.3
Tencent	CN	59	9.5	7.8
Akamai Technologies	US	52	34.7	9.1
NCsoft	KR	51	n.a.	25.8
IAC/InterActiveCorp	US	47	14.7	1.4
United Online	US	46	23.2	9.5
Digital River	US	37	27.7	13
Shutterfly	US	32	62.3	20.8
Computer services				
IBM	US	4327	10.9	5.8
Fujitsu	JP	2053	12.3	4.9
SunGard Data Systems	US	234	11.7	5.8
Indra Sistemas	ES	166	6.8	7
Fujitsu Siemens Computers	NL	134	12.6	2
Prithvi Information Solutions	IN	117	42.5	70.5
Teradata	US	115	18	9.1
DST Systems	US	112	10.3	6.8
Wincor Nixdorf	DE	105	11.7	4.5
Unisys	US	93	3.3	2.5

Source: London Economics calculations based on the 2009 EU Industrial R&D Investment Scoreboard.

Another way of analysing the heavy presence of large players in the R&D investment is by looking at measures of concentration. If we calculate the R&D investment of the top three companies as a share of the total investment of the top 10 companies we see that Internet and computer services are at the very top of the list (with 90% and 89%) and the software sector is fourth, with the largest three companies taking 77% of all investment among the top 10 companies (Table 5).

Table 5: R&D investment concentration (Top 3 as % of Top 10)

Industry and share	Industry and share
Internet [90%]	Electricity [58%]
Computer services [89%]	Commercial vehicles & trucks [58%]
General retailers [81%]	Personal goods [56%]
Software [77%]	Other financials [56%]
Food producers [72%]	Telecommunications equipment [56%]
General industrials [71%]	Health care equipment & services [55%]
Household goods & home construction [69%]	Banks [54%]
Leisure goods [68%]	Semiconductors [53%]
Support services [68%]	Fixed line telecommunications [53%]
Media [66%]	Construction & materials [50%]
Industrial transportation [66%]	Chemicals [50%]
Electrical components & equipment [65%]	Industrial machinery [47%]
Electronic equipment [65%]	Industrial metals & mining [44%]
Travel & leisure [64%]	Gas, water & multiutilities [43%]
Biotechnology [63%]	Oil & gas producers [42%]
Oil equipment, services & distribution [63%]	Automobiles & parts [41%]
Computer hardware [61%]	Pharmaceuticals [40%]
Aerospace & defence [61%]	

Source: London Economics calculations based on the 2009 EU Industrial R&D Investment Scoreboard.

It is noticeably from **Erreur ! Source du renvoi introuvable.** the strong presence of American firms in the group of 10 leading firms. Traditionally, multinational firms had a tendency to keep most of their R&D activities in their home country (or country of registration of their headquarters). At present, the businesses sector is increasingly internationalising their R&D activities and the software sector is not an exception to this. Characterised by the globalisation of its services, the software sector is increasingly placing their R&D activities in locations where they can provide the highest returns. This means situating the activities strategically around the globe to make use of the locational advantages of different regions. This can be in the form of research laboratories, in collaboration frameworks or in competitive clusters (OECD, 2009).

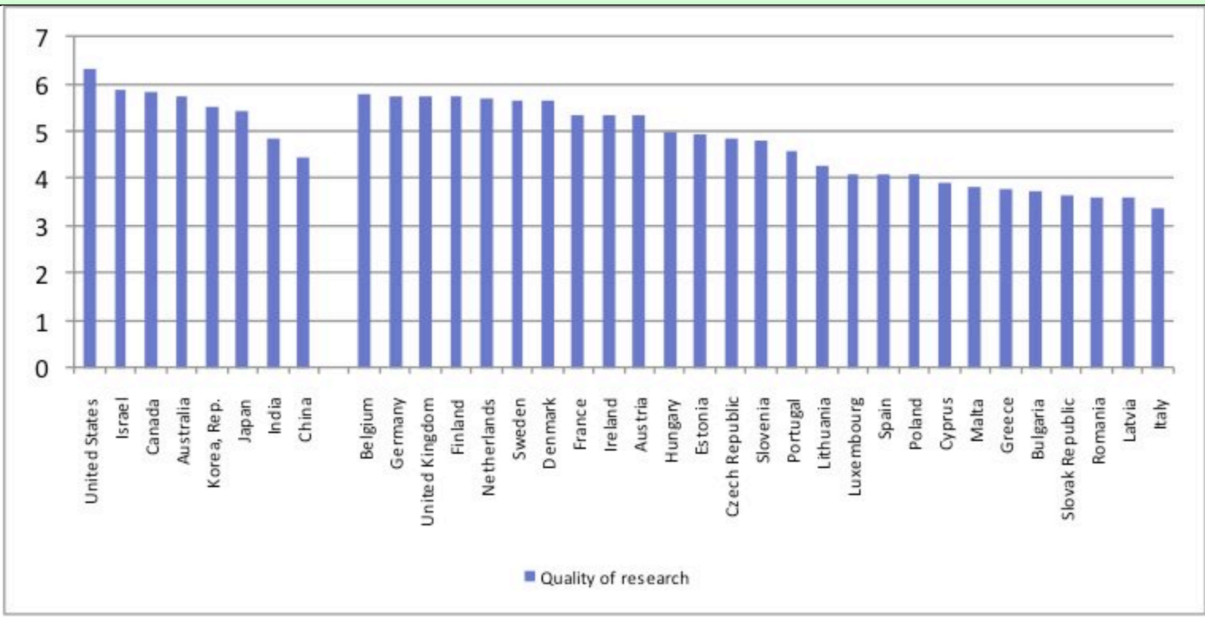
Innovation

The economic literature traditionally has differentiated between innovation inputs and outputs, where inputs include enterprise strategy, knowledge, R&D in the form of capital and human resources and infrastructure, and outputs usually include customer value and efficiency measures achieved (OECD, 2008).

A way to characterise innovation from an input point of view has typically been the quantification and analysis of R&D investments, which we saw in the previous paragraphs. To complement such analysis we now turn to the quality of scientific research institutions; and the innovation capacity of domestic corporations.

In its Global Information Technology Report 2008-2009, the World Economic Forum provides different indices used to benchmark national ICT strengths and weaknesses across countries. The WEF analyses the quality of scientific research in different countries using surveys in which they ask individuals, businesses, and governments to consider whether they perceive quality of research to be high in their country (1 lowest, 7 highest). The highest score for quality of research is reported in the US with a 6.3. Some EU Member States show very high scores (Germany 5.95, Belgium 5.80, the United Kingdom 5.78, or Finland 5.64), which compares well with the scores of other non-EU countries, such as Canada (5.81) and Australia (5.73).

Figure 7: Perception on the quality of scientific research institutions

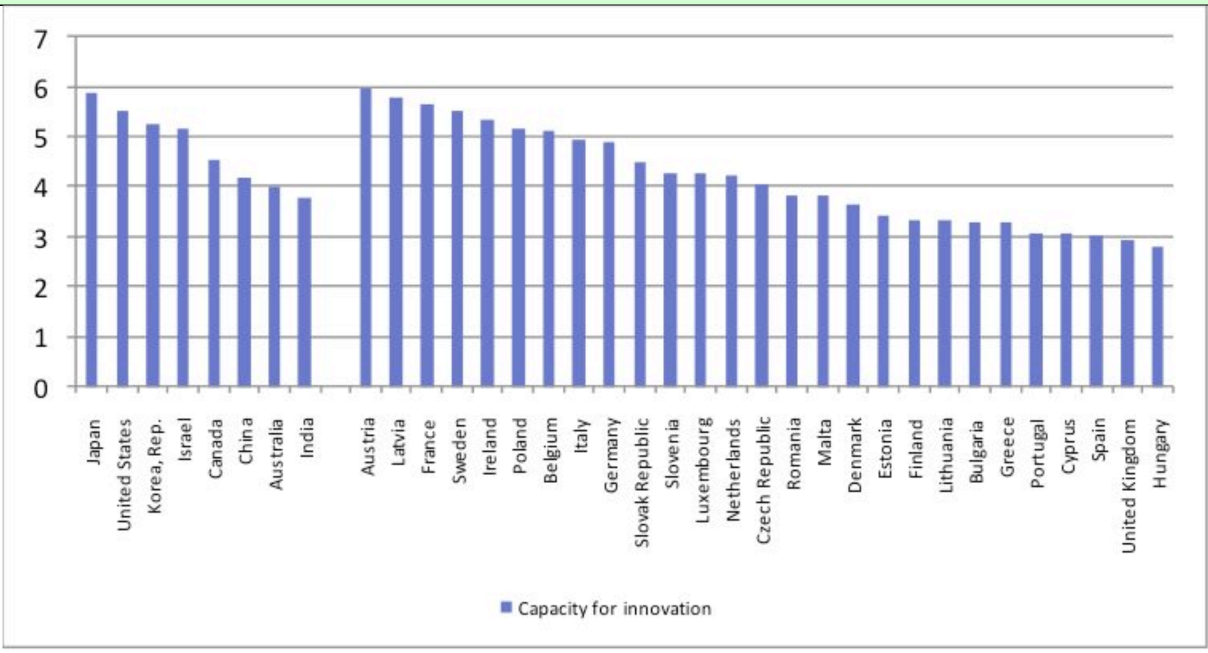


Note: Scientific research institutions in your country (e.g., university laboratories, government laboratories) are (1 = nonexistent, 7 = the best in their fields internationally)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

Likewise, WEF also analysed the capacity for innovation in different countries. For this indicator industry stakeholders are asked the opinion on whether domestic companies are primarily focused on licensing products or they perform their own research and development strategies in order to innovate (1 solely licensing, 7 own development). The perception on innovation capacity is highest in Japan (5.88), the US (5.53) and Israel (5.17) but it compares well with the level found for a limited number of EU countries such as Germany (5.95), Finland (5.64), Denmark (5.52) and the United Kingdom (5.78).

Figure 8: Perception on the capacity for innovation



Note: Companies obtain technology (1 = exclusively from licensing or imitating foreign companies, 7 = by conducting formal research and pioneering their own new products and processes)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

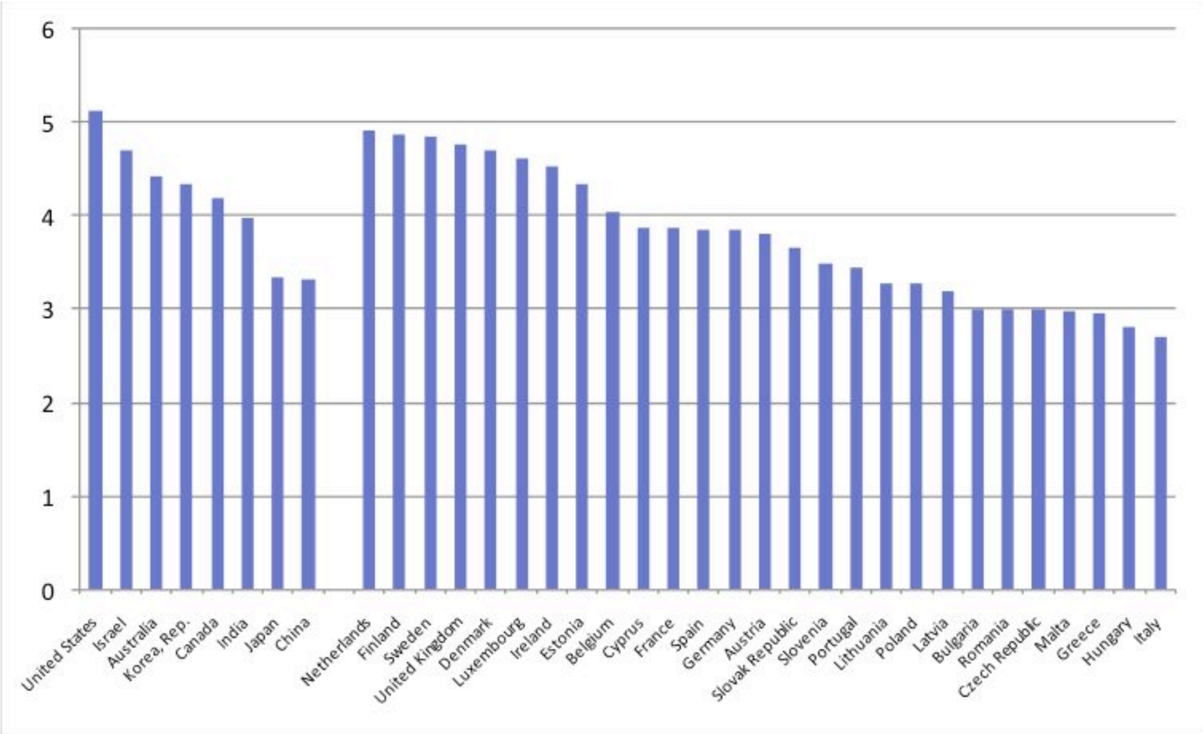
Access to capital and finance

The availability of venture capital is indicative of the capacity to realise innovations in a country, but can also be seen as an important driver of innovation, as inexistence funding source can discourage potential new entrepreneurial activities.

As part of the Global Information Technology Report 2008-2009, the World Economic Forum reports on the venture capital availability in different countries by asking individuals, businesses, and governments to consider whether entrepreneurs with innovative but risky projects can generally find venture capital in their country (1 lowest, 7 highest).

The results show that the highest score can be observed in the US (5.13), which is not far from the scores given in some European countries such as the Netherlands (4.92), Finland (4.87) and the UK (4.76). These countries are closer to the scores provided by Israel (4.71) and Australia (4.43).

Figure 9: Venture Capital Availability



Note: Entrepreneurs with innovative but risky projects can generally find venture capital in your country (1 = not true, 7 = true)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

Summary of competitiveness factor conditions

The US had the largest stock of the ICT researchers in 2006. Comparably, the EU15 (approximately 180,000 researchers) had three times less ICT researchers. It is important to note that Japan, with 30,000 ICT researchers, ranks third.

The statistical number or researchers does not capture the relative size of the countries and populations. When looking at the proportion of science graduates per 1000 inhabitants, the largest figure is was found in France, Finland and Ireland. Most EU countries outperformed the US according to this measure. A similar conclusion is found when looking at the perception on availability of scientists and engineers. The highest figures are found in Finland, Sweden and France, whereas the US has a score lower than the leading EU countries, and lower than Japan and India.

The highest wages for software engineers, developers and programmers (5-9 years of experience) are the highest in the US. The salaries are generally much lower in other EU countries, with exception of Denmark that shows a similar figure (although lower).

The analysis of the capacity for innovation and quality of research shows the US as the country with the highest score, but only slightly higher than Belgium, Germany, the United Kingdom and Finland. Nevertheless, despite the high perception in the quality of research, the previous EU countries fall behind the US in terms of the perception of capacity for innovation.

The score on availability of the venture capital funding across countries is found highest in the US, although some leading EU countries, namely Netherlands, Finland and the UK, were found to have results only a little bit lower than those found in the US.

4.2 SUPPORTING INDUSTRY AND OTHER RELATED FACTORS

The industrial tissue, institutions, regulation and the legal framework plays an important role in the competitiveness of country and regions. We believe the following factors are important for the SSBS industry:

- Economic climate
- Supporting industry
- Intellectual property rights
- Effects of taxation

Economic climate

The EU's 10-year objective to improving Europe's productivity and competitiveness was set at the March 2000 European Council in Lisbon (Portugal). The policy agenda aimed at reaching such ambitious target became known as the Lisbon Strategy of economic and structural reforms[22].

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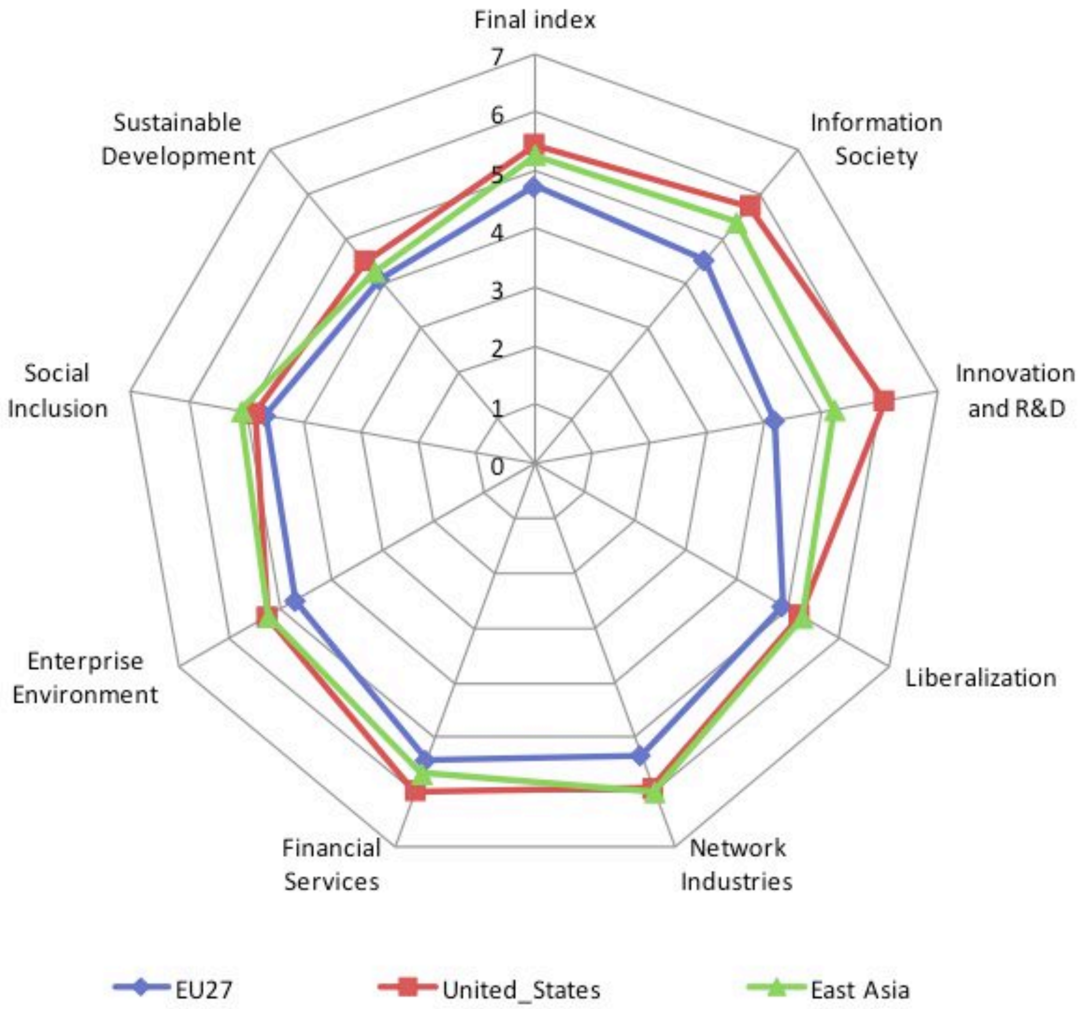
22 The objective was to make the European Union "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" through various policy initiative which included the creation of an information society for all, establishing a European area of research and development, developing a business-friendly start-up environment, completing the single market, establishing efficient and integrated financial markets, building a knowledge society, ensuring more and better jobs for Europe, modernizing social protection, promoting social inclusion and enhancing sustainable development.

Since then, several studies are evaluating the extent to which the EU27 are complying with such objectives. The Global Competitiveness Network of the World Economic Forum is aimed at gauging Europe's progress towards the Lisbon competitive goals in comparison with international standards. The study uses the US and the average performance of five of the most competitive economies in East Asia (Hong Kong, Japan, Korea, Singapore and Taiwan, China) as international benchmarks. Interestingly, the World Economic Forum analysis is based in large part on the World Economic Forum's Executive Opinion Survey (EOS), a survey among CEOs and top executives in each of the countries under analysis. Therefore, the results can be interpreted in large part as the business community's perspective on the countries' relative performances in meeting the goals set by the Lisbon Strategy.

The overall indices show the aggregate EU27 lags behind the US and East Asia in all its eight dimensions: information society; innovation and R&D; liberalization network industries; financial services; enterprise environment; social inclusion; and sustainable development (Figure 10).

Figure 10: Lisbon Strategy indices: EU27, US and East Asia (2008)



Source: The World Economic Forum (2008).

Detailed country analysis reveals large differences within EU Member States (Table 6). New Member States and southern countries (Italy, Spain and Portugal) are all at the middle-bottom of the table. The top three positions within Europe are for the Nordic countries (Sweden, Denmark and Finland) which show a strong performance across all dimensions, particularly in measures of innovation, financial services, social inclusion and sustainable development[23]. These three countries have a final

23 "In terms of innovation, the Nordic countries are the strongest European performers in areas such as their companies' aggressiveness in adopting new technologies and their level of spending on R&D, the high degree of collaboration between universities and the private sector in research, and their strong intellectual property protection. And, indeed, in terms of innovation "output", they register score higher than the US and show superior or similar scores than the US in all dimensions except in innovation and R&D. A second group of countries outperforms the US in four or more indices (the Netherlands, Austria, Germany, and Luxembourg) but innovation and R&D, for which the US shows the highest value.

among the highest rates of patenting per capita internationally. With regard to financial services, they boast sophisticated financial markets and strong auditing and accounting standards, with relatively easy access to capital for good business projects, and a high level of confidence in the soundness of the banking sector at a time when this is declining in many advanced economies" (World Economic Forum, 2008).

Table 6: Lisbon Strategy indices. EU27, US, East Asia comparison (2008)

	Final index	Information Society	Innovation and R&D	Liberalization	Network Industries	Financial Services	Enterprise Environment	Social Inclusion	Sustainable Development	greater than US
Sweden	5.71	6.07	5.6	5.64	6.18	6.3	5.23	5.51	5.12	7
Denmark	5.64	5.71	5.3	5.61	6.26	6.17	5.28	5.74	5.03	7
Finland	5.64	5.27	5.95	5.51	5.99	6.08	5.48	5.67	5.13	7
Netherlands	5.44	5.76	4.86	5.7	5.91	6.11	5.28	5.33	4.56	6
Austria	5.34	5.3	4.69	5.66	6.05	6.05	4.94	5.15	4.91	5
Germany	5.34	4.96	5.08	5.6	6.47	5.91	4.7	5.02	4.96	4
Luxembourg	5.22	5.12	3.93	5.26	5.85	5.96	5.4	5.12	5.1	4
France	5.12	4.96	4.68	5.25	6.2	5.91	4.82	4.81	4.33	2
United_Kingdom	5.12	5.42	4.7	5.16	5.81	5.82	5.06	4.69	4.28	0
Belgium	5.11	4.51	4.73	5.34	5.76	5.93	5.02	5.25	4.36	2
Ireland	5.03	4.44	4.44	5.38	5.13	6.01	5.46	5.01	4.4	4
Estonia	5.02	5.56	4.06	4.99	5.26	5.69	5.34	4.83	4.44	1
Cyprus	4.68	4.33	3.54	4.94	5.76	5.43	4.54	5.05	3.85	1
Portugal	4.61	4.32	3.87	4.7	5.58	5.42	4.62	4.34	4.01	0
Slovenia	4.58	4.71	4.12	4.43	5.11	4.9	4.47	4.61	4.28	0
Czech_Republic	4.53	4.03	3.93	4.82	5.1	4.94	4.4	4.87	4.17	1
Spain	4.52	4.07	3.93	4.87	5.42	5.52	4.16	4.32	3.83	0
Malta	4.43	4.75	3.37	4.8	5.16	5.68	3.84	4.87	2.96	1
Lithuania	4.39	3.95	3.82	4.4	5.04	5.01	4.76	4.35	3.8	0
Slovak_Republic	4.34	3.94	3.48	4.77	4.54	4.92	4.96	4.2	3.91	0
Latvia	4.25	3.93	3.48	4.38	4.55	4.87	4.87	4.07	3.83	0
Hungary	4.18	3.86	3.76	4.4	4.75	4.77	4.51	3.87	3.5	0
Greece	4.1	3.18	3.85	4.31	5.12	5.07	3.78	4.06	3.46	0
Italy	4.05	3.83	3.76	4.27	4.9	4.63	3.69	3.82	3.51	0
Romania	3.84	3.7	3.3	4.04	3.74	4.35	4.52	3.92	3.19	0
Poland	3.76	3.18	3.51	4.24	3.93	4.45	3.8	3.79	3.21	0
Bulgaria	3.68	3.57	3.04	3.9	4.08	4.12	4.21	3.59	2.89	0
EU27	4.73	4.53	4.18	4.9	5.32	5.41	4.71	4.66	4.11	0
United_States	5.44	5.73	6.07	5.23	5.92	5.97	5.27	4.86	4.5	0
East Asia	5.26	5.36	5.2	5.28	5.98	5.65	5.26	5.09	4.26	3

Note: Shaded cells show score better than US score.

Source: The World Economic Forum (2008).

The economic climate for innovation and development of the software sector can be further assessed by investigating the study by the Economist Intelligence Unit 2007. This study reviewed the competitiveness of various countries with respect to their IT sector, using quantitative indicators and qualitative assessments made by the EIU analysis. Among the analysed countries, the US scored the highest result in any category and was identified as the principal enabler and enhancer of innovation across the sample (similar results were found for Japan). South Korea and the United Kingdom show slightly lower results and also Denmark, Sweden and Finland's indices of IT industry competitiveness are lower than the ones reported by the US (Table 7).

Table 7: IT industry competitiveness index 2007, selected countries

Country	Overall index score	Business environment	IT infrastructure	Human capital	Legal environment	R&D environment	Support for IT industry dev.
Category weight		10%	20%	20%	10%	25%	15%
United States	77.4	97	81.3	96.4	92	39.8	86.8
Japan	72.7	82	52.3	67.4	79	84.3	77.1
South Korea	67.2	80	61.7	74.8	66	56.6	74.3
United Kingdom	67.1	95	69.4	81.6	88.5	23.2	84.9
Australia	66.5	92	75.9	76.2	87	21.1	86.2
Taiwan	65.8	88	51.3	73.4	70	54.8	75.9
Sweden	65.4	88	65.7	64.5	81.5	39.6	83.5
Denmark	64.9	93	71.7	60.2	87	28.2	89.5
Canada	64.6	88	87.5	65.9	82	15.5	86.8
Switzerland	63.5	88	88.2	54.8	83	19.8	85.4
Singapore	63.1	91	58.8	84.9	80.5	16.3	87.5
Netherlands	62.9	91	72.4	59.1	87	23.5	86.1
Finland	62.7	88	55.7	67.2	85	32.4	84.9
Norway	59.7	80	59.6	63.7	85	20.9	88.5
Ireland	58.6	96	44.9	74.4	88.5	14.3	84.5
Germany	58.2	88	58	59.4	85	28.9	68
New Zealand	57.5	92	50.9	69.5	79.5	14.7	84
France	55.8	83	54.3	60.3	83.5	20.6	73.6
Austria	55.3	83	55.8	56	85	17.7	78.1
Israel	54.5	83	45.8	64.8	75.5	24.9	68.8
Hong Kong	53.4	100	59.1	49.2	74.5	6.3	84.3
Belgium	53.3	88	45.1	57.7	85	13	81.2
Italy	46.4	72	32.2	59.9	74.5	11.4	69.8
Spain	46.1	80	29.6	61	78	6.6	70.1
Estonia	45.3	83	38.5	54.4	73	2.5	69.9
Portugal	45.3	88	33.1	57.6	74.5	3.8	66.3
Slovenia	44.2	68	29.6	61.1	73	9.7	63.4
Hungary	41.5	83	24	54.9	74.5	6.9	55.1
Czech Republic	40.7	78	26.3	51.7	71	5.9	58
Poland	40	75	22	55.3	73.5	2.9	59.4
Chile	39.5	95	12.7	42.4	67	1.7	79.2
Slovakia	39.5	76	28.3	51	71	2.8	54.7

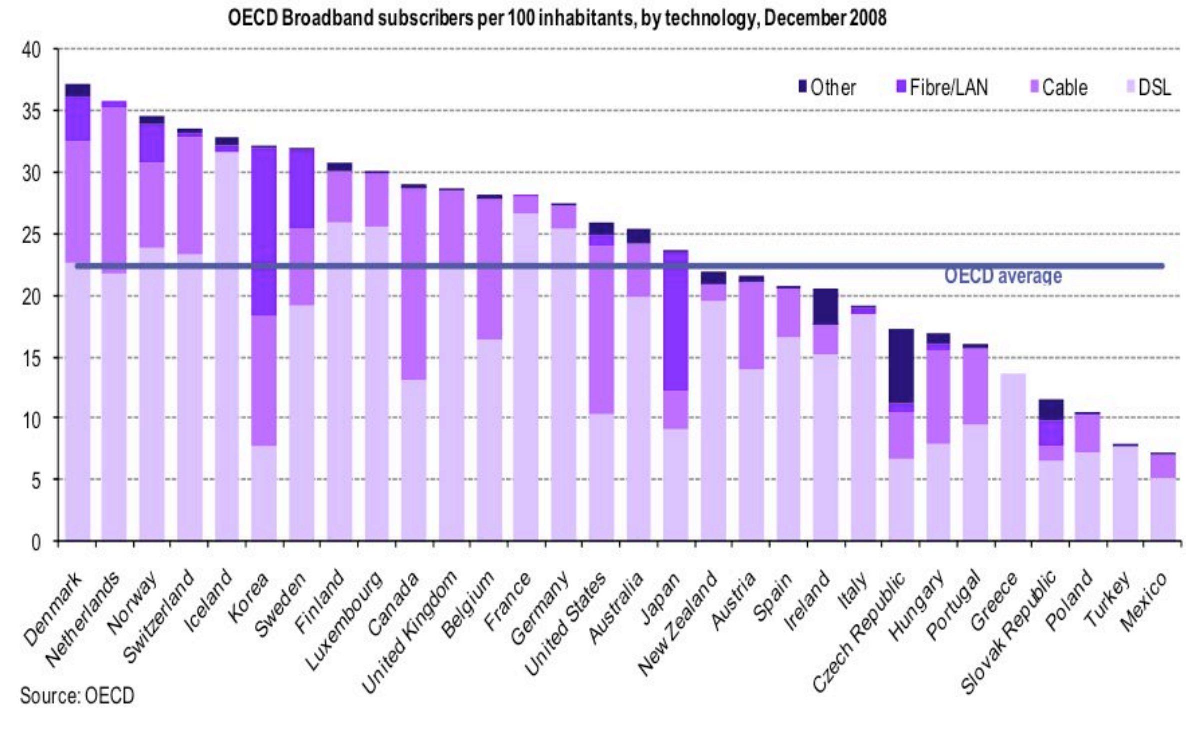
Source: The EIU (2007)

Supporting industry

A dynamic and vigorous software sector necessarily needs support from other sectors that complement the provision of its services and enable the expansion of new and alternative products. In this section we look at the penetration rates of broadband and mobile telephony.

The OECD provides data on the broadband subscribers for 2008 and shows Denmark, Switzerland and Norway as the three countries with the highest penetration rates (above or near 35%). The US is in the middle of the graph, with a penetration rate slightly above the OECD average. Countries such as Spain, Ireland and Italy are found at the bottom of the chart, with penetration rates below the OECD average.

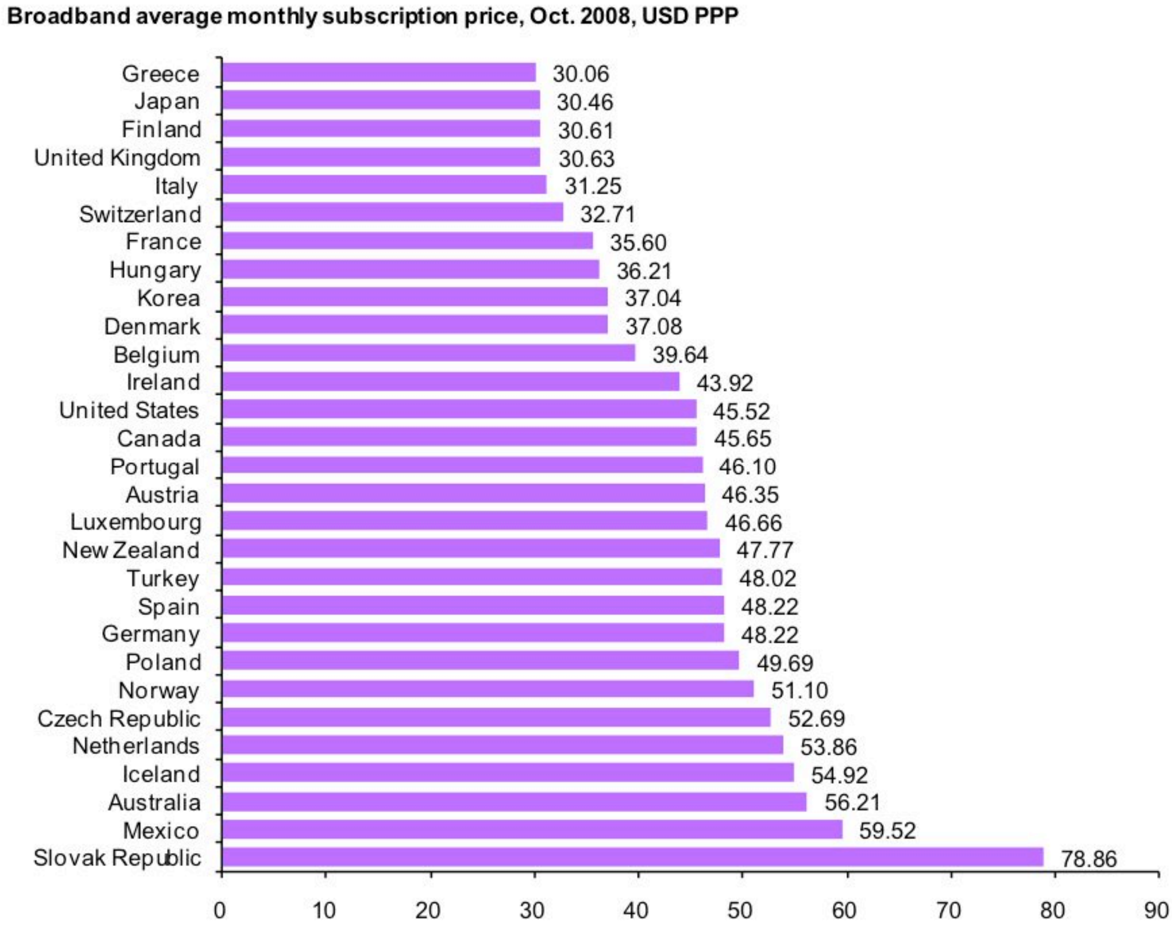
Figure 11: Broadband subscribers, 2008 (per 100 inhabitants and by technology)



Source: OECD Broadband subscribers per 100 inhabitants, by technology, December 2008

Prices are also an important determinant for the penetration, expansion and usage of broadband. The OECD provides estimates on the broadband monthly subscriptions for 2008 (in USD PPP). Interestingly, the US is placed in the middle range of the chart, with higher prices than some of the EU Member States (Greece, Finland, the United Kingdom, Italy, France, Hungary, Denmark, Belgium or Ireland). In contrast, some other EU Member States have prices noticeably higher than the US, especially, Norway, Germany and Spain.

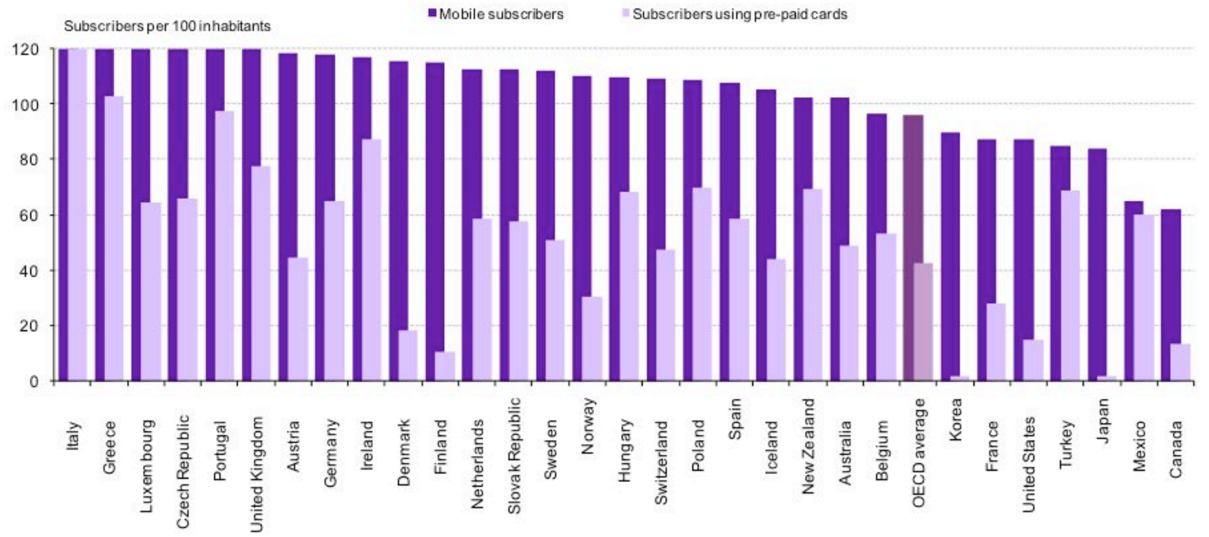
Figure 12: Broadband monthly subscription price (2008, USD PPP)



Source: OECD Broadband statistics, Price range, monthly subscriptions, 2008

The OECD mobile 2009 survey shows the subscribers per 100 inhabitants to be highest in Italy and Greece, followed by Luxembourg, the Czech Republic, Portugal and the United Kingdom. Interestingly, the number of new mobile users in the US, France and Japan is below the OECD, with penetration rates similar to those in Korea, Turkey and Mexico.

Figure 13: Mobile subscribers



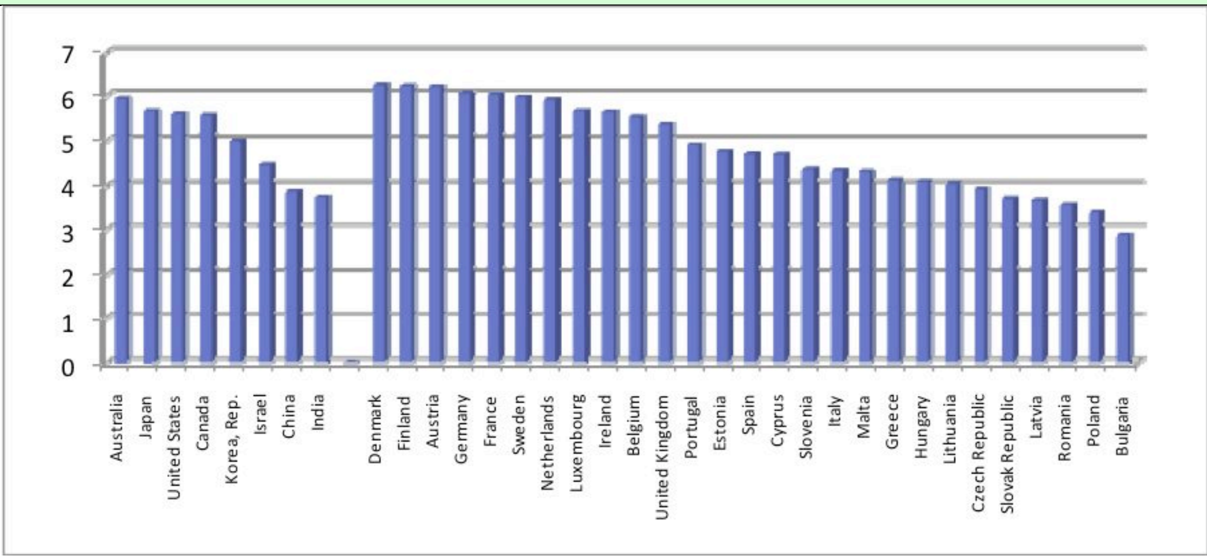
Source: OECD Key ICT indicators, Mobile subscribers in total for OECD, 2009.

Intellectual property rights

The World Economic Forum provides information on the perception of intellectual property protection in different countries, based on a survey to individuals, businesses, and governments (respondents are asked to score between 1 and 7 the perceived protection of intellectual property in their region, where 1 is weak protection and 7 is strong protection).

The highest level of perception regarding intellectual property protection is reported in Denmark (6.22), Finland (6.2), Austria (6.19), Germany (6.04), France (6.01), and Sweden (5.95), all above the scores observed in Australia (5.92), Japan (5.65) and the US (5.58).

Figure 14: Perception on intellectual property protection



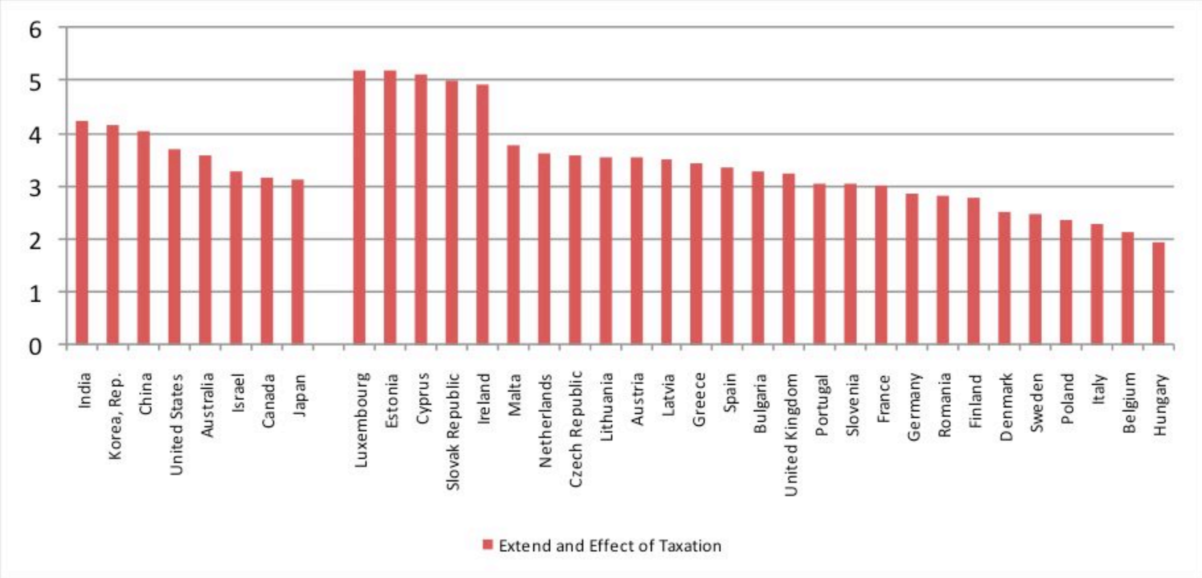
Note: Intellectual property protection in your country (1 = is weak and not enforced; 7 = is strong and enforced)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

Effects of taxation

The impact of taxation on the economic activity and innovation is also reported in the Global Information Technology Report 2008-2009 (World Economic Forum), which is analysed by asking individuals, entrepreneurs and government officials whether they perceive the tax systems to limit the investment and work incentives or whether the tax systems are not considered to be a key issue for economic activity and innovation in their countries (1 to 7). The results of WEF's study show the lowest burden in Luxembourg (5.2), Estonia (5.17), Cyprus (5.13), Slovak Republic (4.98) and Ireland (4.93), all of which are above India (4.25), Korea (4.15) and China (4.03).

Figure 15: Extent and effect of taxation



Note: The level of taxes in your country (1 = significantly limits the incentives to work or invest, 7 = has little impact on the incentives to work or invest)

Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

Summary of supporting industry and other related factors

The EU 27 lags behind the US and East Asia in fields of: financial services; information society; innovation and R&D; liberalization network industries; enterprise environment; social inclusion; and sustainable growth. However, individual countries within the EU perform better than the US. Namely, Sweden, Denmark and Finland outperform the US in innovation, financial services, social inclusion and sustainable development. In terms of the IT sector analysis the US has a leading position in terms of innovation followed by Denmark, Sweden Finland and the United Kingdom.

The supporting industry of broadband and mobiles is well developed in the EU and in some cases with subscription rates higher than those in the US (Denmark and Norway in the case of broadband, and Italy, Greece, Luxemburg, the Czech Republic, Portugal and the UK in the case of mobile).

The perception of intellectual property protection in the EU is high, and in the case of the most developed countries, within a similar range to that of the US. The perception on the extent and effect of taxation is seen particularly burdensome in some of the most developed EU economies compared to the US, in particular Sweden, Denmark, Finland, France and the United Kingdom.

4.3 INDUSTRY STRATEGY, STRUCTURE AND RIVALRY FACTORS

The competitiveness of the EU industry is conditioned by its relative position compared to: current competitors, new entrants or potential entrants. The particularities of different rivals play an important role in assessing the competitiveness of the sector (specific factors such as leadership, reputation and brand value need to be assessed). In addition, for some markets the size and/or fragmentation of the market are important as economies of scale can be an important driver for development.

The software industry is characterised by a very uneven distribution of firm sizes. Hence, there are some very big players accounting for much of the share in the revenues, and a huge number of fragmented companies of a much smaller size. This is shown in Table 8, where we calculated average measures for three groups of companies: the top 10 companies in ranking of sales, the next 11 to 25 companies and the remaining companies to the 150 rank.

The average number of employees, average sales and average R&D expenditures in each of the three groups show the relative larger size of companies at the top 10. The average company in the top 10 has a size of 90,000 employees, compared to less than 4,000 for the companies in the 26-150 group (Table 8). Because of the differences in size, it is interesting to review the measures in relative terms. Looking at the R&D investment per employee or as a percentage of sales for the average company in each group we see that companies in the small group make more similar investments than companies in the top 10.

Table 8: Characteristics of firms (software, internet and computer services)								
	Absolute measures				**Measures of intensity**			
Class / Rank	**R&D investment (in mio €)**	**Sales (in mio €)**	**Employees**	**Operating profits (in mio €)**	**R&D investment (per employee)**	**R&D investment (% sales)**	**Sales per employee**	**Operating profits (% sales)**
Top 10	2,028	22,636	90,373	3,715	22	9	250	16
11-25	164	2,924	21,268	289	8	6	137	10
26-150	63	479	3,691	35	17	13	130	7

Source: London Economics calculations based on the 2009 EU Industrial R&D Investment Scoreboard.

A more detailed analysis of the industry structure is provided by looking at the 10 largest players in the sales market for the subsectors of software, internet and computer services (Table 9). Again, it is noticeable the large differences in size between the leading firms and the rest of the top 10 group, both in terms of sales and number of employees.

Table 9: Turnover and employment 10 top companies: Software, Internet and Computer Services, 2008			
Company	**Country**	**Sales**	**Employees**
Software			
Microsoft	US	42,041	93,000
Oracle	US	16,728	86,000
SAP	DE	11,575	51,638
Symantec	US	4,424	17,400
Infosys Technologies	IN	3,203	104,850
CA	US	3,073	13,200
Adobe Systems	US	2,575	7,335
Invensys	UK	2,363	22,139
Amdocs	UK	2,275	18,535
Intuit	US	2,211	8,200
Internet			
Google	US	15,680	20,222
Yahoo!	US	5,186	13,600
IAC/InterActiveCorp	US	3,302	3,200
freenet	DE	3,263	5,658
Tencent	CN	754	6,194
Check Point Software Technologies	IL	582	1,884
Akamai Technologies	US	569	1,500
United Online	US	482	1,986
TradeDoubler	SE	314	624
Digital River	US	284	1,335
Computer services			
IBM	US	74,555	398,455
Fujitsu	JP	42,309	167,374
SAIC	US	7,250	45,400
Fujitsu Siemens Computers	NL	6,614	10,643
SunGard Data Systems	US	4,026	20,000
Unisys	US	3,765	28,000
Logica	UK	3,711	39,254
Nomura Research Institute	JP	2,717	5,711
Nihon Unisys	JP	2,681	9,512
Indra Sistemas	ES	2,380	24,430

Source: London Economics calculations based on the 2006 EU Industrial R&D Investment Scoreboard.

As seen, the software industry is characterised by the presence of some very large players compared to a remaining fragmented industry. Consolidation at the top is a strategy for making use of economies of scale and exploiting the benefits of compatibility of products in a context of network economies. However, even more important than size, this industry is characterised by a lack of change in the order amongst the players at the top. In Table 10 we have counted the number of times companies in the top 1, top 5 and top 10 have changed their ranking order throughout the period 2006 to 2008. The leading firm remained at the very top in the software, internet and computer services under the period of analysis. Moreover, in the software sub-sectors there was no change amongst the top five companies (and only 10 changes amongst the top 10 companies). This indicates these sub-sector as the ones with less changes, just below industrial transportation. Internet and Computer services also show no changes in the top position (among other sub-sectors). However, in these sub-sectors, especially in the computer services, there have been more changes in the ranking of the top 5. In particular, we observe a significant number of changes in the rankings of the top 10 companies in the computer services sector.

This indicates a trend in the software sub-sector where it is likely that the firm order in the status quo is maintained over the years and where it is difficult to dislodge the firms at the top. The main explanation for this is the economies of scale and network effects of such industry, but other factors, such as brand recognition and a reputation achieved through the years, should also be recognised. In the case of internet and computer services firms there seems to be larger mobility in the ranking of companies.

The implications of this is that past experience shows that it has been very difficult to gain leader positions in the software sub-sector, and less so in the internet and computer services sub-sectors. It is unlikely that, under current circumstances, existing market players will be successful in gaining the top position. The opportunities will come in the provision of new services where new business models are developed, such as emerging segments in the software industry. However, the success of new market players will be limited by the extent to which size, network effects and reputation will dominate in the new industry that is emerging.

Table 10: Changes in ranking 2006-2008			
Industry	**Top 1**	**Top 5**	**Top 10**
Industrial transportation	0	0	0
Software	0	0	10
Chemicals	0	1	36
Electronic equipment	0	2	4
Personal goods	0	2	8
Telecommunications equipment	0	2	10
Aerospace & defence	0	2	16
General retailers	0	2	28
Leisure goods	0	3	24
Media	0	4	5
Gas, water & multiutilities	0	4	16
Biotechnology	0	5	11
Food producers	0	6	21
Other financials	0	7	19
Industrial machinery	0	7	23
Automobiles & parts	0	8	13
Travel & leisure	0	8	21
Internet	0	9	9
Electrical components & equipment	0	9	30
Electricity	0	9	31
General industrials	0	10	34
Commercial vehicles & trucks	0	11	26
Construction & materials	0	12	29
Banks	0	14	29
Semiconductors	0	14	33
Computer services	0	18	46
Support services	0	29	43
Oil & gas producers	1	3	10
Computer hardware	1	4	8
Health care equipment & services	1	6	19
Fixed line telecommunications	1	7	16
Pharmaceuticals	1	10	21
Oil equipment, services & distribution	1	11	19

Source: London Economics calculations based on the 2009 EU Industrial R&D Investment Scoreboard.

Summary of Industry strategy, structure and rivalry factors

The software industry is characterised by very different typology of companies. In particular, few large companies account for a large share of the total sales revenues.

The same is true for the expenditures amounts on R&D investments. However, it is interesting to note that small companies make similar or larger contribution to R&D investment when analysed in relative (R&D investment per employee).

It can then be said that the software sector is characterised by economies of scale, and network economies play a major role in determining the position of the company in the market. There is also little turnover in the companies positioned at the top of the ranking.

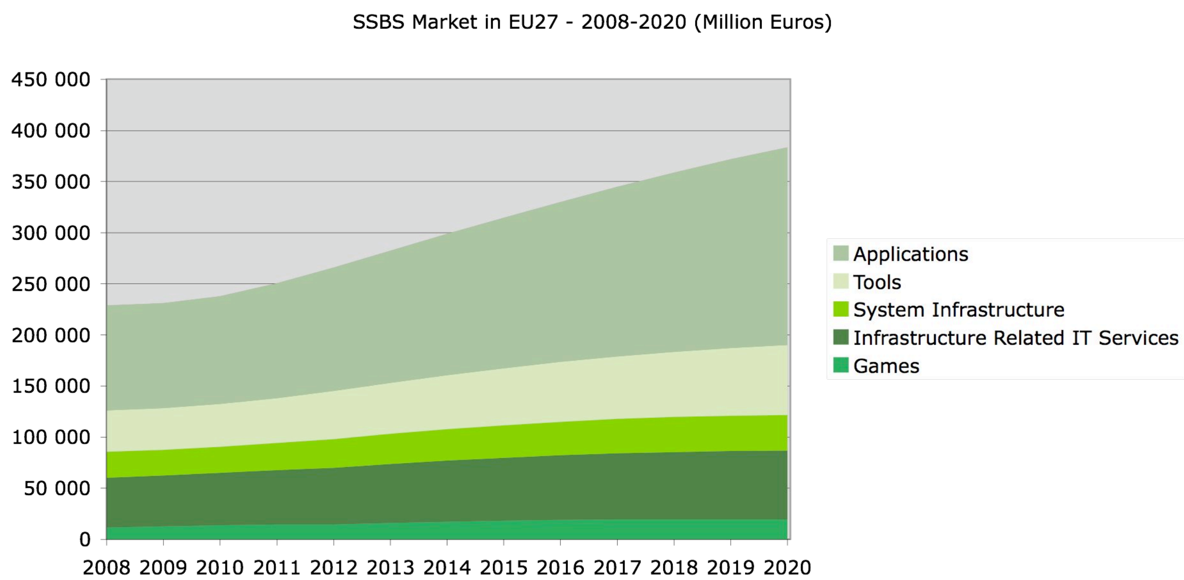
CHAPTER 5
SSBS AND SBIS – FORESIGHT 2020

5.1 THE SSBS MARKET STRUCTURE IN EUROPE IN 2020

This part presents the main results of the forecasting exercise for the SSBS market in 2020. The assumptions in terms of growth drivers and relationships in between segments have been presented in the previous chapters. A more detailed approach to the methodology and models used to build the baseline scenario of the market demand until 2020 is presented in CHAPTER 7.

5.1.1 SSBS OUTLOOK BY SOFTWARE TYPES

The following graphs and tables present the baseline scenario of the SSBS market demand for the forecasted period (2008-2020 period) segmented by software types in the EU27 region.



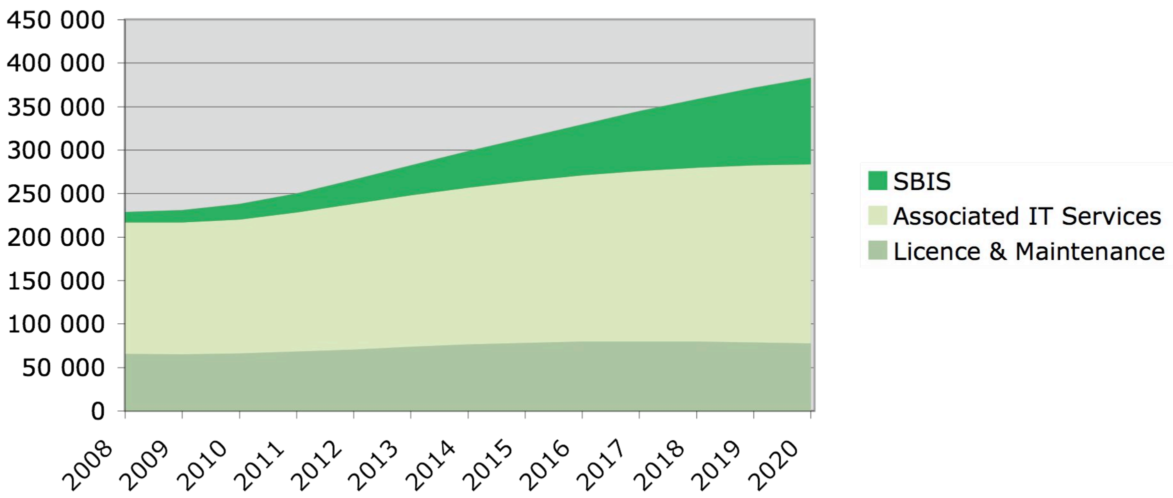
Software type	Market share 2008	Market share 2020	CAGR 08/20
Applications	44.8%	50.4%	5.4%
Tools	17.7%	17.8%	4.4%
System Infrastructure Software	11.0%	9.1%	2.6%
Infrastructure related IT Services	21.3%	17.6%	2,7%
Games	5.1%	5.1%	4.4%
Total SSBS market	100%	100%	4.4%

While the evolutions in the market structure are not as strong as along the revenue model axis, the market value for SSBS software types will clearly move from the infrastructure layers (both system infrastructure software and IT related IT Services towards the application software layer. This is mainly explained by the fact that market forces such as OSS and virtualization have a strong price erosion effects (both direct and indirect cf. p27) on infrastructure related software and services. On the other hand the tools are less impacted by this phenomenon. Games follow also a different evolution pattern (cf. p.

5.1.2 SSBS OUTLOOK BY REVENUE MODELS

The following graphs and table present the evolution of the different SSBS market segments for the 2008-2020 period in the EU27 region. This is the baseline scenario of the SSBS market development for the next 10 years.

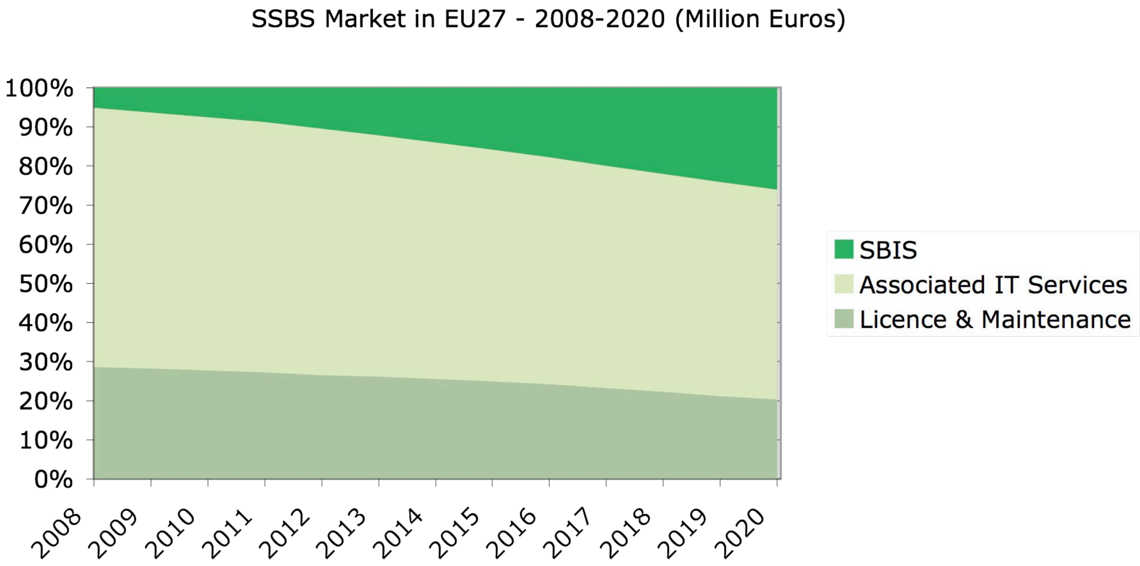
SSBS Market in EU27 - 2008-2020 (Million Euros)



In the baseline scenario, the SSBS market in the EU27 region goes from 228.7 billion Euros in 2008 to 383.5 billion Euros in 2020, a 4.4% CAGR over the 2008-2020 period.

Segments	Market share 2008	Market share 2020	CAGR 08/20
Licence & Maintenance	28.6%	20.3%	1.5%
Associated IT Services	66.2%	53.6%	2.6%
Paid Web Based	5.2%	26.1%	19.2%
Total SSBS market	100%	100%	4.4%

Evolution of the emerging segments share compared to the rest of the SSBS market



During the 2008-2020 period, the structure of the SSBS spending by companies and administrations is changing dramatically as the weight of traditional revenue models (License & Maintenance and Associated IT Services) is decreasing in favour of the emerging revenue models (Paid Web Based and Advertising from the SBIS segment).

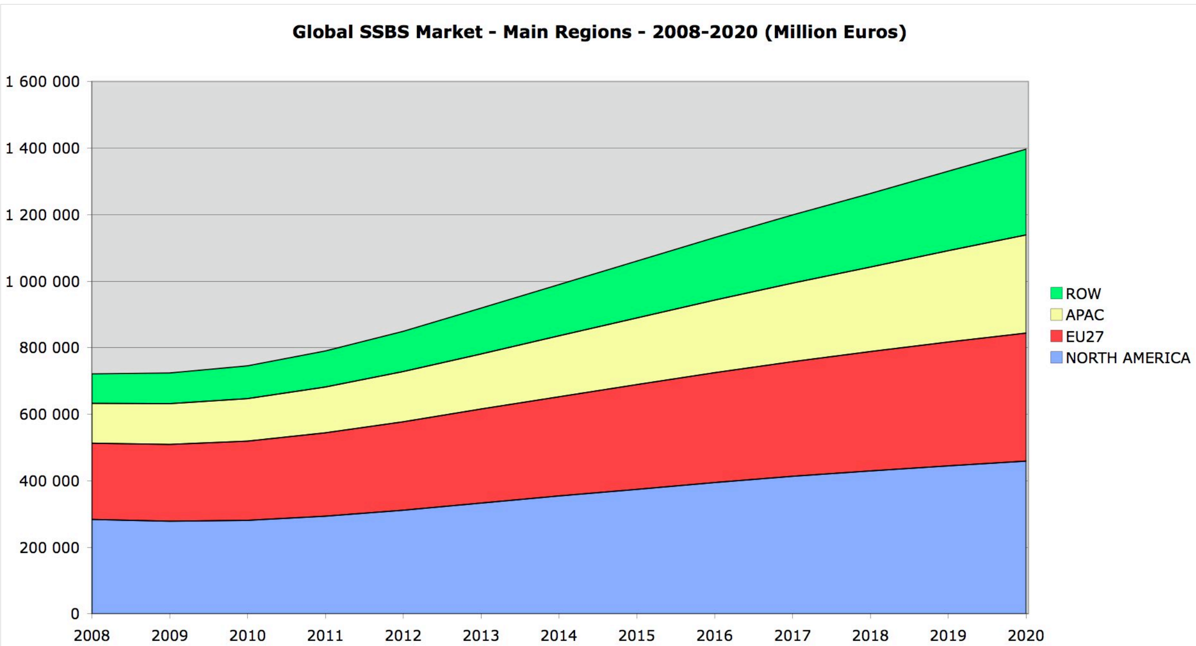
Whereas average annual growth rates of the SBIS segment remain very dynamic in the 2008-2020 period in this baseline scenario, market shares will likely remain in the 25-30% range in 2020. In fact this scenario, which is the most likely, these models do not swipe the traditional models out, the latter having still a positive, although limited growth over the same period.

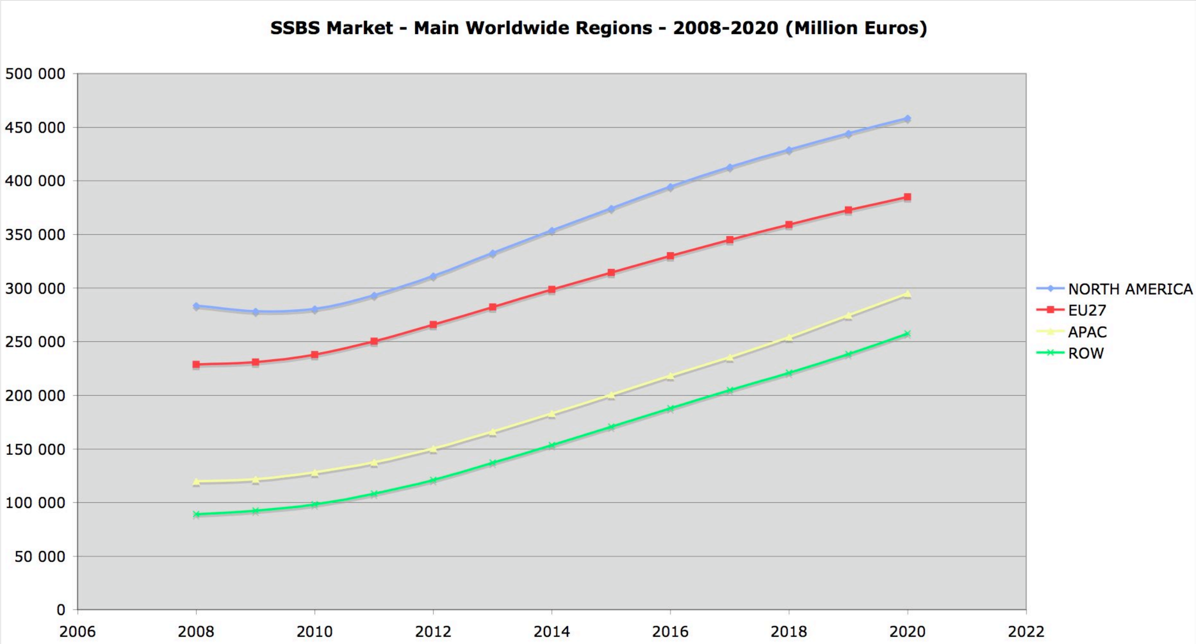
The incidence of SSBS spending on GDP goes from 1.82% in 2008 to 2.23% in 2020. Hence, the SSBS grows faster than the overall economy of the EU27 region. However, this development is relatively slow, just as in historical development trends.

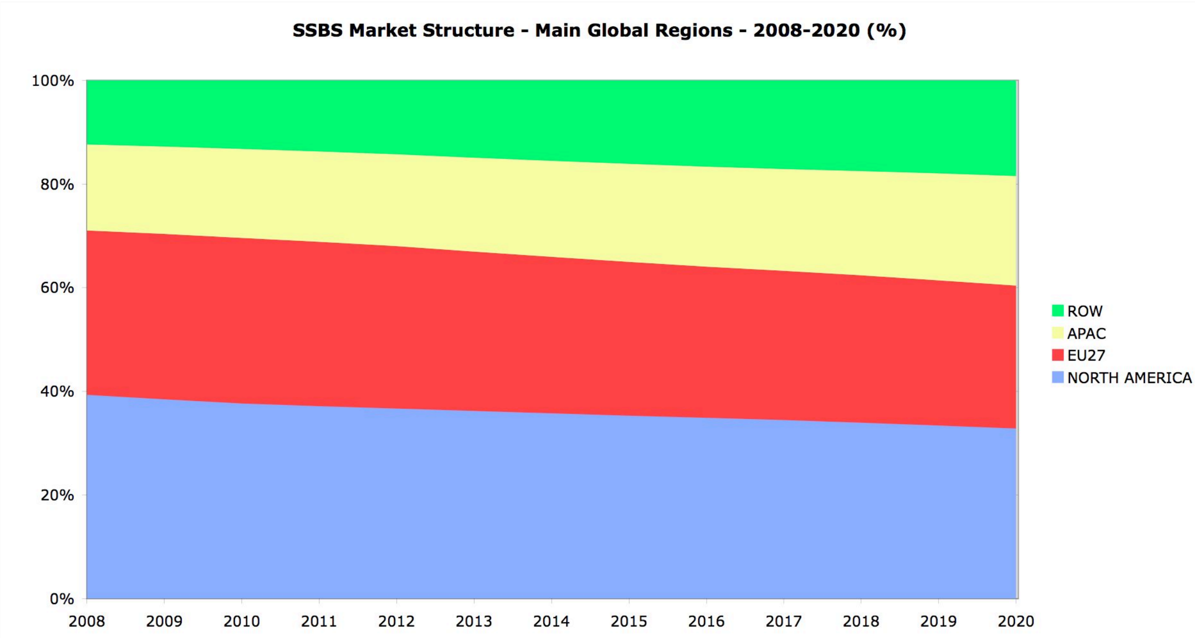
5.2 SSBS MARKET IN 2020 - INTERNATIONAL COMPARISONS

The study team has developed similar SSBS market models for the main regions in the World, including North America, Asia Pacific (APAC) and Rest of the World (RoW – including Latin America, Middle East Africa, Russia and Eastern European countries outside of the EU27 region). Potential growth scenarios are based on GDP as well as demographic forecasts by region, and different elasticity rates of SSBS spending on GDP depending on the level of maturity of the region. Elasticity rates for mature regions such as North America and Japan are similar to those used for the EU27 market model; they are much more important for emerging regions such as the rest of APAC, Latin America, where IT investments grow much faster than the overall economy.

Comparing the EU27 region to other international regions, this evolution of the incidence of SSBS spending on GDP is relatively in line with North America. In APAC and Rest of the World, this phenomenon is much more significant, as the incidence of SSBS on GDP is smaller in 2008 and should progress much faster until 2020, while remaining at lower levels than those expected in North America and in the EU27 region.







Geography	Market Shares		CAGR 2008/2020
	2008	2020	
EU27	32%	28%	4.4%
North America	39%	33%	4.1%
APAC	17%	21%	7.8%
Rest of the World	12%	18%	9.3%
World	100%	100%	5,7%

SSBS spending growth in the U.S. in the baseline scenario is in line with the growth in the EU27 region. In Asia (including Japan) as well as in the rest of the World, SSBS spending growth is estimated to be about twice as fast as the EU27 growth. *In particular the SBIS market will develop much faster than in Europe or in the U.S as legacy systems and investments are not as developed as in the old economies.* Therefore, APAC companies buy in the SBIS models more easily than U.S. or European companies. Hence, market share of mature countries will decrease in the 2008-2020 period, to the benefit of the Emerging countries in Asia Pacific (APAC), Eastern Europe (outside of the EU27), Latin America and Middle East Africa.

5.3 SSBS MARKET – 4 THEME SCENARIOS

The baseline scenario represents an extrapolation of the most likely route of ongoing development and innovation trends. Some of the assumptions embedded in the baseline scenario have high level of uncertainties regarding the rate of these segments' development in the future. In order to better comprehend the potential impacts of the development of selected market forces, we have built four theme scenarios, each focusing on the intense development[24] of one particular market force.

These theme scenarios have been selected for different reasons:

- Cloud computing – this segment is at the core of the SBIS industry. One of the key objectives of this project is to better understand the impact of the development of the Internet of Services on the software industry in Europe. This theme scenario looks at how the market and industry will look like if the developemnet of Cloud computing is more rapid than in the baseline scenario.
- Mobility – with the rapid diffusion of portable devices to consumers and professionals, SSBS players are finding new ways to use software technologies and, more importantly, new business models made possible by the combination of the internet, software technologies and the capability to use the software-based

[24] *In the CHAPTER 2 we have presented some of the key techno-enablers that underly the development of these scenarios.*

service wherever the end-user is located. This theme scenario examines the additional growth that could impact the SSBS industry if the development of mobile applications is faster than in the baseline scenario.

- Open source – as presented earlier in this document OSS is one of the key enablers of the cloud computing models. It is also a model that potentially destroys value in the software product industry. This theme scenario looks at the potential impacts a stronger development of OSS technologies could have on the SSBS market and industry.
- Offshore – Offshore is not a market segment in itself. It is a constraint of the IT services market, a key component of the SSBS market. In the D2 report, we have explained some of the risks and potential benefits of the offshore delivery models. This theme scenario takes a quantitative approach to the question of the offshore models and looks at the potential impacts on the SSBS market and industry if these models were to develop faster than in the baseline scenario.

The Consortium believes that these four theme scenarios provide insights into the potential risks and possible chances that the SSBS industry is facing in the years to come. It will help us better define framework for the policy actions required to foster the development and competitiveness of the SSBS industry in Europe.

The following table summarizes the paces of development of each market force in the baseline scenario and in the theme scenario.

Market force	Baseline Scenario	Theme Scenario
Cloud Computing	Strong growth (2009/20 CAGR: +24%)	Explosive growth (2009/20 CAGR: +31%)
Mobility	Strong growth (2009/20 CAGR: +14%)	Explosive growth (2009/20 CAGR: +22%)
Offshore	Strong growth (2009/20 CAGR: +12%)	Very strong growth (2009/20 CAGR: +15%)
Open Source	Strong growth (2009/20 CAGR: +14%)	Very strong growth (2009/20 CAGR: +18%)

By definition, these theme scenarios are less likely than the baseline scenario, but still could happen. They provide interesting information on the market force related uncertainties, as well as the potential impact of the development of the designed market force.

5.3.1 OPEN SOURCE SCENARIO

5.3.1.1 Reasons for selection

Internet has been the catalyst of the industrial revolution of the IT industry. It is a cost efficient, global, collaborative and open technology that has changed the way we interact with and use information systems. Open Source Software (OSS) and Cloud Computing concepts are some of the most important concepts issued from the advent of the Internet. Technologies have their time, then fade away and get replaced by new technologies while concepts remain.

OSS has already proven to be a game changing concept in the last decade by colonizing entire market segments, especially those that are linked to the Internet - such as Web servers - and has dramatically changed the competitive landscape and significantly lowered prices. OSS is also a concept spanning nearly all segments and IT technologies. Its growth potential, its significant direct and indirect effects as well as its broad reach are part of the main reasons we do a specific high growth scenario for the OSS.

As seen in the first part of this document, OSS has major effects on prices of software products' licences, both directly and indirectly. Overall, a stronger growth of OSS would mean some additional value destruction in the Licence & Maintenance segment of the SSBS market. On the other hand, a stronger development of OSS technologies would mean additional growth in the Associated IT Services segment, as enterprises and administrations would require supplementary integration services.

An overgrowth of the OSS will most certainly damage the activity of some software players, including European ones, especially the companies that are active in the middleware field. Luckily, they are not numerous, and are already positioned on high-end solutions, where OSS technologies are not key competitors. In the application software field, OSS will increase the volume of custom development, largely within major companies, thus hampering the development of some applications packages.

There is also a threat of having small European application software product providers having to compete more and more with OSS equivalents on basic application functionalities. In return, this will push them to innovate in higher value-added functionalities and vertical sector specific applications, where there are no communities to support such niche developments. As far as large application software providers are concerned, the breadth and the sheer power of packaged applications such as SAP, which correspond to what business really need, will prevent this effect from being too widespread.

5.3.1.2 Drivers

The drivers that could trigger this extra growth are the same that have explained its past growth, such as increased commoditisation in particular. Apart from this conjectural effect there are other more structural issues. The most important drivers need to be detailed more.

- OSS is already benefiting from the current economic crisis due to its alleged lower cost of ownership. If the economic and SSBS growth prospects remain limited in the coming years, OSS development should be strengthened as a result.
- A stronger penetration of cloud computing could also stimulate OSS penetration on the market, as OSS is more and more viewed as one of the solutions against one of the most dangerous aspect of the cloud computing: lock-in. Similarly to the Internet or the Web 2.0 concept, cloud computing is strongly based on OSS (Linux datacenters for instance) and numerous startups of the cloud computing' ecosystems are strongly OSS- oriented. Cloud computing also promotes global collaborative IT, which is one of the key delivery means of the OSS.
- OSS could also be deployed more if there is a bigger leverage of IT by end-users when they believe that IT is now so important in their value creation processes that they must have a better and stronger control of it.
- For an opposite reason, industry leaders could also decide that part of their IT systems could be shared with other industry players, as they are important but neither key differentiation factors nor sources of competitive advantages for such companies. OSS could allow them to go into this direction.

- The rapid growth of OSS intensive countries such as China could foster the development of OSS bricks through huge participation levels in OSS communities. Due the great size of their market, packaged OSS could quickly gain economies of scale, and get a good momentum internationally. This influx of competencies and software will surely foster the OSS market growth globally.
- Creation of OSS curricula throughout Europe
- Stronger support of OSS communities and projects through EC funding schemes.

Finally, lowering existing barriers to OSS adoption would most certainly boost the growth of the OSS segment:

- The almost monopolistic situation on the PC segment gets heavily challenged by the surge of other portable / mobile IT devices such as netbooks, Internet based smartphones, mobility devices and game consoles which run more and more on OSS platforms.
- Interoperability standards are heavily enforced by European governments
- A pan–European licence, adapted to the specificities of the cloud computing should be created and enforced, thus promoting the growth of both cloud computing and OSS in Europe.
- The marketing of some software giants against the OSS is fading away as they shift more and more their activity towards services.

5.3.1.3 Impacts

A high growth scenario for OSS will decrease revenues coming from the on-premise licensing model and make the market move faster towards services-oriented delivery modes. Other type of software licensing will remain unaffected, or just marginally with an increase of paid web-based revenues from Cloud Computing delivery modes. Some parts of the SSBS segment will also disappear and will be replaced by large-scale software development collaboration schemes including various stakeholders (CardaMOM middleware project including Thales, Alenia and Northrop Grumman – or the AMQP project that includes Bank of American, Barclays, Cisco, Microsoft, Red Hat…).

This scenario is also likely to enhance the IT services firms' business model against software products vendors. IT Services companies and end-users will have to conduct more software R&D but it will not equal the R&D done by software companies resulting in added value destruction globally. But it could also mean more of it for Europe, where OSS is a strong asset. The main threat could come from the developing world, which could more easily access technology and gain an edge over European companies

Key parameters for the scenario

The scenario regarding OSS is based on :

- Higher diffusion of OSS technologies, which translates into five additional points of growth per year of OSS licences and proportional growth of OSS-related IT Services.
- Part of this higher diffusion has an overall positive impact on the SME and mid-market segments. As a result, these companies get an easier access to software technologies and application software in particular, thus improving the overall productivity and performance of EU-based SMEs. Such technologies are developed, pushed to the market and implemented by small, local services firms that are close to the SMEs and mid-market firms.
- Slowing growth of Licence & Maintenance segment in each of the sub-segments: applications, tools and system infrastructure software. The most important impact is in the tools segment and in the middleware domain in particular, as well as in the system infrastructure software space. The slowing effect is coming from both direct – traditional software products replaced by OSS – and indirect effects, as higher diffusion of OSS technologies means stronger price pressure on the traditional software markets.
- Positive effect on associated IT services. With stronger OSS demand, the OSS-related integration services market would expand faster as it would have more demand from end-users. To simplify, we have kept the same OSS / services ratio. This offsets the loss in Associated IT Services revenues coming from weaker spending on traditional Licences.
- Positive effect on the SBIS segments. The availability of OSS components and the

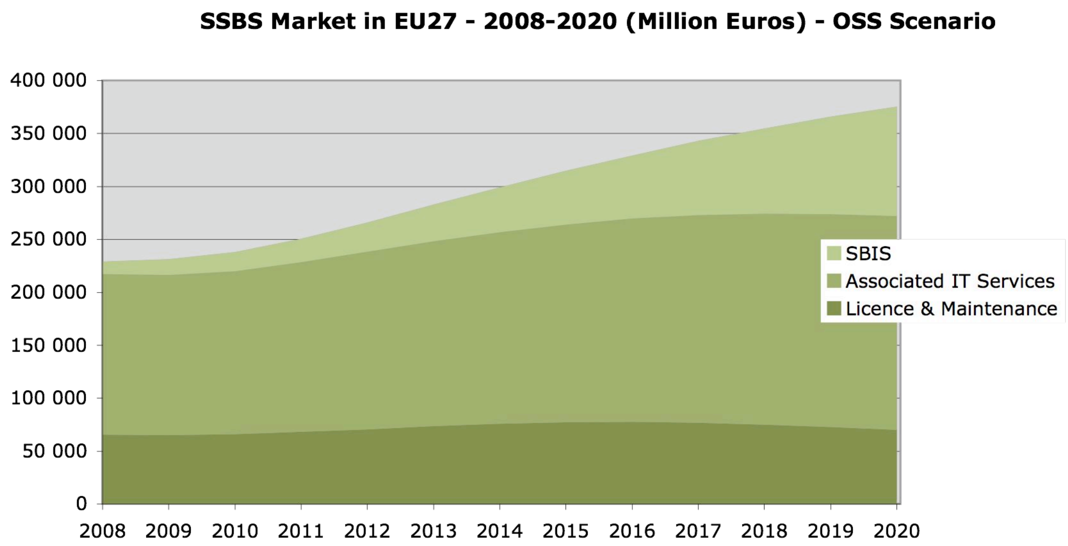
a stronger OSS ecosystem in Europe bring key elements to build a European wide cloud infrastructure. This should benefit the SBIS segments.

5.3.1.4 Main results of the scenario

SSBS market in EU27 (millions Euros)

EU27	2008	2009	2010	2011	2012	2013
Licence & Maintenance	65 529	65 082	66 100	68 210	70 628	73 723
Associated IT Services	151 532	151 491	153 979	160 208	167 668	174 523
SBIS	11 680	14 492	17 829	21 991	27 671	34 449
TOTAL	**228 742**	**231 065**	**237 908**	**250 408**	**265 967**	**282 696**

EU27	2014	2015	2016	2017	2018	2019	2020
Licence & Maintenance	75 991	77 374	77 818	76 907	74 993	72 623	69 946
Associated IT Services	180 994	186 805	191 905	196 126	199 341	201 416	202 206
SBIS	42 169	50 346	59 413	69 816	80 456	91 951	103 123
TOTAL	**299 154**	**314 525**	**329 136**	**342 849**	**354 790**	**365 989**	**375 275**



Revenue Type	Δ* in 2020 market size in EU27 in OSS Scenario (in MEuros)	Δ* in 2020 market size in EU27 in OSS Scenario (in %)
Licences	-7 992	-10.3%
IT Services	-3 411	-1.7%
SBIS	3 198	5.8%
Total SSBS	**-5 133**	**-2.1%**

Segment	Impact
License & Maintenance	--
Associated IT Services	-
SBIS	+
Total SSBS	-

Compared to the baseline scenario, the OSS scenario would represent a lost growth of 2.1% in 2020 compared to the baseline scenario, i.e. -0.2% per year from 2008 to 2020. The overall lost growth would represent 5.1 billion EUR in 2020 in EU27, mostly impacting the Licence & Maintenance market segment (application software products, tools and system integration software). The scenario embeds an additional Associated IT Services growth, due to a additional value creation around OSS bricks. However this effect is counterbalanced by the stronger development of the SBIS models, which have strong impacts on the IT Services segments (cf. Cloud Computing scenario). Overall the additional value generated in the SBIS segment does not offset the decrease in value of the Licence & Maintenance segment and IT Services segments.

In this scenario, the OSS market would be increased by more than 40% by 2020 compared to the baseline scenario, and would represent more than 15% of the EU27 SSBS Associated IT Services market value by 2020.

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* *Compared to the baseline scenario.*

* *Compared to the baseline scenario.*

As a consequence, SBIS revenue share in 2020 would slightly grow compared to the baseline scenario (27.5% compared to 26.1% respectively).

Impacts on jobs

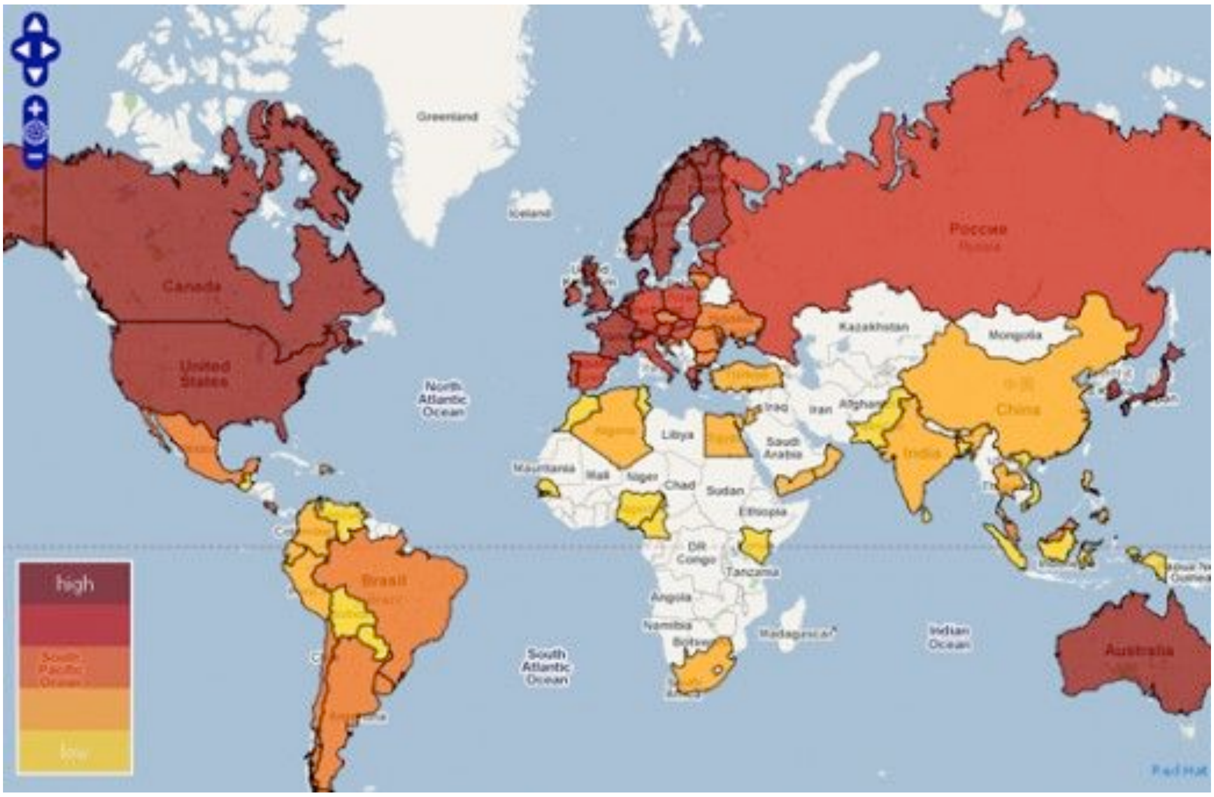
Although the SSBS market growth would be slightly negatively impacted by the OSS scenario, the study team estimates that the demand for IT jobs would slightly increase, as there would be an increased demand for the Associated IT Services around OSS bricks.

OSS scenario should benefit to the SBIS segments (especially the infrastructure related segments – e.g. IaaS and PaaS). The most important impact there is on the value transfer from License & Maintenance and Associated IT Services segments to the SBIS segment. The study team expects a slight negative impact in terms of the demand for IT skills in this scenario compared to the baseline scenario that would most likely be offset by a booming demography in the cloud-based providers.

Overall, there should not be a major impact on the total demand for IT professionals in between the baseline scenario and the OSS scenario. The main impact will be on the types of skills required by enterprises and public administrations in this OSS scenario. Most likely some software products and related IT Services will disappear from the demand, whereas a strong increase in demand for OSS related IT skills will occur with certainty.

5.3.1.5 International comparisons

According to most studies, Europe is the leading OSS region in the World by the number of competencies and projects. OSS is a core differentiator and competitive advantage for Europe.



GeorgiaTech Study on OSS projects 2009

There are differences related to the OSS use in Europe and in the rest of the World.

1°) North America

American entrepreneurship has been quick to create businesses out of the OSS, most notably the leader Red Hat. Other companies are developing a traditional package business like the ones that have assured the success of U.S. editors across the World. Most of those usages concentrate on commodities such as Portals, office productivity software or Operating Systems.

2°) India

The use of OSS is low in India, especially for offshore business. The big software editors that have launched India to the World's IT centre stage, are reluctant to seeing India embrace OSS. The OSS approach is also perceived by India as an obstacle to offshore.

3°) Europe

As often in Europe, OSS is seen as a service or a building brick for custom software. Europe uses commodity OSS, but its most notable uses are for high-end OSS for embedded systems, collaborative software projects and open governmental use. OSS is often used by the internal IT teams of European companies as a factor that prevents outsourcing and offshoring.

5.3.1.6 Industry Structure

The bottom line of this scenario is less packaged software, more custom development as well as more SBIS.

The European IT industry structure is largely based on services. This OSS scenario will reinforce this characteristic. IT Services companies, but also the large telecoms companies entering the IT Services market are benefiting and will largely benefit from OSS. It will also open more IT markets to certain hi-tech players such as Defence and Aerospace contractors. IT Services companies will have more and more Intellectual Property over OSS stacks, blurring more their differences from Software vendors.

Software product companies will have to concentrate on high-end and complex processes or on OSS solutions, embracing a more service-oriented business model. A more important availability of cloud infrastructure components would in turn enable ISVs to leverage more thoroughly the cloud models.

European wide standards, interoperability and patents will be critical for the development of the industry as some IP will be opened, but most of it should be well protected, especially the one sitting on top of or working with OSS stacks. Even in the

OSS scenario, open and proprietary models would co-exist, providing best of both worlds to the enterprises and public administrations using them, which would also mean that openness and interoperability would co-exist with IPR and control.

Player type	Impact
Independent Software Vendors (ISVs)	Significant impact on middleware and software infrastructure vendors. European Software companies will not suffer that much, as they focus mainly on specific high-end application processes and OSS is either on very specific custom development or commoditized applications and software infrastructures. However, it will certainly damage already ill positioned software companies.
IT Services Providers	IT Services players reap most of the benefits of the situation, but they will have to reposition more on the OSS, as some services around certain software products will likely disappear. This calls for major training and re-skilling needs.
Internet Players	Normally more OSS means less business for package online applications or SaaS. But Paas and Iaas will most likely strongly benefit from the influx of new OSS projects.
Telecom Operators	OSS is lowering the value of software by giving easy access on a collaborative mode. Owning the physical network, telecom operators will most likely benefit from those lowered entry barriers.
Other Players (…)	User companies could also be entering the fray on OSS software linked to their activities, where collaboration is more important than competition.

5.3.2 CLOUD COMPUTING SCENARIO

5.3.2.1 Reasons for selection

Internet has been the catalyst of the IT industrial revolution. It is a cost efficient, global, collaborative and open technology that has changed the way we interact with and use the IT. Open Source Software (OSS) and Cloud Computing are the most important concepts issued from the advent of the Internet. Technologies have their time then fade away while concepts remain in place.

Everybody acknowledge that Cloud Computing is the next “big thing”, but it could grow even bigger in Europe if some of the barriers to its adoption are lowered. Cloud computing will reshape the IT ecosystem in the future and determine who are the winners. It will have the similar effects in the IT field as the industrial revolution had in the manufacturing sector.

IaaS and PaaS

Cloud computing is still viewed as a “product” by most North American providers, meaning that providers capitalise on standard offerings and try to have strong lock-in effects with their clients. This model is well adapted for a large and homogeneous market such as North America. However, cloud models rely in essence on modular, adaptable and user-centric services based on open and interoperable infrastructure layers – that resemble energy grids – which can be accessed by any type of device. This model suits very well the service oriented and fragmented European landscape. Europe has also built a big part of its competitive advantage on its extended and high quality infrastructures (roads, trains, energy…). Cloud computing – in its IaaS and PaaS forms – should be viewed as a pan European infrastructure that would facilitate the European integration and competitive stance.

A transparent, reliable, open and pan-European cloud computing infrastructure will greatly increase the fluidity of the European markets. It will then enable pan-European services (IT and non-IT related) markets and enhance European integration. Investments and resources will be better allocated, on real value added processes and such processes will be leaner. As a result, one will have better cross-European processes and will be able to better use innovation from every part of the continent. This could start a virtuous circle of IT innovations that will strongly impact all IT and non-IT industries across the continent as they lower their IT related costs, but also improve their IT efficiency through better and more widespread usage.

In this high growth scenario for Cloud Computing, governmental actions are even more important for the future of Europe.

Saas

In this scenario, this SBIS sub-segment will be taking more and more market share in the detriment of traditional on-premise licensing. Higher private cloud adoption will consequently allow for a bigger adoption of SaaS models, as it solves integration issues and some of security concerns. However, this market will remain largely under North American domination with generalist offerings from Salesforce.com, Google, Microsoft, IBM in a winner-takes-all scenario…

This high-growth scenario also embeds a stronger development of EU27 companies, as a strong and extensive cloud computing infrastructure will enable these players to have an easier access to a European wide market, subsequently benefiting from larger client and prospect bases, better economies of scale, improved financial health resulting in higher valuations.

5.3.2.2 Drivers

The ongoing crisis is stimulating Cloud computing as a whole. If growth remains weak in the next few years, Cloud Computing, which is viewed as a highly cost efficient IT delivery model, will prosper even more, compared to the rest of the SSBS market segments. Apart from this economy related effect, there are more structural and critical issues that will influence the type of Cloud Computing model Europe wants: closed and managed by foreign – mostly U.S. based – companies or open and managed by European players.

Four major factors could help open Cloud Computing reach a hyper growth scenario in Europe, as they will enable to overcome some of the main barriers to its adoption. Such factors are linked with each other and also connected to the adoption of SOA, broadband infrastructure and the Future Internet.

1°) Public Service

Cloud computing is viewed as a public service by most member states as well as the European Commission. Part of the role of these institutions is to participate in the financing of critical infrastructures, such as broadband communication infrastructures. Ideally, the European cloud infrastructure should be viewed as a pan-European IT grid, quite similar to energy or transportation networks. Given the huge upfront investments, public financing will be needed to start the virtuous cycle of IT enabled by the Cloud Computing models.

2°) Cloud Computing Champions: European IT Services firms and Telecom operators

The rise of European Cloud Computing champions will stimulate, in relation with the other factors, the growth of Cloud Computing in the continent. Some front-runners are already emerging, such as T-Systems, Capgemini or Orange. Telecom operators will need to be deeply involved in the process, as they master the network, already have extended datacenters and now to deliver cloud-based business models. Champions will structure the European market place and give it momentum.

3°) Standards and regulations at European level

Cloud computing needs economies of scale that could be reached at a continental level. Cloud Computing standards – especially at the infrastructure and tools levels – have to be open sourced, for everybody to be able to use it, in a similar fashion to the Eclipse framework for Java. These standards will increase transparency and enable cloud interoperability. However, open source software will need a real European licence, which is truly adapted to the Cloud specifications. Moreover, privacy and industry specific laws and regulations – such as Basel 2 in the financial services sector – will need to be modified in order to incorporate the specifics of the Cloud Computing models.

4°) Security and reliability

Security and reliability are critical for increased Cloud Computing adoption. The factors presented above will already strongly improve security and reliability of the Cloud Computing models in Europe. They will also be important for the way the enterprise and the users perceive the market. If Cloud Computing security rules and regulations are conceived and Cloud Computing datacenters are built in Europe, that will boost the market adoption.

5.3.2.3 Impact

In the next few years, cloud computing models should be largely deployed by companies and administrations although internally at first. When the public architecture is ready and security and quality of service issues (among others) are solved, organisations will more and more use “public” Cloud Computing models. Therefore, at first it should have a rather limited impact on traditional models (including license & maintenance) as companies and governments are building their Cloud Computing factories and strengthening their networks in house.

In the second half of the 2010-2015 period, once internal IT systems and external providers become cloud compliants, traditional licensing should begin to sharply decline, as Cloud Computing adoption will be widespread with even some core systems being outsourced. As a result, the paid web based segment should experience a much stronger growth in the 2015-202 timeframe than in the baseline scenario.

The cost of the IT infrastructure (including hardware, software and services) will decrease sharply, giving in return more room to the part of the IT that creates value-added and innovation for European businesses: business processes. It will also boost Services Oriented Architectures (SOA): reuse, modular application conception, business and IT alignment will all be strengthened and more cost efficient.

In the SSBS ecosystem, new breed of companies with little overhead, efficient systems of partnerships will arise in the cloud ecosystem, basing their applications on SIS and Tools platforms and interacting with each other in order to provide high value added services to their clients.

New distribution and delivery models will lead to very strong creations of highly innovative SMEs that find it less difficult to exist in a highly competitive market. They can widen their market more easily thanks to new distribution and delivery models. These companies will be component developers (open source or proprietary) integrated at local level by a platform provider delivering and being responsible before the end-user and client. A significant part of these companies will also be local adapters that will adjust components to local regulations in a still fragmented EU27 market. The software industry will then resemble today's automotive industry.

This surge of the cloud computing will reinforce the industrialisation of the IT industry and enable Europe to be one of the leading cloud computing locations. The added value will be created and will remain in Europe. Building Cloud Computing factories will call for huge local investments that are good for employment. Operating these centers will also require a highly qualified workforce. Being close to the European public services models – with significant European public and private (telecom) investments – there will be no overhead payments to make for the benefits of foreign IT or telecom companies or for the dividends of foreign financial investors.

This will also allow for a better allocation of financial resources of the end-user companies that will be able to get more value from the key parts of their IT systems. Europe could well start a snowball effect around cloud computing when it reaches a critical mass. A homogenous market will be able to get strong economies of scale as well as a brilliant innovation environment. Additional investments from abroad will also come to Europe to profit from existing cloud computing facilities, just like today, with the praise of EU transportation, telecoms and energy grids and networks.

Key parameters for the scenario

The scenario regarding cloud computing is based on:

- Higher share of end-user companies migrating from in-house private cloud environment to external public cloud environments (IaaS and PaaS).
- Higher share of end-user companies migrating from traditional IT models (Licence & Maintenance, in-house located IT infrastructure…) towards SaaS models.
- Outsourcing services providers (Associated IT Services) migrating faster to cloud environments to provide cheaper hosting and infrastructure outsourcing services to their customers.
- Rapidly decreasing prices of IT resources, especially IT infrastructure, as adoption rates of IaaS models increase.
- Premium effect on online advertising. With more users on the Internet, the market

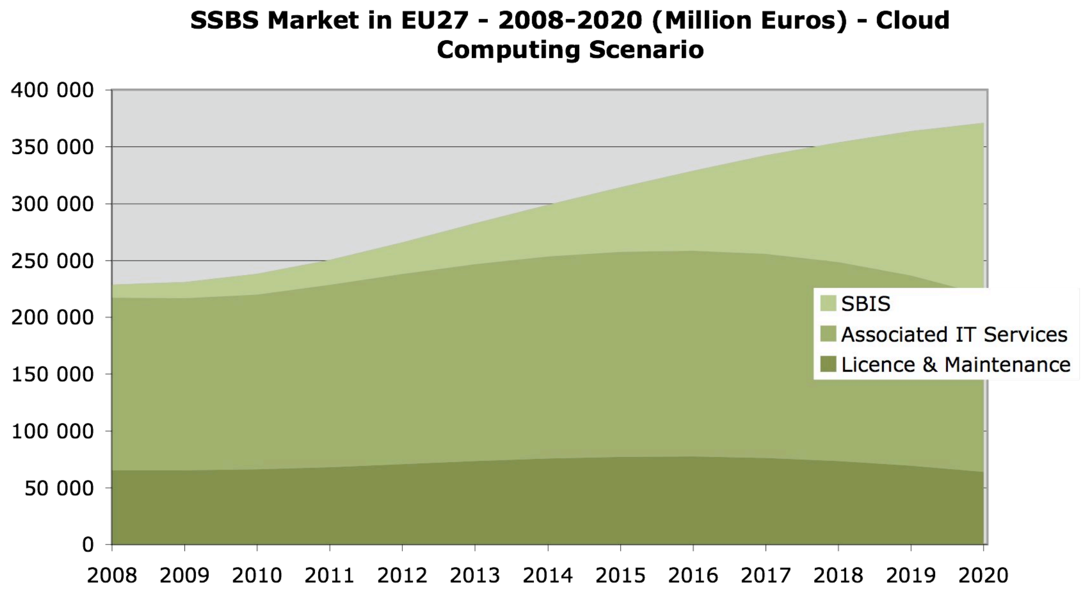
would expand faster as it would have more value for advertisers. To simplify, we have considered a fixed premium.

5.3.2.4 Main Results of scenario

SSBS market in EU27

EU27	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Licence & Mair	65 529	65 082	66 100	68 210	70 628	73 660
Associated IT S	151 532	151 491	153 979	160 208	167 668	173 100
SBIS	11 680	14 492	17 829	21 991	27 671	35 707
TOTAL	**228 742**	**231 065**	**237 908**	**250 408**	**265 967**	**282 467**

EU27	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Licence & Mair	75 880	77 226	77 541	76 271	73 510	69 419	64 018
Associated IT S	177 461	180 271	181 153	179 484	175 047	167 203	155 813
SBIS	45 460	56 680	70 078	86 469	105 034	126 893	151 101
TOTAL	**298 802**	**314 177**	**328 772**	**342 223**	**353 591**	**363 515**	**370 932**



Revenue Type	Δ* in 2020 market size in EU27 in cloud computing scenario (in MEuros)	Δ* in 2020 market size in EU27 in cloud computing scenario (in %)
Licences	-13 920	-17.9%
IT Services	-49 804	-24.2%
PWB	+51 176	+51.2%
Total SSBS	**-12 548**	**-3.3%**

Segment	Impact
License & Maintenance	--
Associated IT Services	--
SBIS	++
Total SSBS	-

Compared to the baseline scenario, the cloud computing scenario would represent a difference in market size of -3.3% in 2020 compared to the baseline scenario, i.e. -0.3% per year from 2009 to 2020. The overall lost growth would represent 13.9 billion EUR in 2020 in EU27, mostly impacting the Licence & Maintenance (applications, tools and most importantly systems infrastructure software) as well as Associated IT Services (mostly outsourcing (excluding cloud services) and to some extent, project services) market segments. This means that the SBIS market size in 2020 would be more than 50% larger than in the baseline scenario and would represent around 40.7% of the SSBS industry by 2020 (compared to 26.1% in the baseline scenario).

The revenue-type winner would clearly be Paid Web Based – with Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) segments gaining about +10% of growth and consolidating their position as the second type of SSBS revenues, ahead of License and Maintenance. The advertising

* *Compared to the baseline scenario.*

* *Compared to the baseline scenario.*

segment would also benefit from this scenario as the larger diffusion of cloud computing models would also mean more time spent online, more opportunities for advertising firms to sell advertising space, especially in the SME market segment.

Impacts on jobs

The overall growth of the SSBS market remains mostly unchanged (slight decrease) in the cloud computing scenario. The most important impact is on the value transfer from Licence & maintenance and Associated IT Services segments to the Paid Web Based segment. The study team expects a slight negative impact in terms of the demand for IT skills in this scenario compared to the baseline scenario that would most likely be offset by a booming demography in the cloud-based providers.

A heavy development of the cloud model could - thanks to its automation and optimisation value propositions – slow the development of the offshore model. This, on the other hand, should not mean a surge in the demand for onshore competencies though.

5.3.2.5 International comparisons

In this high-growth scenario we have based on the assumptions that Cloud Computing is backed by significant public infrastructure spending, strong involvement of telecommunications companies, as well as the market benefits from the right regulatory environment.

In this scenario, IT prices have been largely pushed down. As a result, more and more SMEs have access to efficient IT systems enabling them to benefit from important productivity gains. Also due to lower prices, large companies and administrations have drastically reduced the cost of their IT operations. With an optimised IT budget, these organisations become more competitive and more innovation-driven, as they invest more in IT projects that carry strong added value. Europe could then really start a knowledge and innovation society. This cloud network and associated IT competencies, along with a strong OSS knowledge, coupled with good telecommunications infrastructure and important content capacities will certainly make Europe a very attractive region that is looked at for its leading role in the digital economy.

US will still be leading the market but not by far, while developing countries will be less relevant as offshore locations since IT tasks such as application development and maintenance have been strongly automated in the cloud models.

5.3.2.6 Industry Structure

In the cloud computing scenario the industry structure will change more drastically:

- There will be giant infrastructure providers, some of telecom origins, most with IT Services backgrounds, some as public network managers and some as private companies.
- Content and software could be more easily distributed across Europe, in a very fluid market. This will strengthen European competitiveness through a much better penetration of software technologies as well as better usages.
- IT Services companies will strengthen their system integrators activities, and be less "body-shopping" companies
- Software companies will be focused on the most complex and high performance middleware toll and on the applications that deliver the highest value

Player type	Impact
Independent Software Vendors (ISVs)	Significant impact for the on-premise business models and for system infrastructure software products. As a consequence, this would free up energies for the most valuable software (complex and high-value added software products).
IT Services Providers	They are technology and system integrators that mix business know-how with IT expertise to deliver efficient IT-based solutions via usage-based business models operated on industrial and automated platforms. They have invested a lot of money in automating the whole infrastructure support stack in order to reduce the cost of service.
Internet Players	As pioneers of the cloud model, their role and market share is definitely strengthened in this scenario. They have become large SSBS providers. Their approach to the cloud computing could be twofold: either they embrace openness and innovation and remain a part of the Internet

Player type	Impact
	operating systems25; or they choose to control their piece of Internet, building de facto monopolies (like in the Web 2.0 space where Facebook is becoming the one dominant social network). In some cases their model could merge and be blended with the telecom operators' and in some cases with IT Services companies and/or Independent Software Vendors.
Telecom Operators	Telecom operators have tried to move into the provisioning of software through the Internet but have not succeeded. They remain in the infrastructure space providing infrastructure related IT resources such as storage space, computing power and of course, the sufficient bandwidth to make the cloud models thrive. Even for software-related infrastructure (like IaaS), their initiatives are not really competitive compared to those of Amazon or Google, for instance. Nevertheless, telcos may position in that space and roll first major offerings mid 2009. As connectivity revenues are no longer enough for them, they will more and more extend to the content and software side of ICT markets. IaaS would then be a natural first extension in the cloud and software space, leveraging their assets in terms of connectivity and storage. However, unless adding software development skills, they should most likely position as enablers and providers of infrastructure items to software providers rather than try to sell such items directly to end users.
Other Players (…)	Some of them, heavily involved in IT, like for example travel distribution providers, some banks, some retailers… could become Cloud players

25 The War of the Web – Tim O'Reilly November 16, 2009.

5.3.3 OFFSHORE SCENARIO

5.3.3.1 Reasons for selection

The outsourcing of IT and other business functions to low-cost ‘offshore’ locations has long been a controversial subject, but the current economic crisis has brought it into an even sharper focus in Europe in 2009. Private sector and government organisations are looking to drive down operating costs, in some cases to ensure their long-term survival, and the cost benefits offered by countries such as India, the Philippines, the Czech Republic, Romania, Morocco are highly attractive in the current business environment.

Offshore delivery has become a standard component of IT and other business services contracts in mature European services markets such as the UK and the Benelux region, and is gaining in popularity in the Nordic countries, France and Germany.

The impact on local employment is the most contentious issue within offshore sourcing, and the current economic climate has only heightened its sensitivity.

In the baseline scenario, the growth in utilisation of offshore resources is dynamic: two to three times the growth of the overall SSBS market. In such situation, offshore can help provide an additional supply of IT skills when the EU27 supply of IT skills is not sufficient to address the demand26.

The goal of this high growth scenario is to assess the potential impact of a stronger development of the use of offshore resources.

5.3.3.2 Drivers

Slow economic growth discourages companies and public bodies to invest massively in IT. They leverage offshore delivery models in order to cut costs. Massive waves of people coming from the baby-boom generation and retiring from the IT industry between 2010-2015 also force companies to look outside the Western European

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26 *Monitoring e-skills demand and supply in Europe. http://www.eskills-monitor.eu/*

countries to find sufficient amount of skilled IT professionals in order to assure the continuity and durability of their strategic information systems.

Most IT tasks including development and maintenance but also integration, innovation, and consulting tasks are performed outside the Western European countries. Eastern European countries that are part of the EU27 region are first to benefit from this additional growth providing extra skills to address the demand for low cost IT competences. This benefit becomes soon obsolete, as rapidly increasing salaries in these countries render these offshore destinations not competitive enough: most of the offshore work is then performed outside the EU27 region. As a result, these Eastern European countries turn to lower value BPO services needing non-English language skills, while their onshore IT skills cater mostly to the internal needs of the rapidly developing country.

5.3.3.3 Impacts

First and main impact concerns the Associated IT Services market and the project services and outsourcing services markets in particular that experience dramatic price pressure resulting in decreasing market values even though growth in volume remains positive.

In all the studies made at PAC or at other research institutions in Europe27 or in the U.S. 28 no direct relationship could be made between the number of jobs employed in offshore locations and the number of job losses in the country's SSBS industry.

First because offshore like outsourcing services in general addresses needs from companies to free up some of their internal resources that they can affect to other internal more strategic projects for the company, which had been put aside due to budget pressures or lack of available competencies. Companies can also benefit from economies of scale thanks to mutualisation effects at the offshore / outsourcing services provider. Finally, not all tasks in offshore contracts are moved offshore. In

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27 http://www.eskills-monitor.eu/

28 ITAA – http://www.itaa.org

typical IT Services contracts including offshore about 20-30% of full time equivalent (FTEs) remain onshore, close to the customer premises (consulting, functional specifications, user acceptance, some integration tasks as well as customer facing activities).

Pressured onshore IT salaries make IT careers less attractive for students, which choose other curriculum and other career paths yielding better salary evolutions.

As a result, this scenario has a significant impact on the IT skills distribution between the onshore (EU27 countries) and offshore locations (Asia Pacific countries mostly. Product strategy and development are concentrated at the headquarters of software companies meaning mostly in the US, as well as Asia for the case of IT Services firms (India in particular). Cloud computing players would be mostly non-European, sometimes hosted on European platforms. European skills cover mostly management (mostly in English), sales and marketing tasks as well as some level of integration tasks for complex systems as well as adapting to local specific regulations.

Europe ends up having fewer and fewer skilled IT engineers and technicians and fewer high level curricula thus hampering its innovation capabilities and overall competitiveness at the global level.

Key parameters for the scenario:

- Given a slower overall economic growth, onshore salaries do not grow as much as in the baseline scenario.
- Although offshore models are leveraged more strongly in the U.K., language is not an issue anymore for EU27 companies to leverage such models, as there are translation processes and tools to remove the language barrier.
- Additional overhead costs and loss in productivity remain important, especially for Continental European companies, although they tend to decrease as new delivery models are used and companies get accustomed to using offshore.
- Growth in volume in onshore locations is also hampered by the slow growth environment, as companies do not need to invest as much as if they were in a growing economy.

- Volume of work sent offshore is growing faster than in the baseline scenario, which has also a positive impact on the salary increases at offshore locations, rendering the economic viability of the offshore models more rapidly obsolete. This is offset to some extent by methodologies (lea, six sigma…) and software automation technologies, in which IT services providers invest heavily in order to increase the productivity and transform their business models from a human capital intensive to a more software capital intensive industry.
- During the 2015-2020 period, offshore countries such as China or India will be having a hard time trying to provide high level IT skills (architects, project managers, senior IT people on complex integration schemes and technologies…) to address both onshore (domestic) and offshore (foreign) demand, even though the number of IT engineers and technicians produced every year is by far the highest in the World. This adds an additional inflationary trend on offshore IT salaries for experienced people.
- The annual pace of growth of associated IT services' main sub-segments (project services and outsourcing services) is impeded by the direct and indirect price effect. This phenomenon is offset to a limited extent, by additional volume created by falling prices.

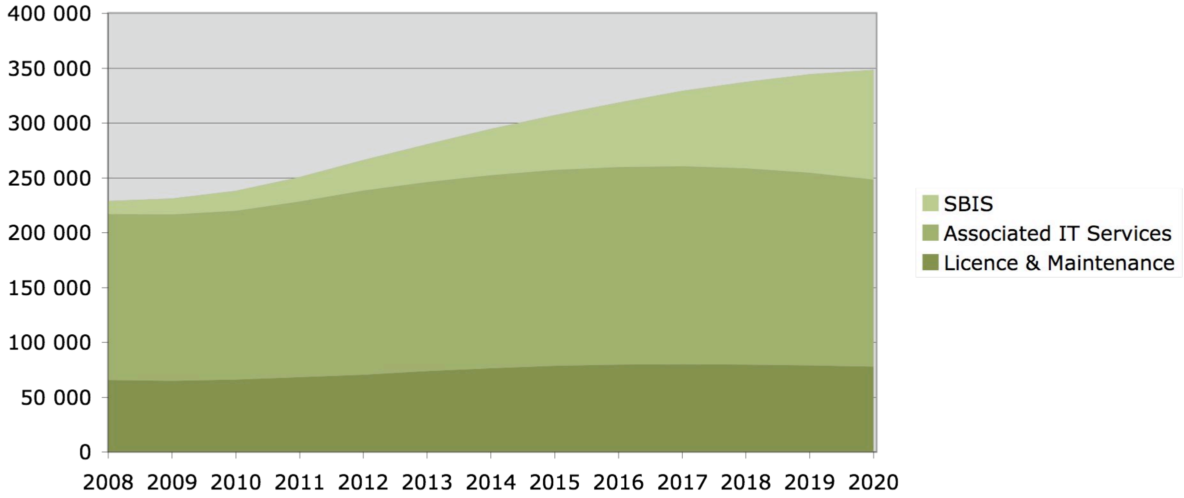
5.3.3.4 Main Results of the scenario

SSBS market in EU27

EU27	2008	2009	2010	2011	2012	2013
Licence & Maintenance	65 529	65 082	66 100	68 210	70 628	73 853
Associated IT Services	151 532	151 491	153 979	160 208	167 668	172 243
SBIS	11 680	14 492	17 829	21 991	27 671	34 353
TOTAL	**228 742**	**231 065**	**237 908**	**250 408**	**265 967**	**280 450**

EU27	2014	2015	2016	2017	2018	2019	2020
Licence & Maintenance	76 443	78 432	79 786	80 111	79 681	78 900	77 939
Associated IT Services	175 955	178 602	180 120	180 311	178 967	175 781	170 581
SBIS	41 923	49 878	58 637	68 631	78 742	89 571	99 925
TOTAL	**294 321**	**306 912**	**318 543**	**329 053**	**337 390**	**344 253**	**348 445**

SSBS Market in EU27 - 2008-2020 (Million Euros)
Offshore Scenario



Revenue Type	Δ* in 2020 market size in EU27 in offshore scenario (in MEuros)	Δ* in 2020 market size in EU27 in offshore scenario (in %)
Licences	0	0%
IT Services	-35 000	-16.9%
SBIS	0	0%
Total SSBS	**-35 000**	**-9.1%**

Segment	Impact
License & Maintenance	=
Associated IT Services	--
SBIS	=
Total SSBS	-

The offshore scenario would represent a difference in market size in 2020 of 9.1%

* *Compared to the baseline scenario.*

* *Compared to the baseline scenario.*

compared to the baseline scenario, i.e. 1.6% per year from 2009 to 2020. The overall lost growth would represent 35 billion EUR in 2020 in EU27, mostly impacting the Associated IT Services market segment (project services and outsourcing in particular). This means that the amount of IT work sent to offshore locations would be increased by more than 30% by 2020 compared to the baseline scenario and would represent more than 25% of the EU27 SSBS Associated IT Services market value by 2020.

Consequently, Paid Web-Based and Advertising revenue share would grow faster than in the baseline scenario, although they would not be impacted directly by the additional offshore development.

This scenario does not take into account the positive price elasticity of the IT products and services. This phenomenon relates that the demand in IT products and services increase when their prices decrease. Cloud computing models have a strong negative impact on prices, although as a result, this price decrease triggers new investments from companies in all segments (software products, IT services as well as additional SBIS) for instance, for new projects that were not economically viable before, projects in SMEs for which investments were too important, or just because these new models have made some room in the IT budgets of companies that can continue to invest more on a domain that continuously yields great value for its business and its activities.

Impacts on jobs

In this scenario, most recruitments are made in low-cost countries. The associated IT Services market segment still grows during the 2009-2020 although solely thanks to increasing use of offshore competencies. The demand of onshore IT engineers and technicians remains flat over the 2009-2020 timeframe. Supply meets demand during the first part of the period, but increasing disaffection of IT careers means by the end of the period that supply of IT skills will slightly decrease.

5.3.3.5 International comparisons

Most developed regions (including North America, Western Europe, Japan, Australia…) would suffer from this scenario, and Europe would be impacted in similar fashion to the U.S.

- North America, which in 2009 accounts for about 60% of the share of the IT Services offshore market globally, is by far the main user of offshore resources. A high growth scenario means for this region to reach faster the cap of the 30% share of the Associated IT Services market provided offshore. U.S. companies would then try to find new ways to decrease costs by replacing human capital by software capital. U.S. innovation culture combined with strong software competencies and a large homogenous market would certainly enable them to develop certified and automated software production tools therefore lessening their reliance on Asian countries for their software production needs.
- At the end of the 2015-2020 timeframe, major Asian players could be facing shortage issues on some high level competences. Other than that, they will most likely benefit from this scenario as being the "software and IT Services lab and factory" of the world.
- Emerging countries should also somewhat benefit from this scenario as the global search for IT talent might start investments in IT education in their countries to supply larger and more advanced economies. It will also benefit their domestic market by providing them with skilled IT competencies to address their rapidly growing IT needs.

5.3.3.6 Industry Structure

The development of offshore would impact mostly IT Services players, as well as, but to a lesser extent, software R&D producing players such as Independent Software Vendors and Internet players.

Large ITS players will face increased competition in the race for global talents, investing in new offshore locations, and in productivity improvement methodologies and tools. Might strong competition between large western IT Services providers and large Indian pure players lead to some consolidation of the industry?

Niche IT Services players focusing on a particular domain will remain mostly unaffected by the scenario. Most industry consolidation moves will concern mid-sized players, which will disappear from the market, as they are too big to be competitive in a niche segment and too small to be competitive on the global IT Services market.

On the Licence & Maintenance segment, offshore will have some impact on licence prices as offshore models render software custom development more attractive. This effect should remain limited though.

The cloud computing and advertising models are not really impacted.

Not all IT activities would be made in offshore locations. Majority would still be performed onshore even in a high growth scenario.

Player type	Impact
Independent Software Vendors (ISVs)	Minimal impacts through price pressure on licence sales. Traditional software players compete more and more against custom software development. Most software R&D teams are located in offshore locations.
IT Services Providers	Strong impact in the case of larger IT Services providers owning access to large pools of offshore competencies. Onshore recruiting remains limited, only to replace retiring employees or the natural, although limited, turnover. Most of their recruiting and investment in delivery centers is performed in Eastern European Countries and in offshore locations, especially India and China. Onshore competencies are trained to take on higher value added type of services (consulting, complex system integration, critical information systems…). Investments in next generation development environment leveraging artificial intelligence, model-driven architectures, new methodologies in order to conserve margin levels in between pricing drops and salary increases. Large merger and acquisition transactions are not likely within the IT Services industry (within the top 10 worldwide). The offshore scenario has a lesser impact on smaller IT Services firms having a niche positioning.
Internet Players	Most software R&D teams are located in offshore locations. Advertising business models remain mostly non-impacted by the scenario.
Telecom Operators	Limited impact on the Advertising and Paid Web Based segments. Telecom providers would nonetheless be impacted on the infrastructure related IT services such as remote infrastructure monitoring (RIM)

Player type	Impact
	activities. This would push them to invest in their offshore capabilities, mostly in Eastern Europe, or in the automation of such services in order to remain competitive compared to large IT Services providers.

5.3.4 MOBILITY SCENARIO

5.3.4.1 Reason for selection of scenario

Mobility is clearly quoted in the interviews conducted by PAC and IDATE as one of the key driver for the SBSS industry today but also in the next 5 years.

Mobility is a key segment of SSBS with still some potential for additional growth, beyond the baseline scenario. The development of mobile applications will most likely come as an extension of desktop with a few mobile-only applications rather than as a replacement of desktop applications. Mobility is indeed a growth scenario with limited potential cannibalisation but rather complementarities with desktop applications by the use of additional devices (primarily mobile phones).

This market would then represent mostly some value creation, either by additional embedded applications or through applications in the mobile cloud for most market segments, including at least games, applications and tools. With the development of open source mobile platforms, the system software segment may not benefit from the same growth and will most likely at best remain flat (more users, less value per user). The market segments impacted would be obviously and mainly mobile software and applications, and to a lesser extent, segments like wireless M2M or Internet of things.

Overall, the mobility market could bring additional points of growth to the SSBS industry, as many of the existing applications could be used by nomadic users. Users would find clear benefits from the development of mobility. Being connected anywhere anytime would provide additional opportunities to interact, communicate, entertain, search for information or buy products, without needing to be in front of a PC. The uncertainty regarding users is mostly about the willingness to pay, especially for consumers seeing the mobile Internet as an extension of PC Internet on which a lot of things are free.

The industry is also adamant to such developments in the mobility, as it would offer additional revenues to traditional software players (software vendors, IT services companies), but also other major players like Internet giants, telcos and device manufacturers facing cost competition on the hardware.

5.3.4.2 Drivers

The adoption of mobile applications could spread faster than expected under a few conditions:

- Cheaper mobile Internet connectivity plans would obviously entice more users to adopt mobile Internet. Like voice or SMS in the past, many initiatives led by telecom regulators and/or telcos themselves (competition) may lead to such result. A lot of telcos are also offering bundles with more value for less to simply maintain the ARPU level.
- Faster rollout of new wireless technologies, offering more bandwidth and more availability, would accelerate the technical aspects of the transition towards mobile cloud.
- Development of cloud itself would accelerate the mobility market, as most mobile applications would then just require mostly additional development exclusively for the client software and the associated user interface.
- Evolution of the workforce towards jobs and activities requiring more mobility or at least more nomadism. With increasing needs, the consumers and enterprises would adopt such solutions to give them more convenience and ensure faster development.
- A better educated workforce would facilitate the adoption by users (enterprises and consumers), who still used their mobile handsets mostly to make calls, and often find it quite complex to use mobile software.
- Having access to enough developers with appropriate skills coming from both the traditional software industry and mobile industry.
- An environment allowing for easier developments, as a consequence of a less fragmented market or of emergence of clear standards for development

5.3.4.3 Impacts

The impact would still be felt differently by type of revenue sources:

- For traditional application and maintenance, additional growth would remain limited. The rise of adoption of smartphones would bring important growth in volume but almost no additional value due to scale economies. Many mobile applications may come through bundles in which mobile applications extension may be offered with a discount. Finally, we expect that an important share of new non-infrastructure applications will be provided either through download or through the mobile cloud (ie through paid web based).

- The evolution for IT services should be very similar. Integration is still required for mobile applications. Some of the additional growth may still be limited by spillovers in cloud developments and bundles with desktop integration.
- Regarding advertising, the better diffusion of mobile applications and mobile devices would clearly strengthen the mobile Internet advertising (more time spent, more screens). Most of the development of this market would be generated by transfers from the overall advertising, including a part coming from online advertising (already accounted in the SSBS market). The mobile Internet advertising would develop subsequently, partly at the expense of the online advertising market. Some of the value may also disappear through discounts/bundles for cross-screen marketing campaigns.
- As a result, paid web based would be the key beneficiary among the different revenue types, getting some transfers from both licences and IT services, but also growing on its own with mobile cloud and downloads.

Key parameters for the scenario

The scenario regarding mobility is based on :

- Higher diffusion of mobile Internet, which translates into an additional ½ point of penetration per year of mobile Internet. Mobile Internet penetration would then represent close to 68% in 2020 (compared to 61% in the baseline scenario), making it closer to PC-based Internet penetration of 2009.
- Higher share of nomadic workers reaching 24% in 2020, impacting spending from enterprises on software and IT services. (compared to 20% in baseline scenario)
- Stable ARPU for paid applications, even though the number of users is increasing significantly (generally the ARPU decreases if the number of users is increased)
- Premium effect on mobile advertising. With more users on mobile Internet, the market would expand faster as it would have more value for advertisers. To simplify, we have considered a fixed premium.

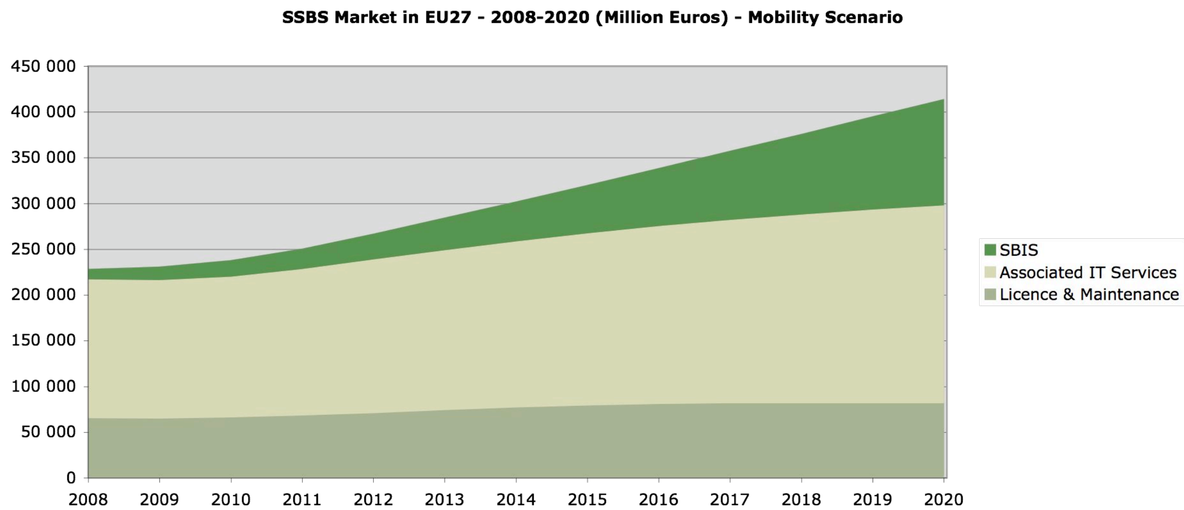
- Faster development of enterprise mobile cloud, through additional transfers from traditional IT services to the mobile cloud.
- Spillovers of the consumer markets on business markets. With the faster development of mobile usage by consumers, business users would be enticed to adopt faster mobile applications and to use them more intensively. The lever on business markets has been considered to be progressive, with more impacts in 2020 than 2010.

5.3.4.4 Main Results of scenario

SSBS market in EU27

EU27	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Licence & Mair	65 529	65 081	66 127	68 300	70 828	74 217
Associated IT !	151 510	151 441	153 992	160 368	168 087	174 975
SBIS	11 680	14 492	17 885	22 200	28 188	35 404
TOTAL	**228 719**	**231 014**	**238 004**	**250 867**	**267 103**	**284 596**

EU27	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Licence & Mair	77 032	79 317	81 041	81 809	81 901	81 762	81 574
Associated IT !	181 720	188 225	194 551	200 634	206 407	211 792	216 769
SBIS	43 791	52 903	63 212	75 231	87 858	101 834	116 080
TOTAL	**302 543**	**320 445**	**338 803**	**357 675**	**376 166**	**395 388**	**414 422**



Compared to the baseline scenario, the mobility scenario would represent an difference in market size in 2020 of +7,6 % compared to the baseline scenario, i.e.

additional 0.6 % per year from 2009 to 2020. The overall additional growth would represent 29.3 billion EUR in 2020 in EU27, mostly coming from the mobile market segment (Internet of things could also benefit from such scenario, even though many hurdles would have to be overcome). This means that the mobility market segment would almost double by 2020 compared to the baseline scenario and would represent around 16% of the SSBS industry by 2020. Mobility would then become the number one emerging market in value.

Revenue Type	Δ* in 2020 market size in EU27 in mobility Scenario (in MEuros)	Δ* in 2020 market size in EU27 in mobility Scenario (in %)
Licences	3 635	4,7%
IT Services	11 152	5,4%
SBIS	16 154	16,2%
Total SSBS	30 942	8,1%

Segment	Impact
License & Maintenance	=
Associated IT Services	=
Paid Web Based	++
Total SSBS	+

The different revenue types would not benefit from this scenario in the same way and would be affected at different scales:

- The revenue-type winner, both in absolute value and relative share, would clearly be paid- web based, with both download and mobile cloud, gaining more than 23% of growth compared to baseline scenario, even though the dominant type of revenues would remain IT services. Paid web based would reach more than

* *Compared to the baseline scenario.*

* *Compared to the baseline scenario.*

16.5% of the SSBS industry (compared to 14.4% in baseline scenario).

- Advertising revenue share would remain mostly stable at 11.5%, as overall additional growth would be very close to the overall market growth.
- Licences and maintenance would only grow by 4.7% compared to baseline scenario. This scenario would still not prevent a decline of revenues from licences and maintenance between 2017 and 2020 in EU27.
- IT services would grab a significant share of the additional revenues, but would see its share of the SSBS still decreasing. Some of the growth would be lost into bundles (discount) or transferred into mobile cloud. This would in fact be the segment with the lowest growth.

5.3.4.5 International comparisons

All regions would benefit from this scenario, but Europe would probably not be the prime beneficiary. All other regions have major assets to expand in the mobility market:

- North America, leader on traditional business software, Internet services and advertising, would benefit even more than Europe from such a scenario. The market would develop as an evolution of the current SSBS industry and North America is leading in almost every category. The only weakness is about mobile phone adoption, but North America is already catching up.
- Major Asian companies would continue to be a major player for most of mobile consumer markets. Nevertheless, they would not catch up on business markets.
- Emerging countries should gain market shares in the worldwide breakdown of SSBS. Emerging countries will massively develop at first around mobile computing, before extending at least partly to desktop applications. They would therefore benefit even more than Europe in this scenario (in terms of growth, but not in absolute value), even though they would remain overall marginal.

5.3.4.6 Industry Structure

The development of mobility would not be a benefit to all type of players, but the impact level would be different according to the type of players (see table below). The impact of this scenario on the industry structure in EU27 would nonetheless remain limited, with leaders remaining big ISVs (like SAP or Oracle) and major IT service providers in the business segment and Internet giants (mostly non-European players) in the consumer market. The business market would also still be the largest market.

All players would accelerate their developments on the mobile market segment, but most of the market would still come from non-mobile applications. In addition, mobile would be in most cases a complement to the PC-based market, which means that the market would develop as an extension rather than a creation. The innovation would come from evolution rather than disruption and favours SSBS incumbents. New players like telcos would remain marginal in the SSBS market as direct providers, even though they would take a significant role as enablers of the SSBS industry.

Player type	Impact
Independent Software Vendors (ISVs)	Minimal impacts through licence sales. Traditional software players would offer more software for mobile devices in volume, but additional value would remain limited. Moderate impacts through paid web based. ISVs would accelerate the shift towards online distribution (download or SaaS-like) through mobile devices. Additional growth would be shared by players offering solutions for business markets but also for consumer markets (games and entertainment type solutions).
IT Services Providers	Moderate impacts through both IT integration and paid web based. All new applications will need to be deployed on the fleet of mobile devices and integrated with the information systems. Spending will be most of the time bundled with desktop integration.
Internet Players	Strong impacts through mobile Internet advertising growth. The higher intensity of usage and the higher penetration of mobile Internet would help to clearly increase the size of this market for which Internet giants will be the prime beneficiaries.
Telecom Operators	Strong impacts through advertising and paid web based applications. Telcos can benefit from their key role in the value chain for delivery of

Player type	Impact
	mobile services (paid or free), as they can act both as enablers (connectivity, infrastructure, and billing), whose revenues are out of the scope of the SSBS market, and as providers of software (application store, portals, development of mobile-centric services, etc…). However, within the mobility scenario, telcos would still be only small players within the SSBS industry, with most of revenues still being generated for instance by Internet players, device manufacturers and a few ISVs on the consumer side. Providing for the enablers and having some control on the device and the network (within a reasonable net neutrality framework) is not enough to take a leading role in the SSBS industry without stronger involvement in service development, which would still come from mainly third parties in that scenario.
Other Players (…)	Device manufacturers would get additional revenues through application stores (free or paid applications). Nevertheless, the value generated through software will remain low compared to the revenue coming from hardware. It is rather an extra revenue than anything else. Also, they will just get a small share of this market, as they mostly get commissions rather than direct sales of their own services. Original services from device vendors would rely on new embedded sensors.

5.3.5 THEME SCENARIOS – SYNTHESIS

While these development scenarios are unlikely, they remain possible just because of the fact that growth assumptions remain reasonable.

Of the four scenarios developed by the Consortium, only one presents a positive Δ compared to the overall SSBS baseline scenario (mobility). It is actually the only one that does not embed a significant part of value destruction or transfer.

The three other theme scenarios yield a reduction of the overall SSBS market in 2020, although it remains limited: less than 10% even for the offshore scenario which produces a very strong development of the offshore models during the 2013-2020 period. What is important to notice is that cloud computing, open source and offshore being today part of the SSBS market and industry in EU27, all have a negative impact on the development of the SSBS market compared to the baseline scenario, mostly because they provide price reductions on SSBS products and services.

Therefore it is interesting to consider the positive price elasticity of the IT products and services. There are many examples in the literature of this phenomenon that sees demand in IT products and services increase when their prices decrease. Offshore, open source and cloud computing all have a strong negative impact on prices, although as a result, the value destruction is not as important as one could have expected. In effect, this price decrease triggers some value creation in the market through for instance, new projects that were not economically viable before, projects in SMEs for which investments were too important, or just because these new models have made some room in the IT budgets of companies that can continue to invest more on a domain that continuously yields great value for its business and its activities.

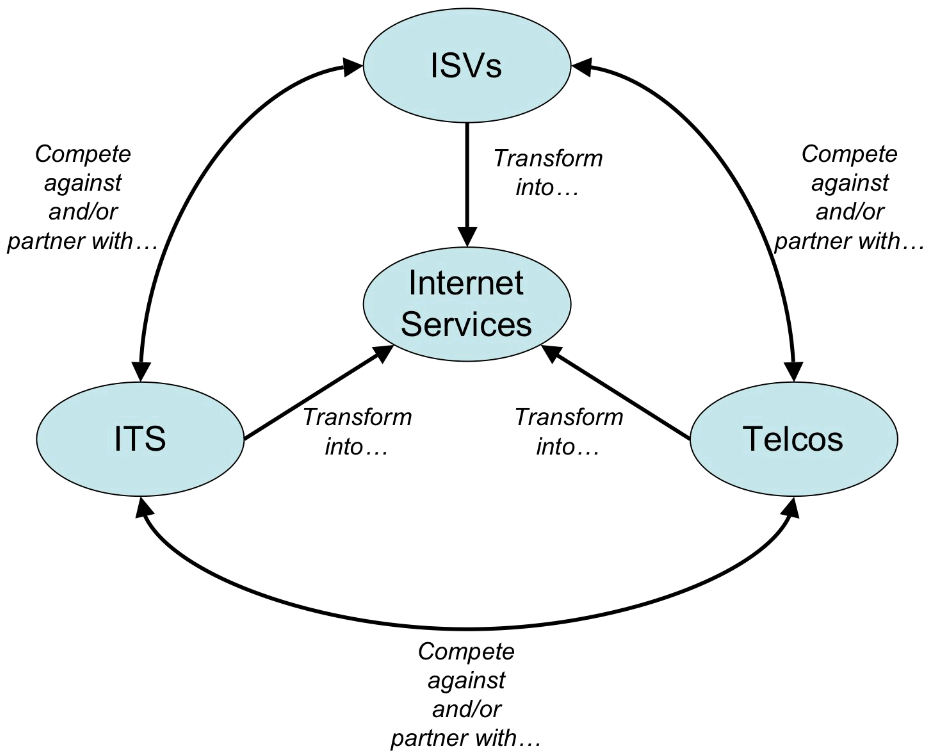
Cloud computing is definitely the one market factor that has the highest impact on the market structure with important value transfers and price reductions and impacting all SSBS segments.

5.4 SSBS PLAYERS IN 2020

Looking at the next ten years, the SSBS industry should remain a dynamic one with massive growth opportunities for all players. Two major trends should nonetheless be more prominent than the other ones:

- ***Serviciation*** – the move towards services – all actors will transform their business models towards activities under an "as-a-service" mode. These services might be based on reusable components and solutions – for the sake of profitability, and time to market – however the clients will buy services in the end.
- ***Internetization*** – the Internet will emerge as the prominent delivery channel for the SSBS industry. All players will have to transform themselves in order to embrace this new delivery mode.

These evolutions are represented in the following figure:



5.5 FUTURE SOCIAL CONTRIBUTIONS

5.5.1 JOBS IN THE SSBS INDUSTRY

There are some data available on the number of IT professionals in the EU27 region, although there is no unique source on monitoring the Software and Software based Services employment in the EU 27. There are some organisations in the selected EU27 countries that monitor the number of jobs in the SSBS industry (Syntec informatique in France or BITKOM in Germany), although methodologies usually vary by country and by trade associations or industry groups within one country.

The Eurostat Labour Force Surveys (LFS) provide statistics on the number of IT professionals in the workforce in EU27. According to the latest Eurostat LFS, in 2007 in Europe there was a total of 3,776,900 IT professionals, including 2,269,200 Computer professionals (ISCO 213) and 1,507,700 Computer associate professionals (ISCO 312). The four largest countries – Germany, UK, France and Italy together come up with more than half (56%) of Europe's IT workforce, and then the seven largest employer countries (also including Spain, the Netherlands and Poland) account for 75%.

According to the same statistics almost half (45.5%) of the IT professionals in Europe work in the core IT industry, i.e. NACE Rev.1 groups 72 (Computer Services) and 64 (Post and Telecommunications), which means that the majority of IT professionals (54.5%) today are working in IT user industries.

The study team estimated the total number of employees in the SSBS industry based on data on annual average salary and employee costs, as well as external IT services spending. This calculation leads us to estimate the number of SSBS employees in EU27 at about 1,715,000 employees in 2008.

As far as the 2020 foresight is concerned, the study team leveraged a recent study commissioned by the European Commission DG Enterprise and Industry: "Monitoring the e-skills demand and supply in Europe"29. This study provides a set of

29 The full study report is available at: http://www.eskills-monitor.eu development scenarios for the supply and demand of IT skills in Europe (ISCO 213 and 312). One of these scenarios – the “Back to normal” – corresponds to the SSBS baseline development scenario and its related assumptions (GDP growth, innovation rate, offshore development…). It is described as “a return to “before the crisis” moderate growth development model, with ICT-based innovation developing unevenly across Europe”. According to the study, this scenario results in a limited e-skills gap (estimated at 384,000 excess demand in 2015, about 8% of the ICT workforce).

Using the supply forecasts elements provided in the e-skills study, the SSBS study team developed a growth baseline scenario for the total number of SSBS jobs in Europe. One important element to take into consideration here is the fact that external IT jobs, including SSBS jobs, will grow faster than internal jobs. This assumption is based on historical trends30 teaching us that companies’ external IT spending (including hardware, software and IT services and other outlays) grows faster than internal IT spending (internal IT professionals).

Baseline scenario	**2008**	**2020**	**CAGR 08/20**
SSBS jobs	1,715,000	2,400,000	2,8%

5.5.2 SOCIAL CONTRIBUTIONS

In the D2 report, the study team has provided examples of SSBS contributions to 8 major social domains. The goal of this part is to anticipate some potential social contributions that SSBS will have in the next ten years.

For the sake of this exercise, the study team has envisaged three SSBS development scenarios: Low, Neutral (corresponding to the SSBS demand baseline scenario) and High, depending on the pace of development of the SSBS market.

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30 *IT spending historical data in Western Europe going back to 1992 in PAC’s SITSI® http://www.sitsi.com*

Scenario	CAGR 08/20
Low	3.0%
Neutral	4.4%
High	6.0%

Social Domain	Impact 2020		
	Low	Neutral	High
e-government	▪ After the hype (till 2015), lack of monitoring/protection of data and networks leads to disinterest: e-government tools remain gadgetry	▪ Participative portals, but heterogeneous and few integrated between different administrations ▪ Virtual counters (via Internet) ▪ E-democracy (survey, polls, citizen agora via mobile or Internet)	▪ Internet is a fundamental right and an universal public service (available in public spaces) ▪ Developed public counters (incl. 3D, rich media) ▪ Generalisation of e-public services ▪ Public services are more efficient, with better quality and more proximity ▪ New public services: servers (hosting, processing) ▪ Digital identification ▪ Advanced E-democracy (virtual world, etc)
e-inclusion	▪ Strong gap between a minority knowledgeable about IT, and a large majority which have a huge lack of trust in regard of data security and privacy	▪ Partitioning due to lack of user-friendly devices / software, despite of quite low prices	▪ Developed human services ▪ User-friendliness ICT becomes more accessible (frequent use: remote medicine, virtual leisure) ▪ Raising gap between employees working in highly globalized and technology intensive activities and the others ▪ Better management of the Internet delivery (continuity, bandwidth)

Social Domain	Impact 2020		
	Low	**Neutral**	**High**
Education	- IT equipment and software are available to only a part of students.	▪ ICT are included into education, but are not the heart of it. ▪ Widespread use of ICT technologies as support materials	▪ Education is ICT-oriented: learning tools, more interaction with teachers, networks lay-out for classrooms, more creativity, ▪ Including 3D and audiovisual ▪ Personalised education: real-time measure and adaptation of needs
Health	▪ Remote medicine support ▪ Dematerialisation ▪ Websites, internet forum providing medical advices ▪ Lack of efficiency and/or security, subsequent lack of trust and disinterest from both patients and physicians	▪ First steps to e-health: remote access to patient data, remote data analysis and exchange, electronic prescription (involving physicians, pharmacists, laboratory, and the patients themselves; inside the EU) ▪ Real remote public service procedures, facilitating access to healthcare (refunding, appointment monitored in mutual call-centers, etc.), with efficiency & cost controlling improvement ▪ E-learning, virtual library, best-practices diffusion for physicians ▪ It implies working on portals, databases, interoperability (IS, devices), collaborative tools	▪ Public-Private Partnerships invest into the development of smart healthcare systems. ▪ Real e-health: personalized prevention (to shorten intervention time), remote monitoring of treatment, remote advices and consultation ahead of a real consultation with the doctor, remote diagnosis and surgery; via mobile health - SI based on wireless captors and/or nanotechnologies ▪ Real co-draft of prescription/treatment, faster acknowledgement/integration of the latest results of medicine ▪ Developed health warning plan (via mobile, web) ▪ It implies huge progress in IT tools to provide these services (robotics, biometrics, network (web, mobile

Social Domain	Impact 2020		
	Low	Neutral	High
			telephone), etc.) ▪ Supercomputers, simulation and modelisation tools for pharmaceuticals and biotechnologies sectors (e.g. to forecast diseases evolution, drugs and new therapies like genetics efficiency…)

Optimization of economic processes	▪ Too many risks / insecurity on the web: slowing down the development of e-commerce, ▪ Raising gap between large companies overcoming ICT, and SMB lacking IT skills ▪ Vicious circle: low investments in software R&D lead to low software productivity which in turn limits the performance of the global economy ▪ Production is supported by IT systems but is not customer-oriented ▪ Lack of interoperability in software and processes: strong partitioning in companies (business units, R&D, SCM, CRM). Business processes are weakly integrated .	▪ Moderate growth in e-commerce ▪ Better performance of processes, but companies are not ICT-based ▪ Immaterial measurement (creativity, teamwork, etc) ▪ Collaborative tools used for internal and external processes ▪ Resources forecast planning tools (human, financial, raw) including risks analysis ▪ New technologies: Internet of things, RFID, robotics-related software, cloud-computing (from basic infrastructure (e.g. desktops) to supercomputers; Paas and SaaS) ▪ Lack of bandwidth availability slows the growth of cloud computing models.	▪ IT is strategic and highly-tied to the organization's core-business / activities ▪ Interoperability of Information Systems, advanced collaboration between companies at each stage of the production (co-innovation, co-conception, supply chain): it implies collaborative platforms, higher security… ▪ R&D: trading/bid for external R&D capacities (easily reachable and integrated into business processes), evaluation and networking of researchers, 3D… ▪ Production: disruptive use of new technologies: RFID (SCM, CRM), HMI (Human Machine Interface), progressive manufacturing, robotics… ▪ Advanced collaborative tools: semantic search engines, interoperable databases, real time translation tools, immaterial activities measurement… ▪ ICT modifies back-office functions: new office software (real time business monitoring, resources allocation forecasting optimization, skills and performances management optimization, user-friendliness with voice and haptic commands…) ▪ Thanks to ICT, creation and organisation are customer-oriented: ▪ Innovation and offering result from a well-relayed demand ▪ Huge development of services for many everyday objects (rental, after sales service, maintenance) ▪ Distinction between leisure time and work time becomes hazy (continuous connection, cloud computing)

Social Domain	Impact 2020		
	Low	Neutral	High
Security	▪ Private and business data, critical infrastructures not protected enough, leading to serious incidents ▪ Non-overwhelming of risks plumbs the Internet (e-commerce, e-government, etc): communications from folks and SMBs decrease ▪ Any State attempt to regulate the Internet is seen as an attack on security and privacy	▪ Reliable electronic identity management: positive effects on e-commerce and e-administration ▪ However, security is not global (e.g. networks are passive in front of cyberattacks)	▪ Security levels reached are substantially higher (critical infrastructure protection, facing intrusion, environmental warming…) ▪ Industrial risks prevention (traceability, infrastructures, catastrophes…) ▪ Defence and homeland security: pictures and data processing, networks securing…

Sustainable Development	▪ ICT and software technologies do not provide benefits to sustainable development, and are rejected as part of a polluting economy	▪ Trading about energy, dynamic price elaboration (via electronic platforms) ▪ Smart grids: control and monitoring of consumption, energy quality monitoring ▪ Some level of optimisation, but limited to single environmental domains – No cross-domain integration.	▪ Public-Private Partnerships invest into the development of smart grid systems. ▪ Advanced smart grid for companies first, and then for private people: real time monitoring of energy prices, choice of carbons rate, ensuring energy continuity, automatic management of energy depending on the environment (weather, temperature, light, time, number of people, etc) ▪ Eco-behavior: traceability of things (Internet of things, RFID) with data about production mode, carbon footprint; ratings via collaborative web ▪ Optimized measurement / metrics of carbon footprint: management software including carbon accounting (and associated costs), environmental audit (modelisation of eco-balance, etc), embedded software calculating and communicating eco-balance of things/products ▪ GIS more efficient: optimisation of city planning, land settlement

Social Domain	Impact 2020		
	Low	Neutral	High
Transportation	▪ Few services, about travels rationalisation (time, costs) limited to large scale transportation operators ▪ Heterogeneous ticketing solutions ▪ Travel information	▪ Simple contextual identification: user behavior, near environment, geo-localisation, automated answers to simple tasks ▪ Interoperability (ticketing solutions) ▪ Simple traffic management (speed camera, real time weather warning) ▪ Supply chain: tracking, yield management ▪ Public transport automation (tramway, subway) ▪ Public transport on-demand	▪ Public-Private Partnerships invest into the development of smart transportation systems. ▪ Virtual mobility substitutes physical mobility (remote services, remote working, etc) ▪ Transports are more integrated: « unique sky », intermodality (via smart geo-localisation, including information of passengers) ▪ Traveling optimisation: improved energy efficiency for vehicles, information about travel time, adaptation to the weather (advices, automatic assistance, mobility optimisation) ▪ Private vehicles automation (incl. anti-collision system, adaptation to road signage…) ▪ Intelligent infrastructure: adjustment to the traffic, to changing weather, automated urgencies management

CHAPTER 6

OUTLINE TO BARRIERS AND POLICIES FOR THE DEVELOPMENT OF THE SSBS INDUSTRY

6.1 BACKGROUND

As shown in prior sections the market for software and software-based services is starting to change. Reasons are new technologies, mostly related to the Internet of Services (IoS), new business models based on these technologies (e.g. paid-web-based or online advertising) and new market players. From this development emerges a new segment of the SSBS industry – namely the SBIS segment – that is likely to gain a sufficient market share in the next decade. But not only industry and market are undergoing a significant change, also policy started to change in recent years. In this context two developments have to be taken into account in the analysis of barriers and possible policy measures: the re-emergence of industrial policies and the shift within industrial policy towards an innovation-based approach.

Thus, the scope of our research was to identify the barriers for the development of the European software and software based service industry and to determine policy measures to remove or mitigate them. Given the current structure and the expected future development of the SSBS industry as shown above the analysis focuses on the emerging segment of software based Internet services (SBIS) for several reasons. The main aim is to develop a future-oriented innovation-driven industrial policy as part of an European Software Strategy that enable the European SSBS industry to foster innovation, new businesses and markets. Within our time horizon of ten years the rise of the SBIS sector is the most significant development. Moreover the structure of the existing SSBS industry that is mainly dominated by American companies can not be changed easily. Finally the emergence of SBIS offers a window of opportunity for changing this situation in the medium and long term.

To achieve this aim we follow a three-step approach. The first step aims at collecting, reviewing and analysing of the existing background materials, such as documents about EU initiatives like i2010, the New Industrial Policy or the ICT Task Force, as well as on recent studies and position papers on the European SSBS industry and to some extend EU ICT industry. This step serves two purposes: (1) To understand and clarify the framework for a possible innovation driven industrial policy and approaches that could be used for it and (2) to gain a first overview on barriers and measures for the European SSBS.

Based on this we carry out an empirical analysis that is itself two-folded. In a first part we conduct a series of 55 face-to-face and telephone interviews where we asked SSBS stakeholders to assess the barriers and measure and possibly add new ones. This also serves the purpose to evaluate if the SSBS stakeholders opinion on barriers and measures differ from the literature. The aim is to identify current and future barriers and measures that are specific for the SSBS industry and especially for the emerging segment of SBIS.

In a second part the results of this interviews will complemented by a workshop with stakeholders and policy makers. The workshop will validate, enrich and if possible or necessary specify the results of the interview process. At the end of this step we will have a list of prioritized barriers for the current and future development of the SSBS industry in Europe as well as a list possible, desired policy actions to remove or mitigate them.

Finally, in a last third step, we will develop a method to determine which policy measures that are significant for the European SSBS and especially SBIS industry can be addressed with specific measures for them. This document will cover an overview on the work done in the background analysis as well as the results from the interview process.

6.1.1 THE RE-EMERGENCE OF INDUSTRIAL POLICY WITHIN EU

Industrial policy as a term underwent several changes after the Second World War and there is no clear definition of what it means. In earlier phases industrial policies was often a synomyn for policies of “picking winners” or “protecting immature markets”. Since the 1990s the EU and the member states switched to a horizontal approach of industrial policy. In the last decade, however, the idea of (vertical) industrial policies had a revival. This was clearly marked by the 2002 Communication on “Industrial Policy in an enlarged Europe” (EUC 2002). In 2005 a new framework for industrial policies was introduced with the Communication on “Implementing the Community Lisbon program: A policy framework to strengthen EU Manufacturing – towards a more integrated approach for industrial policy” (EUC 2005). The most significant change in this framework is a matrix-like approach, which combines horizontal policies with sector-specific vertical policies. This development resulted from the experience of the 1990s, that pure horizontal policies aiming at a favourable competition environment varied strongly in their impact on different industries. Therefore the new integrated approach clusters manufacturing industries into four groups with similar challenges and combines them with seven cross-sector policy initiatives. Furthermore, a set of industry-specific actions was identified (Zourek 2005; EUC 2005). This framework was only slightly revised after a mid-term review in 2007 and is still valid today (EUC 2007). Though mainly addressing the manufacturing industries in Europe it also provides a framework for the development of policy actions for other business sectors including the European SSBS industry. Thus, possible policy measures have to be in line with this element of European policy.

6.1.2 THE SYSTEMS OF INNOVATION APPROACH

Another recent development is the shift towards an innovation driven understanding of industrial policy. Over the past decades most policies have assumed that economic growth and employment were based on the competitiveness of single, first good and later also non-good producing industries. Therefore policies aimed as described at the identification and support of such “strategic” industries in terms of R&D funding and market regulations to prevent or reduce the so-called market failures. This “picking winners” strategy was challenged in the late 1980s and early 1990s as several studies showed that economic growth and employment do not base only on single firms and industry, because innovation and therefore economic growth are not based on a performance of individual firms or sectors (Freeman 1987). Instead, they argued, that economic growth and employment are not dependent on knowledge and innovation systems, where all actors function well (Lundvall 1992; Nelson 1993).

This systems of innovation (SI) approach enabled new insights to innovation policy. Before that, market failure was the classical reasoning for policy intervention in the field of technology and innovation policy. It assumed that in a perfect, i.e. completely competitively and decentralised market, a lack of knowledge, because of external effects, uncertainty, asymmetric information and the public/merit character of knowledge, is the cause of it. As a consequence and based on a linear understanding of the innovation process policy maker focussed on support of the production of knowledge by the public sector itself or the support of knowledge producing institutions, e.g. research organisations or companies. However, this approach neither indicates in which phase of the process or in which segment of market the failure takes place nor gives a hint to what extend the support should be.

The systems of innovation (SI) approach, however, understands innovation as a non-linear and interactive process characterised by reciprocity and iterative feedback mechanisms in which actors (e.g. firms), organisations (e.g. universities, customers, government) and institutions (e.g. regulations, culture) interact in many ways. Therefore innovation is based on cooperation and interactive learning between firms, research organisations or others as central aspects of the process. As a consequence of this interaction another crucial point of the SI approach appears implying that innovation is an evolutionary process that creates variety, initiates selection above the variety and therefore creates feedback to the actors. Last but not least it is the significance of legal institutions (e.g. regulations, law) as well as traditional institutions (e.g. culture, values) that play a role for the reduction of uncertainty in the economic system. They shape the interactions and at the same time they are shaped by them. All of these components and the relations between them can be affected by malfunctions hindering the innovation process, which are called systemic failures. As a consequence they argued that innovation policy includes all political measures which influence innovation processes, e. g. the development of new products and process innovations. Further definitions use it as an umbrella term for all activities that tend to influence the decision of actors to develop (invention), commercialize (innovation) and use (diffusion) technologies (Edquist 2006; Larédo/Mustar 2001; Chaminade/Edquist 2009).

The consequence is that the development of existing and emerging technologies and industries, which should drive growth and employment, can not be based on a single industrial policy alone, but need to be complemented by a broader look at the consistency to other domains of policy (Soete 2007; Edquist 2006). This more systemic view, which was incorporated in the Lisbon Strategy, is explicit formulated and implemented in the policy frameworks of the EU as expressed for example in the communication on a broad-based innovation strategy (EUC 2006).

6.1.3 IMPLICATIONS FOR THE STUDY

Both developments have a strong impact on the aim for developing an innovation driven industrial policy in the field of the SSBS industry in Europe. This is clearly marked by the Report of the ICT Task Force (EUC 2006), which was established as one sector-specific measure of the new industrial policy of the EU. In this report and the follow-up report the Commission refers to the Lisbon Strategy as well as to the broad-based innovation strategy with its systemic approach.

The Task Force, which was initiated in summer 2006 and consisted of stakeholders from the ICT industry (including SME) and the civil society (e. g. trade unions, consumers, investors or academia) published a report in November 2006. The report identifies the major barriers for the competitiveness of the European ICT industry and gives recommendations to improve it. In total the Task Force identified seven areas each encompassing several sub-topics.

Table: Selected items from the ICT Task Force Report (EUC 2006)

ICT uptake	lack of consumer demand; investment in networks and services interoperability; lack of awareness etc.	increase consumer skills and demand eGovernment as stimulation for broadband development increase consumer confidence by a charter for consumer rights etc.
SME and entrepreneurship	barriers to efficient information exchange with SME growth, expansion and entrepreneurship access to finance adoption of new technology etc.	encouraging ICT SME by public procurement fostering development of electronic signatures and eIdenty encouraging Entrepreneurship by education, tax incentives for business angels promote take-up and use of ICT by SME etc.
Single regulatory environment	regulatory structure market fragmentation trade barriers ineffective transposition of EU legislation etc.	foster creation of internal market establishment of European Forum on Services in the Internal Market strengthening and clarifying of consumer rights etc.
Intellectual property	IPR, open standards, interoperability and open source etc.	EU Patent reform criminalization of patent infringement fighting counterfeiting awareness raising for IPR etc.
Innovation, Investment & finance	Innovation and R&D Lack innovative culture Investment and finance etc.	better exchange on innovation best practice support effective R&D partnerships for European Technology Platforms prioritize leading edge markets create VC friendly environment reform EU state aid policy etc.
Standards	legal, semantic and organisational aspects of interoperability etc.	ensure stakeholder participation for all interoperability related policy efforts promote effective conformance systems develop procurement policies that promote interoperability etc..
Skills and employability	stimulating the Interest of future generations in ICT Communication on long-term e-skills strategy create environment for ICT practioneers	reduce e-skills gap between SME and larger organisation increase collaboration between industry, governments, employers and education institutions encourage ICT industry and stakeholders to develop better statistics on e-skills

The EUC took up this document and responded with a follow up report in 2007 (EUC 2007a). Referring to the recommendations of the ICT Task Force the EUC documents what activities and initiatives are already ongoing or planned by the services of the EUC in the different fields. Therefore the Follow up report with its overview on all horizontal and ICT-specific vertical policy actions spans the concrete framework which has to be considered to identify obstacles that are specific for the SSBS industry. Together with the SI approach, which enable a more systemic understanding, this will build a basis for developing specific measures for the SSBS and especially SBIS industry in Europe that use existing instruments of this framework like Lead Markets or supplements and complements existing activities.

6.2 IDENTIFICATION AND CONSOLIDATION OF BARRIERS AND MEASURES

Given the constantly growing importance of information and communication technology and especially of software based technologies in the last decades it is no surprise that the number of policy documents related to the ICT and SSBS industry has significantly grown in the recent years. Examples are the OECD study on the ongoing changes in innovation in the software sector (OECD 2009a), as well as an increased number of research publications in the field as result of the new technologies (e.g. Cloud Computing, SOA) or new market segments like SBIS and their implications for the SSBS industry. The process of defining a European Software Strategy initiated another push. Therefore a various number of documents (an overview of all covered studies will be provided in the Reference List) exist, which covers a broad spectrum of viewpoints from different stakeholders, including policy makers, industry representatives, national industry associations as well as user industries and customers. This variety is reflected in the number as well as the formulation of the identified barriers and measures to remove or reduce them. in a first step we analysed these studies to extract them and build a framework based on the SI approach to consolidate them.

6.2.1 FRAMEWORK FOR IDENTIFYING BARRIERS

The idea that stood behind is that systemic failure can require political interventions, which unlike in the case of market failures have to go beyond the production of knowledge by financing of research and development or research infrastructures. Moreover they have to support the functioning of the system as a whole. Within the existing literature a variety of possible system failures are differentiated (Woolthuis et al. 2005):

- Infrastructure failures: flaws in terms of material, academic and technological infrastructure
- Transition failures: inability to adapt new technological developments
- Lock in or path dependency failures: inability of the entire system to adapt to or to recognize new technological paradigms
- Hard institutional failures: malfunctions of the legal and of the regulative framework conditions;
- Soft institutional failures: malfunctions of social institutions (e. g. political culture, values, expectations, etc.);
- Strong network failures: too tight relationships between actors result in „blindness“ towards developments outside the network
- Weak network failures: lacking relationships between actors result in an inability to use and transform complementarities, interactive learning and idea creativity
- Capability failures: insufficient competence result in the inability of especially small firms to learn rapidly and effectively so that they stick to existing technologies

The variety of possible systemic failures requires an innovation policy, which is much more encompassing and thereby more difficult to form as in the case of a market failure. One reason is that a simple innovation and industrial policy based on a set of rules is not possible, because the system efficiency depends on a high degree of interactions between the single components. Therefore a constantly monitoring of the system to detect weaknesses and failures and initiate according actions is required. Additionally, the resulting innovation driven industrial policy should be highly differentiated to be able to influence the variety of different actors and the relationship within the system.

Based on this conceptual consideration a first set of named barriers was sorted along a scheme derived from the OECD ICT policy framework (see table xx) and assessed according to categories of possible system failures.

Table: Initial overview on named barriers

domains	possible sub domains		
framework conditions	infrastructure	lack of broadband infrastructure	Infrastructure Failure
	public regulations	ICT/SSBS specific regulation requirement	Institutional Failure (Hard)
	demand	risk of producing goods for which there is no demand	Network Failures
		shifts in demand and business structures	Path Dependency Failure
		lack of customer responsiveness to new goods or services	Transisition Failure
	SMEs and start-up-companies	SMES often depend on large companies	Network Failures
		entrepreneurial initiative and risk less developed	Institutional Failure (Soft)
		SMEs face a lack of research capacity	Capacities Failure
	Fragmented market	market dominance by established enterprises hinders innovation	Instituional Failure (Hard)
		Fragmentation presents many barriers to growth as: Struggling to scale in a fast consolidating global market	Institutional Failure (Hard)
human capital	education and training	shortage of skilled labour	Infrastucture Failure
		lack of e-skills throughout the society	Infrastructure Failure
	employment	labour market regulation impact economic growth negatively	Instituional Failure (Hard)
		lack of skilled labour	Infrastructure Failure
		human resources mobility	Instituional Failure (Hard/Soft)
financial capital	Risk capital	lack of venture capital	Institutional Failure (Hard)
		lack of appropriate sources of finance	Institutional Failure (Hard)
	Fiscal and accounting policies	tax incentives for R&D	institutional failure (Hard)
		unfavourable business environment	Institutional Failure (Hard/Soft)
	Financial systems	access to external sources of financing such as public money, venture capital or loans	
		credit market regulation impact economic growth negatively	Institutional Failure (Hard)
		unfavourable business environment	Institutional Failure (Hard/Soft)
	Funding	weak public or private financial support to R&D and innovation	Institutional Failure
		difficult access to private financing for R&D and innovation	network Failure
		governmental procurement and EC R&D public funding policies are disconnected	Network >Failure
Innovation policy	R&D funding/promotion	potential for companies to gain tax refunds on their R&D expenditure differ considerably among member states	Institutional Failure (Hard)
		SMEs face a lack of research capacity	Capacities Failure
	Patents and IPR	wrong patents and IPR regime can hinder innovation	Instituional Failure (Hard)
	Technology transfer	lack of information on technology	Network Failure
		little structured cooperation between businesses and knowledge institutions	Network Failure
	Public Procurement	lack of coordinated public procurement policies	Transistion Failure
		governmental procurement and EC R&D public funding policies are disconnected	Transistion/Network Failure
Competition, internationalisation and globalisation	Market liberalisation	market and business regulation impact economic growth negatively	Institutional Failure (Hard)
	Market internationalisation	barriers to cross-border business	Institutional Failure (Hard)
		barriers to doing business internationally	Institutional Failure (Hard)
	Cooperation between different countries	barriers to participation in European processes and a fragmented regulatory landscape	Institutional Failure (Hard/Soft)
		barriers to partnering with firms within the EU	Instituional Failures (Hard/Soft)
		legal and cultural barriers as well as the complexity of legislative procedures and red tape hinder cross-national expansion	Instituional Failures (Hard/Soft)
	Market intelligence	Lack on information on markets and technology developments	Network Failures/Path Dependeny Failure
		large number of small-size SMEs, while positive in terms of their existence, often compete on the same markets thereby creating a potential risk	Network Failures
Networking and partnerships	SBSS networking	European companies' involvement in industry for software standards and interoperability issues is insufficient	Network Failures
		lack of large software players, both as vendors and as structures OSS organisations	Network Failures
	Public-private partnerships	need for PPP to enforce development	Institutional Failure (Hard)
	SSBS Partnerships	cooperation with competitors in innovation projects is rather rare	Network Failures

Furthermore this initial overview allows some first insights to existing barriers for the development of the SSBS industry in Europe. At a first glance it is obvious that the named barriers span over the full spectrum of policy fields, but at a closer look especially with respect to their classification within the system failure concept it seems that institutional failures prevail, followed by network failures. Infrastructure or transition failures appear less, while capacities and path dependency failures can be nearly neglected. This focus is not surprising giving the fact that most of the reports may reflect more the industry perspectives than other perspectives. On the other hand there are several ambiguities within the institutional and network failures from which one can conclude that not only intra-industry problems are addressed. Some points like networking and partnering, market liberalisation or market intelligence also give hints to problems in the relation to user industries and customers. In opposite to this, especially the infrastructure failures in areas like network infrastructure and education seem to be very clear and well defined.

6.2.2 FRAMEWORK FOR IDENTIFYING POLICY MEASURES

As a consequence of the development of industrial policy to innovation policy most OECD nations have been successively widening their activities within this policy area during the past few years. Furthermore the conceptual basis has been continuously expanded and new instruments based on this have been deployed. Out of this, a complex structure of goals, starting points and measures has evolved that can also be found in the cuurent policy documents related to the SSBS industry.

Rammer (2008) gave an overview of most of the innovation policy instruments used in OECD countries (see table below) using a target-instrument-matrix. The assignment of the instruments to more than one goal is not exclusively, because in some cases the instruments can be matched with different goals or depended on the design. Some instruments can serve other targets than the one they are assigned to in this matrix. Empty fields in the matrix mean that there are very seldom examples for this combination in reality.

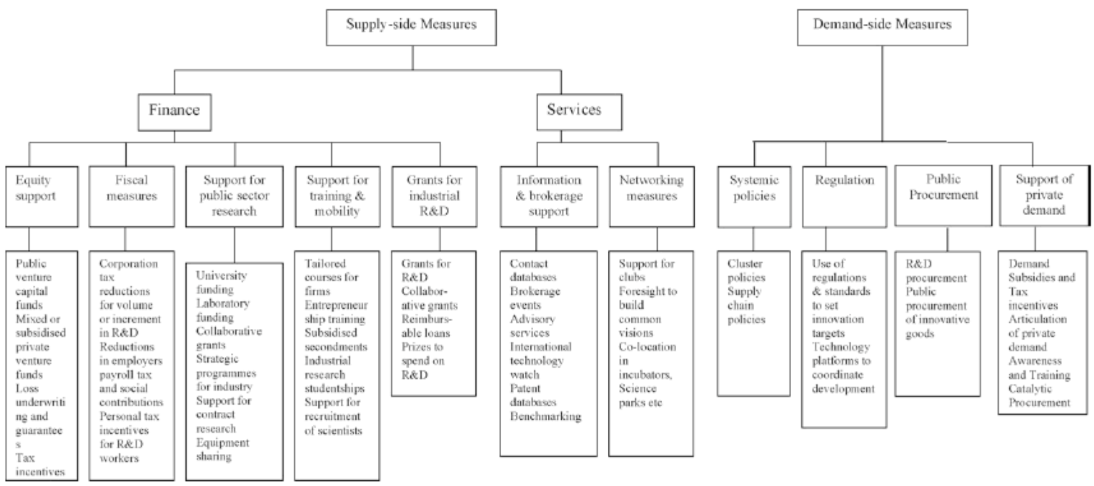
Table: Innovation policy matrix, Source Rammer 2008

Tool / Objective	State production of goods/demand	Financial subsidies	Loans	Equity capital assistance	Tax concessions	Information consultancy, training & qualification	Technological infrastructure	Regulation/ legislation
To increase R&D/innovation activities in firms	R&D contracts to firms	R&D subsidies, subsidies for patent costs	Laons for innovation, securities	VC funds for firms undertaking research	R&D taxes	R&D/innovation benchmarking	Test and experiment centres, innovation centres	Protection of intellectual property
To secure/expand an efficient science sector	State universities/research centres	Subsidies for application-oriented scientific projects	Loans for investments	State involvement in PPP models	Donations to science deductible		Provision of larger equipment	Institutional reforms in science
To promote cooperation between actors	Competence centres	Subsidies for R&D cooperation agreements		State involvement in PPP models	R&D contracts deductible	Transfer platforms, transfer fairs	Technology centres	Institutional reforms in science
To internationalise the innovation system	Operation of international research centres	Subsidies for exchange/cooperation programmes			Concessions for researchers from abroad	Cooperation fairs, information services	Contact offices, cooperation/placem ent agencies	Dismantling of bureaucratic hurdles to migration and immigration
To adapt the education system to the training and qualification required	State schools/school programmes	Subsidies for individuals/firms	Loans for education		Education-related, expenditure deductible	Educational fairs, awareness-raising events		Reform of school/university courses
To develop/adopt new technologies promptly	Procurement system	Subsidies in technology programmes	Loans for innovation, securities	VC programmes in particular technologies	Tax benefits for use of new technologies	Technology awareness	Operation of test facilities	Statutory promotion of concrete new technologies
To set up high-tech firms	ETBFs preferred for public contracts	Special subsidies for ETBFs	Loans for starting a business	Seed and early phase programmes	Negative corporation tax	Consultancy services for business start-ups	Business incubators	Dismantling of bureaucratic hurdles in the way of business start ups
To diffuse cross-cutting technologies rapidly	Procurement system	Subsidies for the use of new technologies	Loans/securities for investment in modernisation	Subordinated capital for investment in modernisation	High/special depreciation rates	Benchmarking, visit programmes	Demonstration/cons ultancy centres	Standardisation, norms
To (internationally) market new technologies without delay	Procurement agreement with other countries	Export subsidies, subsidies for participation in trade fairs	Export loans		Preferential tax treatment for export losses	Organisation of participation in fairs abroad	International technology offices	Technology and trade agreements

For obvious reasons we will not give descriptions of all instruments, but rather show some possible classifications of instruments, which can be helpful in order to select target-oriented instruments.

Other classification differentiated according to the fields of innovation systems that are to be influenced. Normally that differentiation is made between supply-side-oriented and demand-side-oriented instruments. These classifications and taxonomies are also well suited, because they show both sides of the matrix approach to industrial policy. On the one side are the horizontal supply side-oriented policies and on the other the sector related demand-side policies, which were, as Elder and Georghiou state, not considered within the EU. Only since the introduction of concepts like the Lead Market within the framework of the new industrial policy of the EU this part of innovation based industrial policy started to gain more importance.

Figure: Taxonomy of innovation policy tools, Source Edler/Georghiou 2007



Another important issue for this study is the is the question which policies are suitable to influence the formation and development of new specific technologies and businesses; in our case especially the emerging segment of SBIS. Within the SI approach this refers to the concept of technological innovation systems. A technological innovation system can be described as a network of actors, who interact under specific institutional infrastructure to generate, apply and distribute a specific technology (Carlsson/Stankiewicz 1995). Main components of a technological innovation system are actors, institutions and networks which correlate steadily and pursue a common goal. Each technological innovation system shows a certain stage of uniqueness, for one thing with regard to structural composition, for another thing through its specific components. Single components can be part of technological innovation systems at the same time. Especially new technological innovation systems contain few technology-specific components and therefore structural overlapping and dependency on other systems is immense. This is clearly the case for the emerging segments within the SSBS sector, which refers strongly to systems of software and Internet. Another characteristic of technological innovation systems is that the technology or knowledge is based on the institutional and technological infrastructure of one country or region (Hekkert et al. 2007). Today, the relevant knowledge basis of most technologies comes from different territories worldwide. The sectoral borders of technological innovation systems show a similar feature.

Normally the main processes and activities of a system of innovation were called functions. They serve the overall goal; to invent, use and diffuse innovation. Normally every system of innovation has a unique set of functions, which is characteristic. Although there is no consent agreement on which functions are the most important, there seems to be a set of six functions named by a majority of researchers (Hekkert et al. 2007).

- Knowledge production and diffusion
- Entrepreneurial activities (founding and experimenting)
- Search processes
- Market creation
- Mobilisation of resources (capital/human)
- Creation of legitimacy

Among new technological innovation systems only few structural components can be found. Therefore a majority of the listed functions cannot be fulfilled sufficiently yet. In early stages of a new technology development the constitutive elements first have to develop and to agglomerate, e. g. through the entry of new enterprises and other organisations, formation of networks, institutional adaptation as well as accumulation of knowledge and artefacts. The systemic character of technological changes simplifies the slowness of the process and makes it difficult for politics to influence or even to regulate. Furthermore, speed and direction of technological change is relative not only to competition with other technologies but also and primarily to competition with different established innovation systems. According for example to the innovation policy matrix of Ramer (2008) the last four rows seem to be the ones relevant to support new and emerging technologies, i. e development and adaption of emerging technologies; set-up of high-tech firms; diffusion of cross cutting technologies and internationalisation of new technologies.

Based on these conceptual considerations for an innovation based industry policy in the field of SSBS as well with respect to the identified barriers for the development of the SSBS industry we set up a list of possible single policy actions, which are appropriate to reduce or remove the barriers as well as to support the emergence of technologies.

6.3 RESULTS FROM THE INTERVIEW PROCESS

The results from the prior work package were assessed by stakeholders in telephone interview. For the interview guideline the initial lists of barriers and measures had to be focussed to a manageable set of relevant topics. For this purpose the identified barriers as well the measures or respectively clear objectives for measures were classified into four categories (technical, economic, social and cultural, legal and policy). Some topics were included in more than one category, which helped to determine to which extend topics are considered as a technical, socio-cultural, legal and policy or economic issue.

In total we carried out 55 telephone interviews. All interview partners received the questionnaire with explanations before the interview. The sample of interviewees included stakeholders from European SSBS companies, representatives of trade associations, venture capitalists, company end-users, researchers and policy makers. They were asked to select and rank the three most important barriers for the current and the future development of the European SSBS industry and three most promising countermeasures within each of the four categories. It was possible to add barriers and measures.

In the following sections we give a short description of each barrier and measure. In the following we will analyse the results. The prior described approach allows us to differentiate between non-weighted results, i.e. how often a barrier or measure was named in total, and weighted results, i.e. how the barriers and measures were ranked. In the case of the barriers we can also analyse differences between the results for the present time and the future, i.e. time horizon of five and more years.

The analysis focuses on two central questions: 1) Are there differences between the results of the interviews with SSBS stakeholders and the results for barriers and measures in the previous analysed literature. This would be an indicator for identifying barriers and measures that are specific for the SSBS and especially the SBIS industry in the future.

Firstly if there are differences between the results of the interviews with SSBS stakeholders to results for barriers and measures in the ICT or other sectors in order to our aim of indentifying barriers and measures that are specific for the SSBS and especially the SBIS industry. 2) Are there barriers and related countermeasures that are specific for the emerging segment of SBIS and should thus be taken into account in the formulation of the strategy for the future SSBS industry.

6.3.1 TECHNICAL BARRIERS AND MEASURES

6.3.1.1 Technical barriers

Standardisation – is due to its complexity one of the most controversial topics. In the case of the SSBS industry this is especially problematic, because the processes of standard-setting bodies are rather slow, while the industry has a high rate of innovations. Therefore, the dominating global market players tend to create their own de facto standards using network effects, leading to lock-in effects or natural monopolies. It is difficult for European SSBS companies to compete with these standards and normally follow these market players. Moreover, within the active and efficient standardisation bodies related to SSBS or SBIS (mostly industry driven bodies like IEEE WG) European companies are lacking of participation and as a consequence their influence is limited.. Additionally, European SSBS companies pursue different strategies concerning standards (open vs. market). This situation hampers the competitiveness of the European SSBS industry strongly (Nessi 2008, Europe Innova 2008, 3S 2008, EUC 2006).

Possible indicator: Number of representatives of European firms in international committees

Interoperability – For software and software based services interoperability is one of the key factors, because the ability to communicate and interact with other systems is a pivotal factor (network effects). In reality many of the existing, mostly dominant market players pursue very restrictive approaches to interoperability. The mostly aim at controlling their own proprietary software world to prevent others to enter these areas by restrictive IPR use or non-disclosure of specifications. This reduces the possibility the possibility for companies to create new products and services based on existing technologies and hinder therefore innovation and the uptake of new market segments(CapGemini 2006; 3S 2008, EUC 2008). Moreover this kind of behaviour has also a negative impact on on the economy as a whole, because it leads into lock in effects or path dependencies which reduce the possibilities for customers to choose and use technologies from more than one supplier (CapGemini 2006; 3S 2008). Finally, the need of interoperability will raise with the merging of SBIS. The required interoperability there will be not limited to a pure technical level, but also in areas like service engineering (ESA 2009).

Possible indicator: number of released products that are interoperable according to general standards (lf. e. ISO/IEC 2382-01)

Lack of control (on certain) technical layers – Several technical layers in Internet but also in software technology in general are controlled by de facto standards of mostly American players. Therefore the lack of control reduces the competitiveness of the European SSBS industry, because it forces European firms to act as followers and not as first movers within some markets.

Possible indicator: none

Security – Security of SSBS technologies is a decisive, but also multifaceted point for further development of the industry for several reasons. It encompasses topics like reliability, data security or secure transactions. At the moment the security especially of web-based services is seen very critical by businesses and consumers as shown by press coverage. On the other hand a lot of security problems arise not because of the lack of appropriate technologies, but because of non-technical factors such as the lack of knowledge of or disinterest in security requirements of it or other human factors (3S 2008, ESA 2009, Sharpe 2009). Both leads to a low acceptance and use especially of new software based businesses and services. This does not only hinders the development of the European SSBS companies, it also contributes to the low growth of the EU economy as a consequence of a low adaption of ICT, where software and software based services are key factors (Eicher/Strobel 2009)

Possible indicator: number of security relevant patches per year

Critical information systems – SSBS technologies are crucial parts of most information systems in enterprises and administrations. These systems like core banking systems, supply chain management systems in manufacturing or control, command and supervision systems in the transportation, energy (smart grids) or defence sectors are of strategic importance to the activity of the organization. Therefore, these complex systems are of utmost importance to the EU economy and will have major contributions to growth in the future. Lacking sufficient skills in these domains could have major impacts on the competitiveness of the EU economy.

Possible indicator: none

Broadband (in rural areas) – For several new SBIS applications such as smart homes or Internet of things, a highly reliable and fully developed broadband network infrastructure is required (CapGemini 2006). These functionalities also require a more high-speed broadband as available at the moment in the most developed areas (above 50 MBits). A lack of (high speed) broadband infrastructure in Europe would prevent the adaption of these technologies and impact the development of development of new services in the context of the Internet of services and finally lead to a legging-behind of European SBIS companies. Even in central Europe there are (rural) areas with very limited available bandwidth, not mentioning areas in Eastern and South Eastern Europe.

Possible Indicator: Broadband Coverage according to EuroStat

Mobile coverage (and speed) – The use of software and services by mobile devices (smart phones, netbooks, etc.) plays a central role in most Future Internet scenarios for both the development of the Internet as well as of the SSBS industry and SBIS in particular. Therefore, the build-up of next generation mobile network (infrastructure and services) will be a crucial milestone to make Europe to the leading area in the use of the new services and enable European SBIS providers to take a leading position.

Possible Indicators: Mobile Broadband Coverage Index similar to the statistics on flat wired broadband coverage

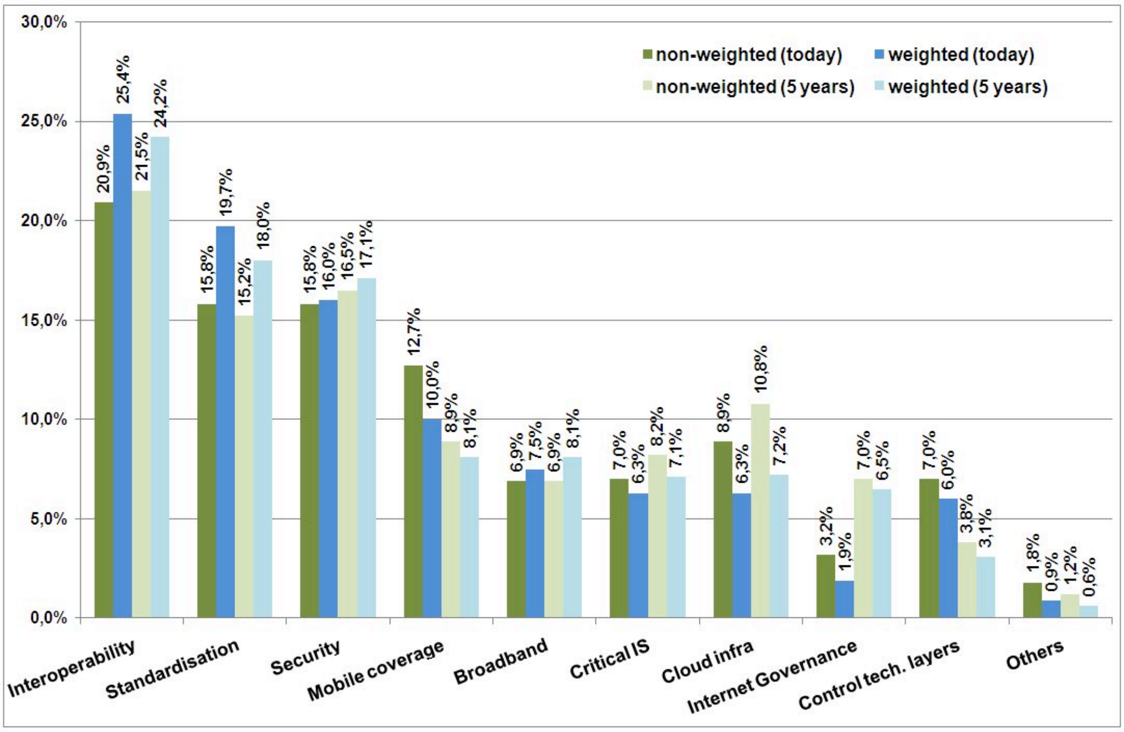
Cloud infrastructure – Several critical issues for success have been raised since the rise of Cloud Computing as a major concept of the emerging SBIS segment. Examples are the harmonization of security, data protection and services on a European and international level as well as the adjustment of education and skills initiatives to the requirements of cloud computing. Another crucial aspect in future will be the availability of a reliable and trustworthy infrastructure for services offered in cloud computing environments. A lack of this infrastructure would underpin the already existing reluctance and low adoption of it by European business and public authorities. In the long-term run this would hinder the European SSBS industry to develop new businesses and services on their own and become leading in SBIS.

Possible Indicators: Market share of Cloud Computing in the SSBS market as well as the share of European Companies in that market.

Internet Governance – The inequality of representation and influence in the current structure of Internet governance can become a barrier for further development of the European SSBS industry, especially in emerging segments such as the SBIS. Beside the political level, where the American influence on ICANN is still a latent problem, there is also a misbalance within the technical part of Internet governance, for example in the committees and working groups of ISOC, especially IETF. These committees have a strong impact on the development of standards, which are crucial for the development of SBIS (FIA 2009).

Possible indicators: European participation in Internet governance bodies (ICANN, IETF, W3C etc.)

Figure: Technical barriers for the development of the European SSBS industry



Within the technical barriers interoperability and standardisation, which are connected, are considered as the most critical points for the current as well as the future development. The results underline especially the high importance and peculiarity of interoperability for software and software-based services. A lack of it does not only harm the competitiveness of the European SSBS companies, it is also a reason for the low adoption and as a result for a lower growth in Europe. Less prioritized, but also often named was security. Although these topics are already addressed within the framework of industrial policies, they have specific dimensions for the SSBS sector that can be addressed by additional vertical measures. Other relevant results are the current importance of mobile broadband as well as the raise of lack of cloud infrastructure and Internet governance as topics in the future. These developments seem to be especially relevant for the development of the take up (mobile broadband) and the future development (governance, cloud infrastructure) of the SBIS segment. Other barriers had no real significance for the interviewers. Additionally named was the legacy problem.

6.3.1.2 Technical measures

Support participation in standardisation process – One measure to improve the European influence on the standardisation process in the area of market and industry standards, which are dominating in software and software based services sector, is to promote the participation of European institutions and companies, especially SME, in these fora.

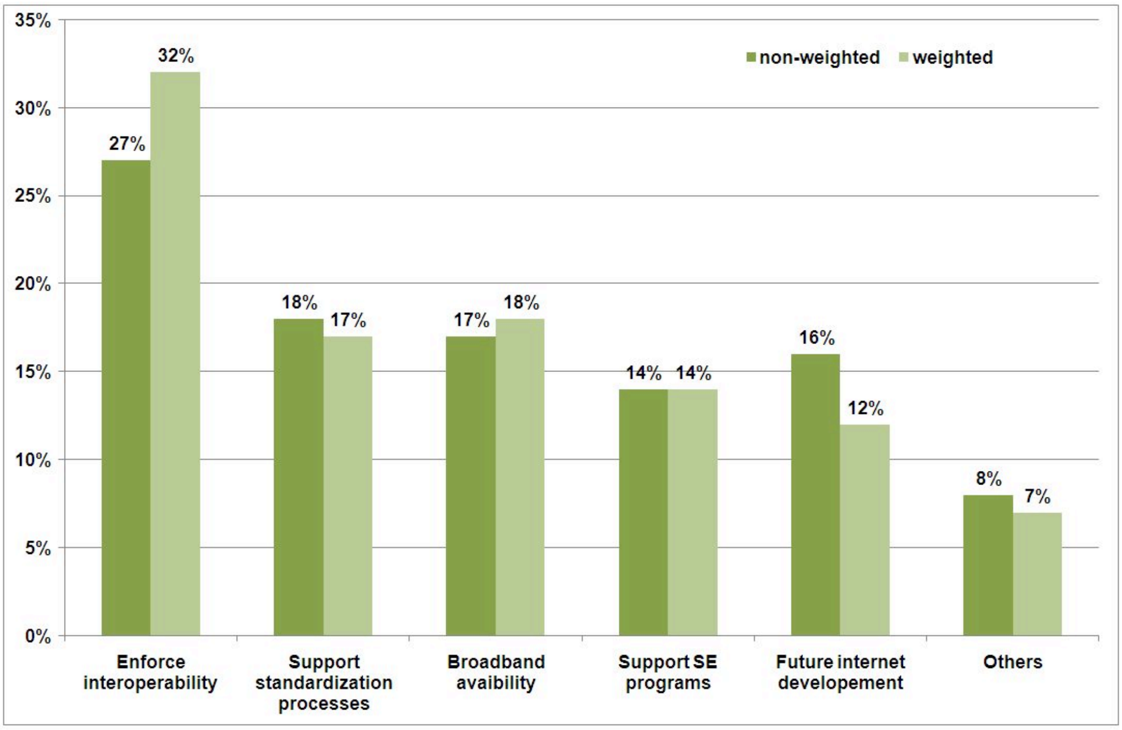
Enforcing interoperability – Enforcing interoperability for software can be achieved in different ways. One way is to enforce the implementation of open standards by adequate measures. Another way is to enforce the disclosure of necessary information for interoperability with proprietary software standards. Political measures to achieve this are directives and guidelines to enforce interoperability of software or the implementation, for example public procurement processes that require the use of open standards.

Broadband availability (raise support for) – Since the availability of broadband access (especially mobile broadband) is essential for a successful take off of the SBIS, measures should be implemented to enforce it. Therefore, the EU should set obligatory targets for the quality and degree of mobile broadband availability (similar to the ones for fixed-wire broadband).

Software Engineering (SE) programs – Based on the fact that innovative, but also secure and reliable software and services create a competitive advantage for European companies and users, the need for processes and methods to ensure a high level of quality in SSBS industry is obvious. Therefore it seems useful to complement R&D support programmes with topics on improving software engineering processes and methods that can help to improve the quality as well as the level and rate of innovative software products and services.

Proactively promote future Internet development – Due to the fact that software based as well as software enabled Internet services will gain an important market share in the future years, the importance of future Internet development will rise. Therefore, an active role in the development is required to enable European companies to profit from this development. This can be done in two ways. First, R&D programs supporting future Internet technologies, which are already under way thanks to promotion of the European technology Platforms and other R&D initiatives, can be continued and increased. Second, by complementing the technological evolution, a strong participation in the accompanying political process is necessary to guarantee the perception of European solutions by for example establishing technology platforms or public-private-partnerships, where the role of SBIS is clearly marked.

Figure: Technical measures for the development of the European SSBS industry



Given the strong emphasis on standardisation and interoperability as barriers for the European SSBS industry it is clear that enforcing interoperability and with some distinction the support of participation in international committees are the most named measures. But while interoperability has a distinctive dimension in software and services, the support of participation in standardisation processes is already covered by other horizontal measures. Maybe the knowledge on this should be more promoted especially to SSBS SME. Broadband availability and support of software engineering reach also a considerable size and priority. In the case of broadband especially the support of the mobile broadband infrastructure, which is essential for the take up of SBIS, has a clear importance for the sector. The support for software engineering programs that refers to the obstacles of security and critical information systems is very specific measure for the SSBS sector. Especially since the acceptance and adoption of new software and services delivered by the Internet the need for reliable and secure products and services is crucial for the uptake of SBIS in Europe. This was also stressed in the additional named measures in form of support for security solutions, the promotion of cloud computing solutions and best practice networks.

6.3.2 ECONOMIC BARRIERS AND MEASURES

6.3.2.1 Economic barriers

Market fragmentation – Unlike other sectors, network effects are dominating the software business, i.e the size of the market plays an important role for the success of software and software based service companies. Contrary to the US, the EU market for software, digital goods and services is still fragmented and the national markets are too small. There are still big differences, e.g. in VAT levels, liability rules etc. (ESA 2009, EUC 2008, Europe Innova 2008). In effect, most European markets are dominated by few non-European players, while the rest of the market actors is a large number of SMEs. Although the number of SMEs is a good sign for the dynamics of the industry, they often compete on the same markets and market segments. This impedes the development of more competitive medium-sized players (EUC 2008; Nessi 2008).

Possible indicator: Market structure and industry structure by size of company

Economic crisis – The current economic crisis can have long lasting effects on the development of the SSBS industry in Europe and worldwide. Although the software and services are not affected as hard as the hardware sector, the slowdown of expenditures and the following decrease of R&D spending can influence the innovation performance and competitiveness in a mid to long-term perspective (OECD 2009b).

Possible Indicator: General indicators on economic growth

Access to credit and financing solutions – Several studies have shown that the access to credit and financial solutions, especially in form of venture capital, is considered to be a crucial point for start-ups and young SMEs in the SSBS industry (Europe Innova 2008; ESA 2009, CapGemini 2006). This argument can be based on the results of the OECD comparisons. While in the US 25,3% of the venture capital investments are directed towards the SSBS sector (Nace 72), the European average is 7,4% (OECD 2008). This forms a barrier to the growth of small, but innovative firms and therefore reduces the competitiveness of the industry and hinders the development and diffusion of new and innovative technologies and services.

Possible indicator: Share of SSBS in venture capital investments

Offshore, competition with emerging countries – As indicated in the previous report and previous chapters of this report Offshoring forms a threat to the European SSBS industry. In opposite to other sectors, the intangible character of software makes it particularly easy to move the development as well as the operating from one country to another. There are several examples of emerging countries within the EU (Ireland, Slovakia) and outside the EU (India) that entered this market. Due to high quality and low costs they were able to attract SSBS companies as well as user enterprises directly to allocate jobs in research and services (ACM 2006). Beside the loss of jobs offshore also holds the risk of knowledge, not only for SSBS but also for user companies.

Possible indicators: Size of Offshoring market

Investment cycles – The development of the SSBS industry is shaped by cycles of investment. One reason is the rapid development of hard- and software itself, which has the tendency to produce and place new versions within short cycles at the market. This can lead to several risks. Firstly, companies introduce new products and services too fast with considerable consequences. Secondly, this development sometimes collides with normal business investments. Both can be a problem for the development, diffusion and refinancing of new, innovative technologies and services.

Possible indicator: none

Lack of revenues due to cannibalisation and copyright infringement – Cannibalisation and copyright infringements are both well-known reasons for the decrease of revenues in the software sector. Whereas copyright infringement is an open discussed topic with a long history of partly contradictive studies, cannibalisation was well known, but never discussed for obvious reasons. In the last decade the discussions on copyright infringement were mostly dominated by the effects of Internet and P2P networks especially for the end-user/home market (Games, OS etc.), while cannibalisation was only a minor topic. This changed with concepts like SaaS and Cloud Computing, because for games and Office software this new models allow several new revenue models, but especially cannibalisation by SaaS has become a major topic for the producers and providers of enterprise-related software. In total, both can lead to a lack of revenue, which would impact the possibility of financing new developments. Therefore it can be a barrier.

Level of R&D spending – The level of R&D spending of European SSBS companies was for a long time lower than the level of main competitors like the US or Japan. As shown in studies the European software sector (numbers for NACE 72) lags behind in almost every R&D related measures in comparison to the US (IPTS 2008). As a result of the Lisbon strategy this level is raising, but especially SMEs are still lagging behind. There are various reasons for this like the access to financing solutions or the complex R&D funding processes (Europe Innova 2008). In total, this development has a negative impact on the industry as well as on society, because it hinders innovation.

Possible Indicators: Share of R&D spending on BERD/GERD

No EU leader – The European SSBS industry consists nearly to 99% of SMEs. Only in few segments some European companies have significant role like SAP for the ERP market, but this singularity leads to the problem that for example SAP revenues make 36% of total revenues of the 100 biggest software companies (Truffle 2009). Beside the fact that this makes the development of the industry dependent to one company, there is the more important fact that big players normally create a certain kind of ecosystem. Within this ecosystem smaller firms with innovative products can grow easier and gain significant market shares. Therefore, the lack of EU leaders is a barrier for the development of the European SSBS industry as a whole.

Possible indicators: List of 100 biggest companies and their shares on market

Limited advertising market – The limitations and fragmentations of the European advertising market through public regulations and also through cultural differences (languages, acceptance, etc.) can build a barrier for the development of especially emerging technologies and business models, which partly rely on advertising as a revenue model.

Possible Indicator: Size of advertising market; share of PWB on revenues in the SSBS sector

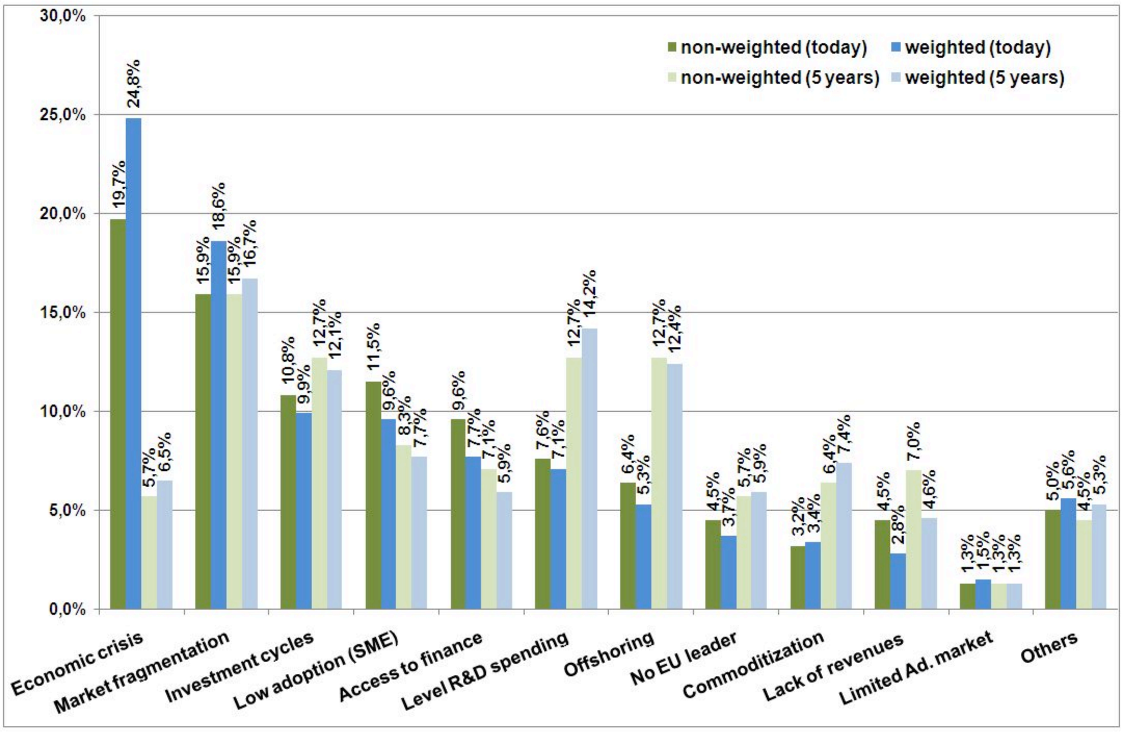
Low adoption/penetration levels in SMEs – The low level of diffusion, especially of emerging technologies within SMEs, which form with nearly 99% by far the biggest part of the European economy, is as already mentioned clearly identified as the major reason for Europe's lagging behind in the productivity growth (EUC 2007a). This does not only impact the EU economy as a whole, it especially impacts the development of the SSBS industry and the emerging segments of SBIS. For the success of new technologies like web based services offered by European companies the fast penetration in their European home markets is a decisive key factor. Since the majority of SMEs is reluctant to adopt them for reasons like a lack of market information or cultural-based restraints, this builds a barrier for the take up of SBIS.

Possible Indicator: Diffusion level according to the EuroStat statistics on the use of Internet

Commodization through web, FLOSS, etc. – The commodization of services and software, provided by web offers or through FLOSS solutions is considered to be a possible barrier, because it destroys existing revenue models. Especially the shift in the value creation from the producers to third-party service providers is critical, because of the unclear mechanism of participation in new revenue models.

Possible indicator: none

Figure: Economic barriers for the development of the European SSBS industry



Not surprisingly, the current economic crisis is considered to be the most important barrier for current development of the European SSBS industry. As a consequence, at least a stagnation of the current growth is expected, but as indicated by the estimation on future impact, this judgement may incorporate a bias. Therefore, this topic should be excluded for long term strategy considerations. A more long lasting and also often named and prioritized barrier is the market fragmentation. It is a general topic, which is already addressed in different horizontal measures (EUC 2007b), but due to particular importance of network effects and the fact that stakeholders expect a growing significance in the future market (partly expressed in topics of no EU leadership). In parts this judgment is also significant for the low adoption of SSBS and especially SBIS by SMEs. A more particular barrier for the SSBS sector is the problem of investment cycles, which will grow in the future. The example of Windows Vista shows that also biggest software companies are not immune against this problem. Also the importance of the level of R&D spending and the competition through offshoring will rise in future. While the particularity of offshoring for the SSBS sector is obvious, the low level of R&D spending is a general problem that has already been taken up by several measures as a consequence of the Lisbon goals. Special characteristics for the SSBS and especially the SBIS markets are the commodization and the lack of revenues due to copyright infringement and cannibalization. Although both have a low level of priority, their growth in the future can lead to possible problems or at least to stakeholder fears.. The relatively low results for the access to credit and financing solutions are interesting, because in other studies of the overall ICT sector this was always considered to be one of the major problems (Europe Innova). Furthermore, the bailout of small emerging companies through American firms and conservative spending policies were named additionally.

6.3.2.2 Economic measures

Ease access to credit and financing solutions – Since the access to financing solutions for European SSBS companies and especially start-ups is very limited, a measure to improve it are special investment and loan programs. This kind of programs targeted especially at SSBS or SBIS start-ups and SMEs can be initiated on EU as well as on national level.

Support seed and venture capital – One possible measure to increase the private venture capital investment is to allow tax incentives for business angels. For two reasons such measure would help especially start-ups in emerging segments like SBIS. Firstly, it enforces especially investments in early stages. Secondly, the engagement of business angels would increase the management capabilities of start-ups.

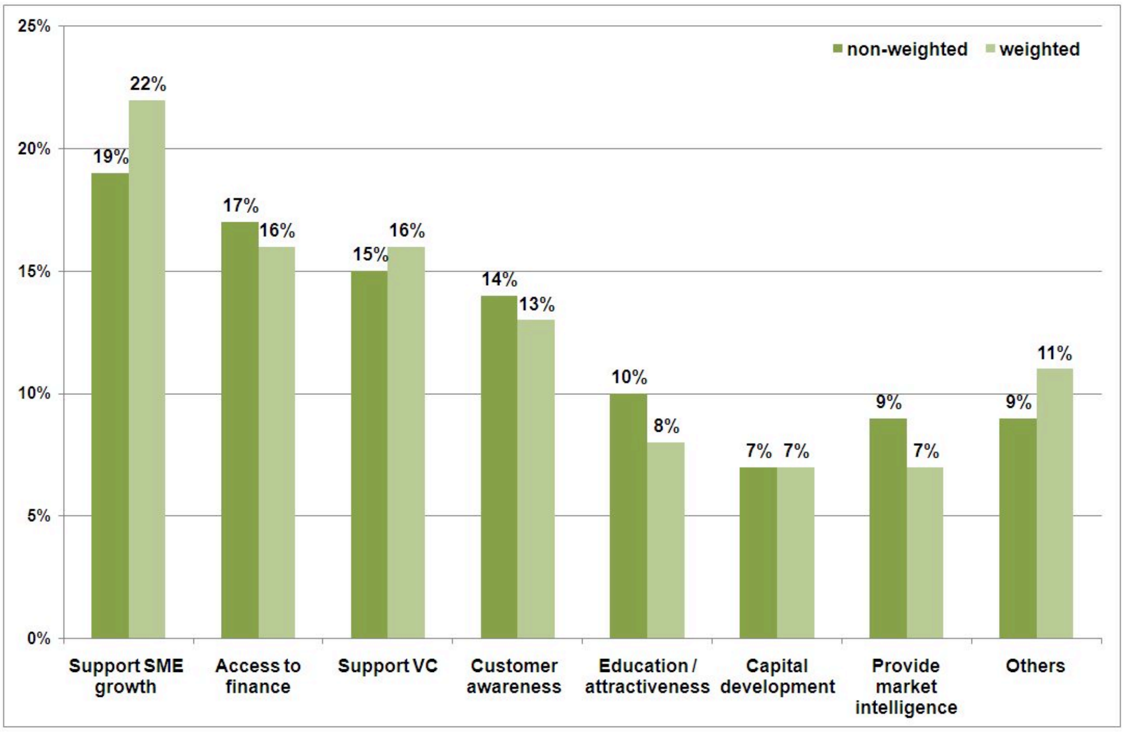
Capital development – One significant point in the structure of the European SSBS industry is the lack of medium sized companies. One reason could be the lack of support in the third stage of growth after venture capital. In this stage companies need support for the expansion on national and international level. Therefore the set up of special investment programs addressing medium sized companies in this stage of capital development will help them to stabilize their growth.

Provide market intelligence – Most of the available indicators shows only the development of the ICT sector as a whole. Therefore, a lack of data exists concerning the SSBS industry and its impact. The emergence of new segments like SBIS that are not covered by official statistics will boost this situation. Therefore, the development of a reliable set of indicators, their continuous measurement and publication will improve the knowledge for decisions for both, entrepreneurs as well as policy makers.

Support SME growth in the SSBS sector – Since several horizontal measures to enforce the growth of SMEs are already in action or planned (EUC 2007a), there are only limited possibilities to additionally support the growth of SSBS SME. Most favourable is that the EUC initiates national governments and trade associations to build up network of excellence for SSBS SMEs in order to share best practices in several fields (financing, public procurement, cross border) and set up measures to connect and coordinate these networks on a European level.

Stimulating customer awareness – Although everyone of us uses software in many everyday situations, the majority of people only know a few numbers of software brands. This situation can be observed especially in the end-user area. A measure to counter this is to set up initiatives to raise awareness. They can pursue two aims. On the one side to raise awareness for the importance of software in everyday life and especially the contribution of European companies to it. On the other side to raise public awareness for alternatives to well-known products for end-users, but also for business users and public authorities. One example is the successful campaign for Mozilla.

Figure: Economical measures for the development of the European SSBS industry



Although the access to credit and finance solutions was not the most prioritized economic barrier for the SSBS stakeholders, the ease of access to it and the support for seed and venture capital are highly required objectives for economic measures. Although there are initiatives at a horizontal level (EUC 2007a), there are possibilities for specific measures targeted at SSBS and especially SBIS companies. More different is the situation in the field of support for SSBS SMEs, which is the most desired objective for measures. Because of the fact that the support of SMEs is a goal of the overall EU economic policy, there are several initiatives related to SMEs ongoing (EUC 2007a). In contrast, the awareness for SSBS seems to be particular for the SSBS sector as it has not been addressed yet.

6.3.3 SOCIAL AND CULTURAL BARRIERS AND MEASURES

6.3.3.1 Social and cultural barriers

Lack of trust from end-users – Trust from end-users is a crucial point for the success of software and software based services. This counts for existing as well as emerging technologies like SBIS. First, trust in software products und services is influenced by general technology acceptance. A low acceptance might lead to reluctance to new software products and services (OECD 2009, Europe Innova 2008). As the use of software implies processing of confidential or personal data, security and privacy concerns occur and demand for trustworthy solutions. Since SSBS technologies are ubiquitous, reliability of technology is an important factor. Public discourses on security, privacy and reliability, like publication of cases of data misuse or software systems failure affect trust from end-users in SSBS. This has to be considered, because a lack of trust from end-user will hinder the success and therefore create an obstacle to the growth of markets or the whole SSBS industry.

Possible indicator: consumer trust, e. g. online shopping, e-banking; technology acceptance indicators..

Lack of entrepreneurship – the SSBS industries' dynamics are high and this implies a strong demand for entrepreneurship activities. And although the innovativeness of Europe's software developments is high, entrepreneurship in SSBS is insufficient. One reason for this is a lack of entrepreneurial skills of software engineers. The quality of technical education in Europe is considered to be high, but the skilling of students in entrepreneurship is far away from that. As several studies indicate, the lack of a more risk-taking entrepreneurial and innovative spirit seems to be one of the reasons of the commercialisation gap between invention and innovation in the ICT and especially SSBS industry in Europe (Europe Innova 2008; Sharpe 2009; ESA 2009). Therefore this lack of entrepreneurial spirit and skills is a clear barrier to the growth of the industry especially in emerging segments like SBIS.

Possible indicators: Integration/Share of management skills on technical education; number of start-ups per year; industrial dynamics,

Management skills – The lack of managerial skills is closely connected, but not the same as the lack of entrepreneurship. While the latter aims more at mindset to risk the undertaking of new businesses, the lack of managerial skills addresses a problem that occurs in both, start-ups as well as existing firms. Most of the SSBS-skilled workforce is not adequately prepared for the requirements of project, technology and business management (OECD 2009a; Europe Innova 2008). This causes severe problems especially in the all-day business as well as in strategic planning and results in a barrier for the growth of firms. This problem not only occurs in SMEs and start-ups. In addition, there is a close link between the development of management skills and the demand for innovative software-based management systems.

Possible indicators: Evaluation of management skills in IT-/software engineering education and in SSBS companies, (spending on) further training in management skills,

Change management/Path dependency – The adoption of new technologies, businesses and services like SBIS is often hindered by the fact that users tend to stick to existing technologies and reject the new one (Europe Innova 2008). Therefore end-users should be actively involved in the innovation process to make sure that new products and services are in-line with users demands. Furthermore, additional effort should be made in the diffusion phase to support end-users in the process of implementing SBIS technologies. Especially the shift to Enterprise 2.0 has a major impact on the organization of the company, so an implementation process has to be accompanied by a change management of business processes. Path dependencies of SSBS or a lack of change management has a negative impact on SSBS demand and thus on the European SSBS industry as well as the European economy as a whole.

Possible indicator: Diffusion rate of emerging technologies, *SSBS-spending*,

Privacy concerns – Privacy concerns are the most crucial determinants for the acceptance of SSBS, especially for emerging web-based technologies in the Internet of Services (3S 2008; Europe Innova 2008, Sharpe 2009). The further virtualisation of data processing and storage as well as the increasing market for cloud solutions leads to an increased demand for trustworthy services. Due to the different regulations on privacy protection in the different countries within the EU as well as outside the EU companies are challenged to adjust their SBSS products and services to this. But this challenge can also be seen as a chance because there is a huge market for convenient solutions due to rising awareness for security and privacy problems.

Possible indicators: Privacy violations in the EU, public debates on privacy, acceptance of and demand for cloud services,

Technical skills – A simple technical skilling is not sufficient anymore for the requirements of the increasing complexity of software technologies. The ubiquity of software implies that engineers and technicians in this field should be able to work and cooperate with other fields, where the software is applied, as well as to quickly adopt new skills demanded. Moreover, Europe's SBSS industry suffers a lack of skilled personnel and at the same time an alarming trend of decrease in graduates in this field (OECD 2009, Sharpe 2009; Europe Innova 2008). All this hampers the growth of the European SSBS industry and impacts the overall economic growth and employment negatively.

Possible indicators: Statistics on graduates in the field of SSBS, demand of skilled personnel,

Mobility of workforce – The low mobility of workforce as a barrier has several dimensions. Firstly there is a low mobility of high skilled workforce between EU member states as well as from outside the EU, because of regulative and cultural reasons (OECD 2009a). Secondly there is a low mobility between science/research and private businesses and finally a low mobility between sectors. The latter is highly required because of the cross-sectional innovation potential of SBSS (Europe Innova 2008). All these factors have a negative impact on the SSBS industry, because they hinder growth through a lack of skilled personnel and cross-cultural experiences which are also needed for the development of new markets.

Possible indicators: Statistics on Mobility of workforce between states and between science and business, cross-sectoral cooperations, industry-university cooperations.

Lack of usage of IT – The use and therefore the demand for new and innovative software products and services in Europe is less developed as in other regions of the world. This low responsiveness to new products and the lower adoption rate of IT in European companies, administrations and homes is according to several studies the reason for the legging behind of Europe in the productivity growth (van Ark 2003). Since software is the key factor for the productivity growth by ICT (Eicher/Strobel

2009) the increase of the usage of SSBS and especially SBIS is crucial point to improve the competitiveness of Europe. Moreover this ongoing lack is also clear barrier to competiviness and growth of the European SSBS industry. As a result, European SSBS firms get less stimulus from their home markets and they are neither able to develop and create lead markets nor establish new products and services (Europe Innova 2008). Furthermore the lack of usage also impacts the development of IT-skills and the overall economic growth and employment due to the fact that software intensity is one of the major determinants for the increase of productivity in traditional industries.

Possible indicators: Usage statistics for certain products or services (partly carried out by EuroStat), IT-spending, spending on IT-skills development,

Governance issues – Beside the lack of usage of IT and especially SSBS there is also the problem of using it efficiently. Often SSBS technologies in general and emerging technologies like SBIS in particular are introduced without a clear understanding of their purpose or possibilities. Moreover the new technologies are inadequately integrated in the existing IT landscape as well as the organisation and business processes of the firm. Therefore they could never deploy their full potential. A lack of strategic direction and organisation methods hinders the successful use of SBSS and thus the competitiveness and growth of a company. In total, it builds an obstacle for growth and employment in the European SBSS industry and Europe's economy in total.

Possible indicator: increase of process efficiency through SBSS

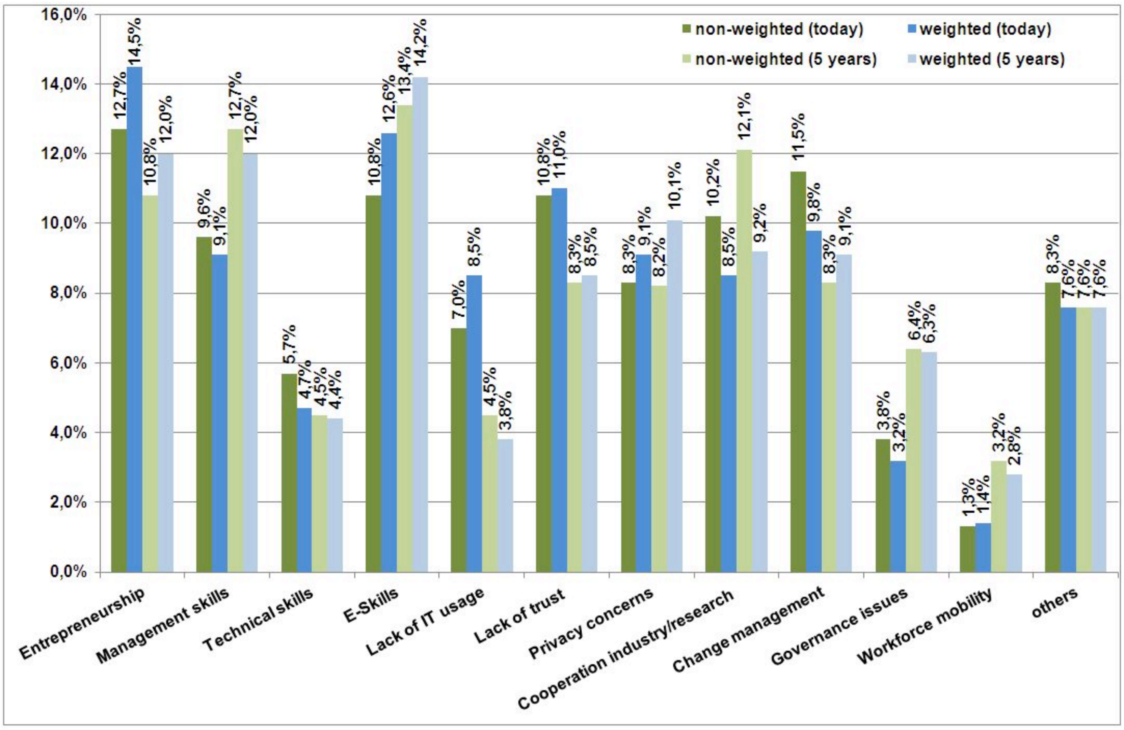
E-skills – As indicated by several studies there is a lack of IT skills in Europe, especially on the level of consumers and business users. This shortage has severe consequences. It prevents people from participating in the digital world. It hinders the uptake of innovative SBSS and reduces the attractiveness of Europe as a lead market and thus as location for SBSS and IT companies (ESA 2009, Sharpe 2009, EUC 2008). The impact on the competitiveness of both the European SSBS industry as well as the European economy as a whole is immense and builds a clear barrier to growth and employment in Europe.

Possible indicators: Statistics on graduates, evaluation of the education at universities; ICT specialist in total economy, use and intensity of use of IT and Internet services, esp. Social Software,

Lack of cooperation between industry and research institutions – Cooperation between research institutes and industry is one crucial precondition for the development of new software and services in the context of the Internet of Services. The interaction between both enables the transfer of new knowledge into products and services. Also research needs industry cooperation to get new insights into market developments and demand of developers and users. One indicator is the low mobility between both (Europe Innova 2008, AETIC et al. 2008). And in addition, the SBSS industry suffers from a lack of knowledge transfer between science and users as well as between software developing and software demanding industries. Therefore a lack of cooperation can cause severe problems to innovation capabilities of the European SSBS industry and hinders growth and employment.

Possible indicator: Statistics on common R&D projects and PPPs; mobility statistics, regional clusters

Figure: Social and cultural barriers for the development of the European SSBS industry



Within the social and cultural barriers there is a high prioritization of topics related to skills and education. It addresses SSBS companies (technical and managerial skills, entrepreneurship) as well as user's skills. Due to the long time known significance of these topics, they have already been identified and addressed before (EUC 2007a). Only the growing significance of particular managerial skills is not represented in existing studies. Also often named as a current and a future barrier, but less prioritized was the lack of cooperation between research and industry, which confirms the results of other studies and reports (Europe Innova 2008, AETIC et al. 2008). More particular for SSBS and SBIS are the barriers of change management as well as the lack of trust and privacy concerns, which are highly connected. While change management is a clear barrier for the growth of the European companies, trust and privacy concerns are more ambiguous, because they can also be considered as a chance. A more user-oriented software development with respect to trust and privacy can be a competitive advantage for European SSBS firms. Other barriers like governance issues and the mobility of workforce have no real significance at the moment. Only governance issues seem to be a possible topic in future. Complementing the balanced picture of this category is the high number of additionally named barriers. Among these are the recognition of real innovation, the cooperation between large firms and start-ups, lack of usage of mobile internet and management culture.

6.3.3.2 Social and cultural measures

Increase support for knowledge transfer – The insufficient commercialization of research results is one of the most often mentioned examples for problems of European SSBS innovation system (AETIC et al 2008, ESA 2009). To counter this situation different instruments can be used. One possibility are initiatives to establish and enforce the build up of specific networks for knowledge transfer. This effort should involve national authorities and trade associations. Another one is to enforce the cooperation in public private partnership.

Promote e-skills programs – Several studies show that the EU gap in productivity is caused by the low adoption and use of ICT (.f e. van Ark 2003). Other studies show that for the success of productivity growth by ICT software is the key factor (Eicher/Strobel 2009). This problem will rise with adoption of new concepts like Enterprise 2.0, which are based on SBIS. Therefore, the existing e-skills programs should be enforced and complemented by measures aiming at skills in the field of social media and other areas of SBIS.

Alignment of data protection rules – The regulation of data protection is a major issue for the upcoming segment of Cloud Computing. Although there are EU directives, the implementation in the member states differs, which causes problems for cloud-based business models. To improve this situation and prevent premature actions, the already ongoing considerations on EU level by WP 29, EDPS, ENISA as well other involved services should be coordinated by a high level group to align actions in favour of both, users and industry.

Promote online trust – A lack of trust is one key factor of low acceptance for especially new technologies like Internet based services. Therefore, the promotion of trust in these new services will be a crucial aspect. Beside awareness raising actions like trust seals another possible measure is to enforce public services to implement secure and reliable services based on these technologies. Both can improve the trust in new technologies and create the required legitimacy to let them succeed in Europe. Most of these activities have to be implemented at national level, but can be initiated by guidelines on EU level.

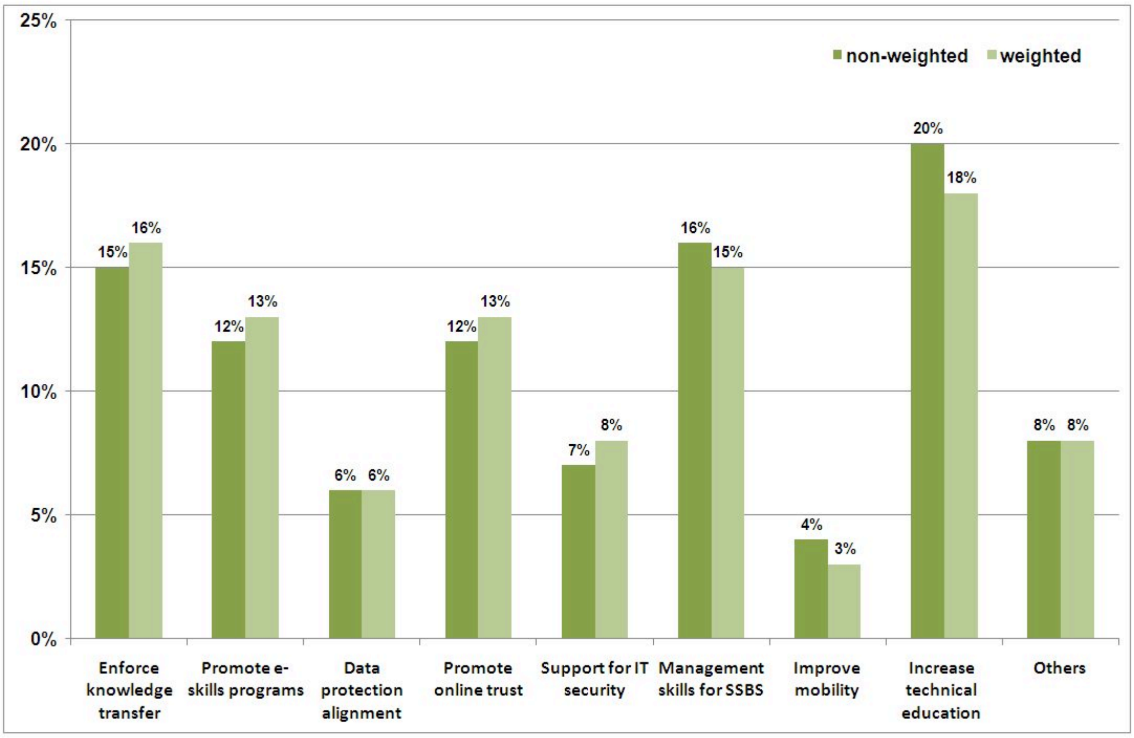
Increase support for IT security – Improving the support for IT security is one measure to encounter the lack of trust. Moreover the dedicated integration of security in all R&D programs, especially the one related to web services, is suitable to create a competitive advantage for European SBIS technologies, products and services. On the other side the trust in security and reliability of software and especially internet based services can be improved by e-government applications as pilots. Examples are electronic invoice systems or electronic identities.

Promote management skills for SSBS companies – There are two possible measures addressing this problem. First of all one initiative at EU level could be to start initiatives and guidelines to raise the share of management education in the relevant study fields like software engineering and informatics. The second would be part of the concept and initiatives to lifelong learning. Together with national governments and trade associations initiatives and networks could be set up to offer further education and knowledge transfer.

Improve mobility – The lack of adequate workforce for both, technical as well as managerial jobs, is evident for the SSBS industry (Sharpe 2009, ESA 2009, AETIC et al 2008). One measure to reduce this barrier is to improve the mobility of young talents for SSBS within the EU as well as from Non-EU states. While the mobility within the EU can be tackled by special programs on EU level, e. g. in form of grants and promotion as well as the reduction of regulations, the mobility from outside the EU has to be approached on national levels.

Increase technical education in school in support of SSBS – One measure to encounter the shortage of skilled workers is start initiatives to increase the share of technical education in school curricula. This can only be done in cooperation with the different national level authorities. The aim would be to raise the awareness for technical jobs

Figure: Social & cultural measures for the development of the European SSBS industry



There is a strong emphasis on skills and education within the social and cultural measures. Especially the technical education in schools and the promotion of management skills for SSBS firms show a clear need for more and better educated professionals in the SSBS industry. Although several measures at broad level have already been undertaken (EUC 2007a), there are some possibilities to shape or complement them with specific actions for the SSBS industry. This is also valid for the promotion of e-skills for end-user, which should be expanded towards new skills in required internet services. Concerning the emerging segment of SBIS areas like trust, data protection and security have a high importance. There are several possibilities to act in support of the take up in these services.

6.3.4 POLICY AND LEGAL BARRIERS AND MEASURES

6.3.4.1 Political an legal barriers

Lack of harmonization across EU – Although the EU member states and the EU Commission undertook great efforts to create a single market in Europe as shown in different directives and initiatives, there are still smaller and greater differences between the different states that especially hinders the take up of SBIS. Examples are the number of differences in the legal and regulatory environments (e.g. VAT regulations on services, consumer rights) as well as the lack of harmonized in finance and financial instruments as well as (CapGemini 2006; Sharpe 2009). This lack makes it difficult for SSBS companies to participate and grow within the European market.

Possible Indicators: none

Lacks of governmental procurement policies – Many of the EU Member states underestimate the strategic value of governmental procurement policies. Procurement policies can serve at least three purposes: 1) precommercial procurement can help especially SME to commercialize innovative developments and present a first reference user; 2) procurement can be used to increase the diffusion of the emerging SBIS by public lead user like the introduction of public services that use software based web services (eID); 3) procurement can be used to enforce open standards, especially in a field like SSBS that is dominated by non-european, proprietary suppliers (Nessi 2008; ESA 2009, Sharpe 2009)). The lack of such strategies limits the competitiveness of the whole sector and hinders the diffusion of emerging technologies.

Possible indicator: number of pre-commercial procurement procedures, infringements of procurement guidelines.

Lack of R&D funding – European SSBS sector as mentioned before legs behind in all R&D related activities, including the level of R&D funding (IPTS 2008). Although several overall activities are initiated to change the situation (e. g. Lisbon goals), it needs more efforts to change the situation. One example is, that especially for SMEs the funding procedures are often too complex and long lasting (OECD 2009a; EUC 2008; Europe Innova 2008).

Possible indicator: Share of R&D spending on GERD/BERD; number of SSBS R&D researcher

Barriers to cross-border business – As already implied there are several problems in doing cross-border business especially for SSBS/SBIS SMEs. Some reasons result from different regulations like the complexity of the various VAT and financial systems; the existence of different standards and regulations in different countries or variations in employment law and between different countries (Ecorys 2009; ESA 2009). Other reasons result from cultural differences like different working culture or values. Another point is that only a few European SSBS firms operate worldwide, while most of the firms, especially SMEs, are only active on their national home markets and partly in neighbouring markets (Sharpe 2009, ESA 2009; Ecorys 2009). All this forms still significant impediments to geographical expansion and hinders the expansion and growth of SSBS and especially SBIS companies and limits their competitiveness against non-european, multinational companies.

Possible indicator: Statistics on cross-border cooperations and businesses within the EU (especially of SMEs); Trade in software and software-based services in Europe and international

IPR regulation – The regulation of intellectual property rights is one of the most controversial points of discussion, especially in field of software and services. This is demonstrated by the different controversial discussions and the regulation processes that was stopped by the European parliament. This controversial situation is also obviously within the SSBS industry in Europe. While one group of stakeholders argue for stronger IPR regime, other groups argue against. Both have arguments why and how the IPR regime impacts the development of the SSBS sector, but it seems clear that neither traditional copyright nor patent regulations can reasonably be applied for software and thereby cannot solve all IPR related problems of software industry (3S 2008). Therefore, the lack of new approaches to IPR builds a barrier for the industry's growth.

Possible indicators: Number of IPR related law suits in the EU; number of SSBS related patents

Lenghty regulatory process and litigation in dynamic markets – The development of emerging and dynamic markets and industries as the SSBS and especially SBIS market and industry are often impacted by long lasting regulatory processes. Normally less regulation can be a good stimulus for innovation and as indicated by several studies countries with low regulations create more innovators than other countries (Europe Innova 2008). In opposite to this there is a tendency of premature and over-regulation of markets within the EU. Another point is a regulatory incoherence caused by different implementations of directives. As a consequence too much and partly incoherent business, credit market and labour market regulation impact economic growth of the SSBS industry negatively and especially hinder the take-up of SBIS.

Possible indicators: Number of general and specific regulations related to SSBS in Europe

Lack of Tax incentives for R&D – One of the reasons for the low level of R&D in SSBS (IPTS 2008) is the low share of business spendings in R&D (BERD). This can be caused by a lack of tax incentives that ould especially SME allow to do more R&D. Although some EU member states already introduced it, the regulation on tax incentives for R&D differs considerably between them. Some countries use this instrument for a longer period, while other countries still discuss the introduction. But within several countries there are also differences regarding different sectors or sizes of firms (ESA 2009, Europe Innova 2008). The lack of harmonization within and between the EU member states in comparison to other countries impacts the development of a European SSBS industry.

Possible indicator: Tax statistics, R&D spending on BERD

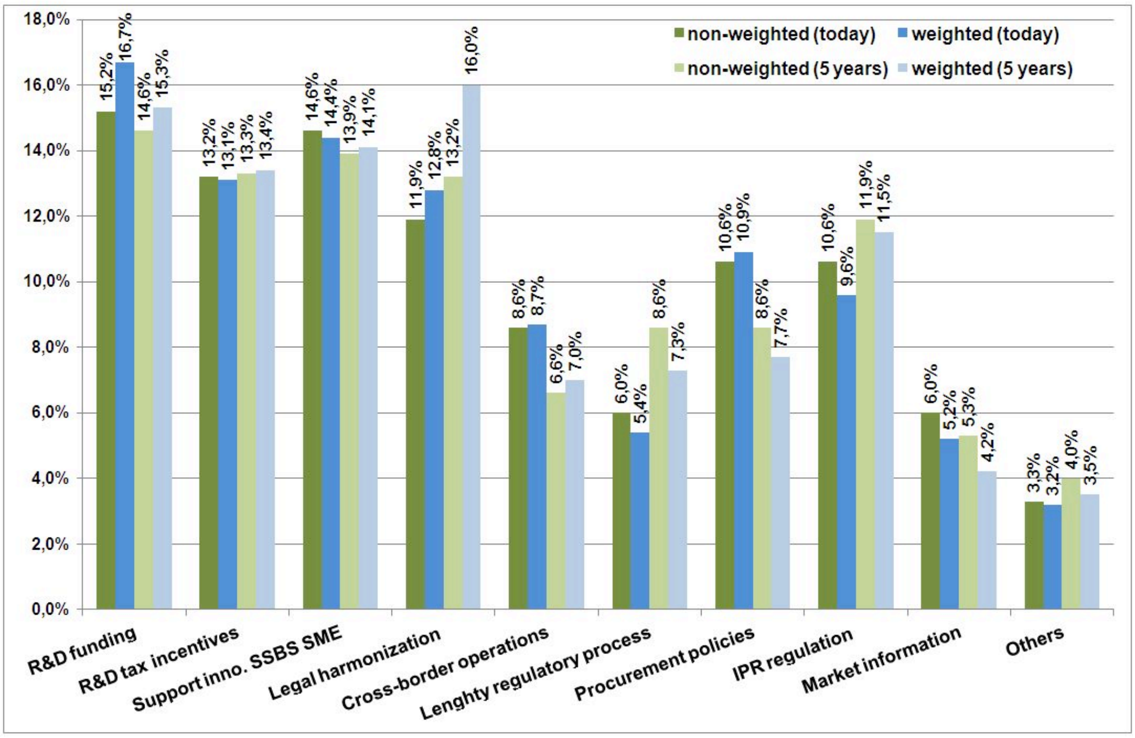
Lack of market information – As described in several prior sections of this report there is a lack of information on the SSBS and especially the SBIS sector in Europe. This lack causes problems for both, business as well as policy makers. On the one side the lack hinders SSBS companies, especially SMEs, to recognize new developments like SBIS and possible partners in other countries. On the other side the lack of information also build a barrier for the monitoring and supporting of the development of the industry by policy on both, national as well as EU level. Therefore it hinders the development of new strategies on business as well as on policy level.

Possible indicators: none

Support of innovative SSBS SME – Although 99% of the European SSBS firms are SMEs, the conditions for them are not considered to be not favourable. The support for growth and expansion, for example in form of access to finance, is less developed in most EU member states. Also the public R&D funding or public procurement procedures are perceived as too complicated and unfavourable, e. g. because of long paying periods, especially for innovative SSBS SMEs. Other points are for example complex regulations that hinder the establishing companies or the change of their legal status (ESA 2009; Ecorys 2009). The improvement of the acknowledgment and support of innovate SMEs would not only have positive effects on the industry, but also a positive effect on the region's overall economy.

Possible indicators: Share of SME in R&D funding; Indicators on Business environment for SMEs

Figure: Political and legal barriers for the development of the European SSBS industry



The priorities within the political and legal barriers are very clear. One priority is the low level of R&D either in form a lack of R&D funding or in form of a lack of tax incentives for R&D. The other priority is the lack of support for innovative SSBS

SMEs. These barriers are not surprisingly and already named in different studies (f.e. Europe Innova 2008) and only partly specific for SSBS. Another point of importance is the lack of legal harmonization, which has a specific significance for the SSBS and SBIS and which will rise in future. This is underlined by the fact that the lengthy regulatory processes that hinder dynamic firms and markets refer also, but not exclusively to similar problems and will also rise in the future perspective. Although both are general barriers they contain several issues that are specific for SSBS and especially SBIS. In parts this also applies to the problems with cross-border-operations and internationalisation. In contrast the lack of procurement policies is considered to be a declining obstacle, though it has in parts high relevance for especially SBIS. One reason is maybe that as a general barrier it is already addressed. IPR regulation, which has a great specific component for SSBS, is also seen as a topic that will gain of importance in future. Of less importance is the lack of market information, although the lack of specific information on SSBS still exists. Additionally named was the three strikes policy (here the Hadopi law in France).

6.3.4.2 Political an legal measures

Tax incentives for R&D – As prior mentioned the use of tax incentives within the EU member states for R&D differs a lot. This situation is especially for SSBS SMEs unfavourable, because in opposite to the multinational operating software companies they are not able to profit from this incentives. Therefore a harmonisation based on an EU leve initiative would migititate this imbalance and offer all European SSBS SMEs the access to this incentive for doing innovative developments.

Harmonisation of the internal market (single market) – The dominant character of network effects for the SSBS industry is the major reason for the harmonisation of the internal market. Though the creation of a single market is already adressed by the several initiatives including the aim of the single European information space within the i2010 program, there are complementing actions that could especially foster the the uptake of the SBIS segment. This includes clarification on VAT rules, consumer rights and liability for services developed, executed and delivered in different EU member states.

Reduction of regulatory issues for SBIS – Premature or outdated regulations can prevent the successful diffusion of emerging technologies like SBIS. Therefore a high level group of experts from the different Commssions services involved should accompany and monitor the development of regulations for the emerging Internet of services and if required give recommendation to the Commission and the EU member states on adjusting regulatory issues in order to improve the takeup.

Increase R&D funding – Another way to encounter the low level of R&D activities is to rise the level of public R&D funding. This measure also allows to adress specific emerging technologies as well as SMEs. While EU level the funding in the SSBS was raised with the expansion of the ICT programm in the 7th FP, the level of funding in the different member states vary (IPTS 2008). Therefore additional instruments could be to set up initiatives to raise the share of SSBS and especially SBIS related funding in the different member states. Above that the different national and EU R&D initiatives especially in emerging segments could be more coordinated to ensure a more efficient use of public R&D funding.

Promotion of PPP – Public private partnerships are one possibility to encounter two obstacles. Firstly the improve the cooperation between industry and research by its character. Secondly the funding of of PPP also gives incentives for companies to do more R&D expenditures. In total this will raise the level of R&D. In the last year the EU launched several PPP in the context of the Internet of Services. In a first step an integration of SBIS related companies would be a benefit for both. In a second step PPP with reölevant topics for SBIS could be initiated.

Enforcing IPR – The ongoing debate on patent staus of software and software based services shows that the existing IPR system is not adequate to deal with the problems raised by SSBS (Sharpe 2009). Furthermore the existing IPR system is often used to stabilize the existing partly monopolistic structure of the market, e.g. by using IPR to protect de-facto-standards. Because of this the should should be proactively engaged in the development of new intellectual property rights systems and coordinate the efforts of the different memeber states. This engagnement should aim at an IPR system that balance between the needs of large compabnies and

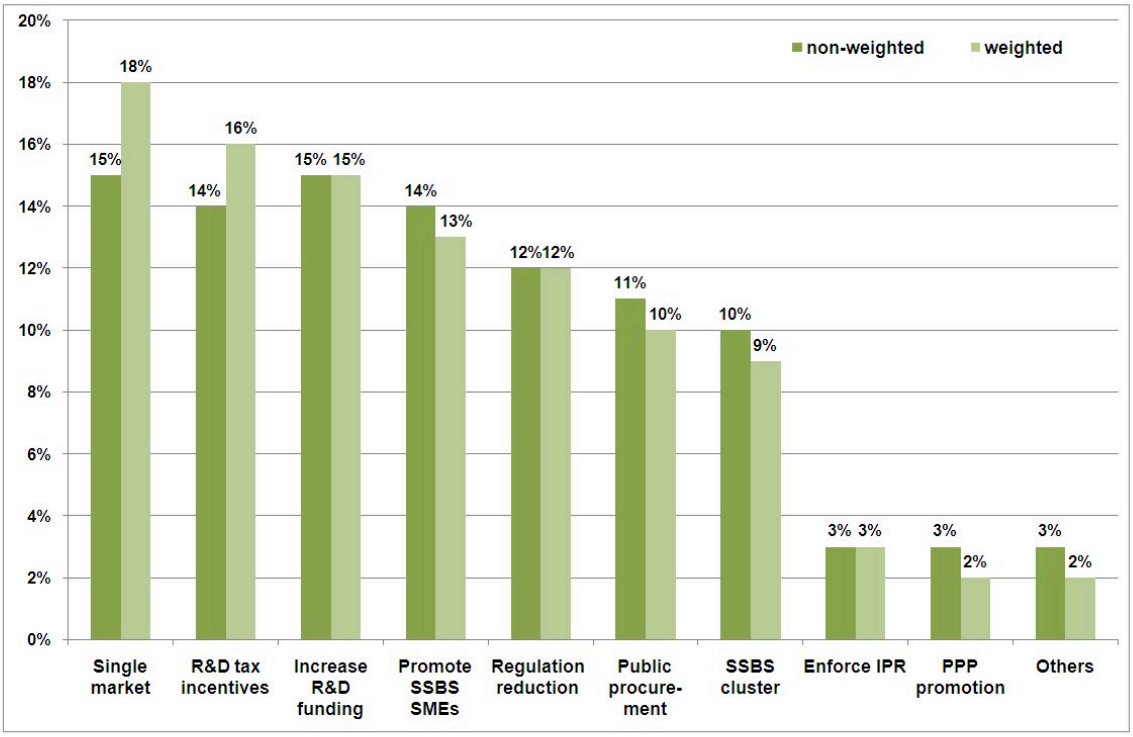
SMEs (especially in the field of OSS) as well as between companies and end-users.

Public Procurement – Due to different guidelines and directives there is no need to do further actions in this direction, instead it seems more important to enforce the strategic use of the instruments as desired by the in the Lisbon goals. Therefore EU could set up initiatives to rise the awareness for it as well as to connect national authorities and organize the exchange of knowledge on it.

Promotion of SSSBS SME – As already mentioned before there exist a broad variety of horizontal measures to promote SMEs. Beside of these underlying measures there are possibilities to initiate in cooperation with national trade associations the build up of SME networks in SSBS. Aim should be to connect SMEs on antional and EU level to share knowledge on SME promotion and to enforce cooperations to use them.

Establish SSBS cluster – As shown by different analysis (Truffle 2010) there are already regions in Europe with a high specialisation on SSBS activities and a level similar to other areas in the world. At the moment all activitiers to support clusters only relate to the ICT sector as a whole, but not all ICT clusters are also SSBS clusters. Within the existing cluster observatory the differentiation of ICT could be enforced to gain better data on this. On this basis special programms adressing existing or upcoming SSBS clusters could be set up at EU level.

Figure: Policy and legal measures for the development of the European SSBS industry



On the level of political and legal measures two fields of actions outreach the other. One of them is the support of R&D either by more funding or by tax incentives, which are both highly prioritized. While the increase of R&D funding on EU level is already implemented, there are some coordination actions that could be done in cooperation with the member states. The question of tax incentives is neither SSBS specific nor part of the regulative set of the EU. The other area is the harmonization of the internal market. Although this is already addressed on broad horizontal level with the single market strategy, there are some points that are not SSBS or SBIS specific, but of high relevance for their further development like the VAT regulations. Also highly prioritized is the support for SSBS SMEs, where specific measures for SSBS SME could complement the horizontal measures for SME. Less prioritized, but with more specific significance for especially SBIS are the establishing of SSBS clusters and the reduction of regulatory issues for SBIS. Somewhat surprising is the low level of IPR enforcement and public procurement, which both can have great significance. While in the case of IPR it may can be that the result is due to the wording, the low prioritization of public procurement is maybe owed to low knowledge on it.

6.3.5 CONCLUSIONS AND OUTLOOK

Concluding we can state that some of the prioritized barriers and measures are topics that are due to there non-specific character like SME promotion or single market are already addressed by horizontal policies. Furthermore these results for current and future barriers confirm to some extent the results from other studies (f. e. Europe Innova 2008). In some of the cases like interoperability, procurement or the lack of access to finance it is possible to use supplementing respectively complementing measures or instruments to encounter SSBS specific obstacles. But there are also several issues prioritized issues, especially for the future development, that directly deal with SSBS and SBIS specific problems. There specific measures and instruments are possible.

These results will be presented in a policy workshop where they will be discussed among policy experts. The first aim is to consolidate and enrich the results, i.e. to validate the determination of importance by the stakeholders and to add additional barriers and measures. The second aim is to discuss the results in the context of the existing framework of (industrial) policies within the EU to identify more barriers and measures that are specific for the European SSBS and especially SBIS industry. In the final step of this phase we will develop and apply a matrix approach based on methodology introduced and integrating the EU industrial and innovation policy framework (e. g. the ICT Task Force report and related activities) to select a list of operational and coherent policy instruments. They will be capable to improve the competitiveness of the SBBS industry and especially the upcoming segment of SBIS in the next years.

In the following final phase of the project the potential economic and social impact of these policy measures will be assessed accordingly to the impact assessment guidelines of the EU. The results of this assessment will lead to a set of concrete and coherent policy recommendations. This set can be the basis for the development of a European Software Strategy, which will enable the European SSBS and SBIS industry to foster new markets, but which is also fits into the existing framework of European innovation and industrial policies in form of lead markets or other action programs and plans.

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CHAPTER 7

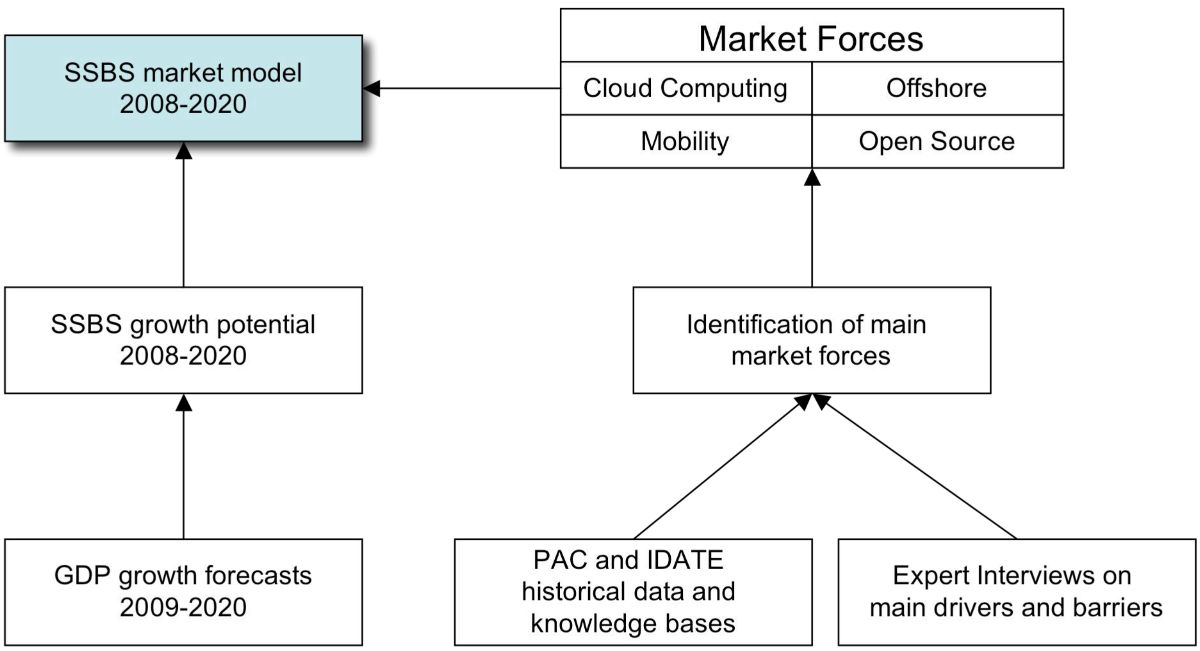
FORESIGHT 2020 - METHODOLOGY

In this section we present the SSBS market foresight of the 2013-2020 period. The work is based on the model presented in the D2 report for 2007-2012.

We focus on the evolution of the SSBS market over the next 10 years in terms of growth, and also on the relative development of emerging segments and their potential impact on the development of traditional segments.

The model will be used as a benchmark in part 4 of the study when we assess the impact of different policy actions.

7.1 METHODOLOGY AND MAIN ASSUMPTIONS



The SSBS market growth model (2013-2020) is constructed by taking into account three main aspects: the macro-economic outlook; the economic, social and political environment, as well as some market forces, whose evolution is still uncertain at present .

7.1.1 MACRO-ECONOMIC OUTLOOK

Historical data[31] in the US comparing the pace of the software investments growth against the economic development have revealed that, for the past 30 years, software investments have grown at a pace of about 1.5 to 2 times the growth of GDP; and during the last 10 years, software investments have grown at about 3 times as fast as real GDP. PAC historical data on the SSBS market for the EU27 region over the past 10 years also corroborate these findings.

As a result, we have taken as the basic assumption a potential growth for the 2013-2020 period for the SSBS software of +6,5% a year on average (this is 2,6 times faster than the economic GDP growth in volume32).

7.1.2 ECONOMIC, SOCIAL AND POLITICAL ENVIRONMENT

Our baseline scenario is built on the assumption that the economic, social and political environment will continue to evolve in the same way it has been evolving in recent years, and in particular:

- Stable economic growth during the analyzed period excluding any economic

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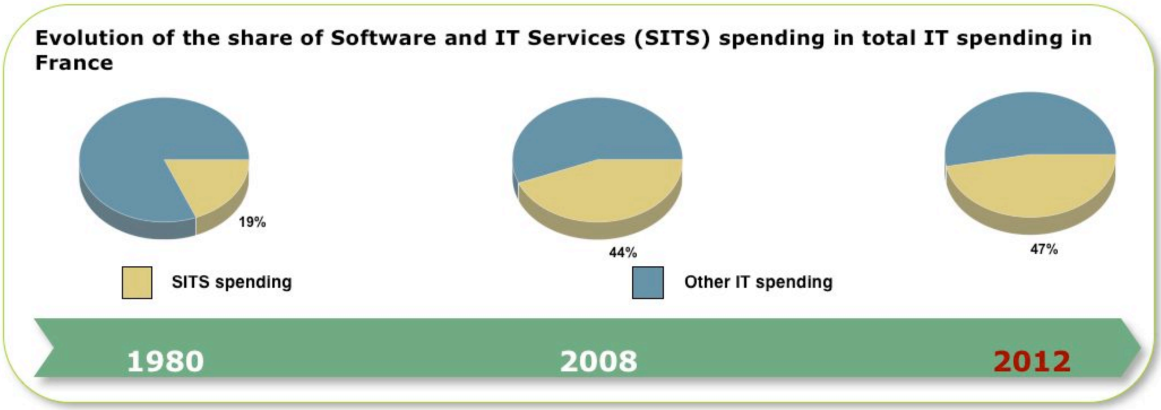
31 Bureau of Economic Analysis (www.bea.gov).

32 The GDP forecasts are developed based on the average of economic growth forecast by main economic institutes (OECD, IMF, and the EC). According to these organisations data GDP growth for the EU27 in constant currency should slowly recover in 2010 and 2011 and should stabilize in the range of 2.5% a year for 2012 and 2013, when the economy gets stabilized again. We assume here that the economic growth remains 2.5% for the 2013-2020 period (linearly projection on IMF 2012 and 2013 forecasts), which is a conservative assumption. For the 2010-2012 period, the economic growth scenario remains the same as the one presented in the D2 report.

cycles.

- Acceleration of the knowledge-based economy in the EU27: knowledge-based services and industries gain ground against more traditional industries at similar development rates compared to those experienced in the last decade.
- ICT continues to play a key role in the development of the European economy, although the rate of innovation in ICT remains similar to the one witnessed in recent years. For instance, our model does not embed the development of the Future Internet and potential related European programmes.
- Slight shortage of ICT practitioner skills. While ICT skills shortages are not a major issue in times of crisis, we expect this theme to reappear once the growth phase is resumed in the next couple of years.
- Moderate attractiveness of IT careers: image of ICT careers are moderately secure and levels of remuneration fairly competitive compared to other sectors.
- Constant currency exchange rates (2008 basis)
- Unemployment rates will remain high in the first years of the recovery and should gradually come down as the economy is back on historical development tracks.
- Fragmentation of EU27 market
- Lack of standardisation and interoperability
- Lack of knowledge transfer
- Moderate R&D funding
- The share of software and IT services spending continues to increase in the total IT spending of companies and public administrations as shown in the following charts:



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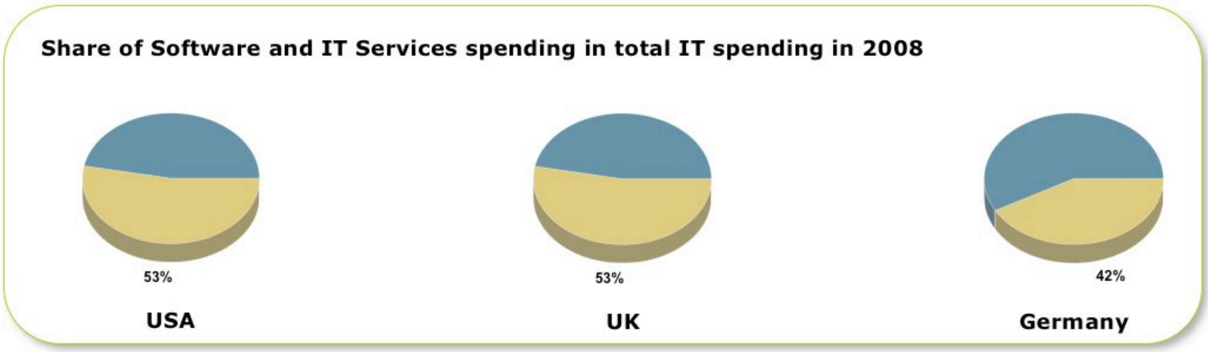

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7.1.3 INTERACTIONS FROM PROMINANT MARKET FORCES

Five market forces have been identified as potential important drivers in the evolution of the market structure and the structure of the SSBS industry in the next 10 years: open source software, virtualization, mobility, cloud computing and offshore. In the baseline scenario we use growth models for these markets with average growth rates 3 to 5 times higher than the growth rates of the overall SSBS market over the 2008-2020 period. These assumptions are based on both PAC's research methodology and models as well as on going interaction with leading industry players that have validated these assumptions, in particular during the interview process.

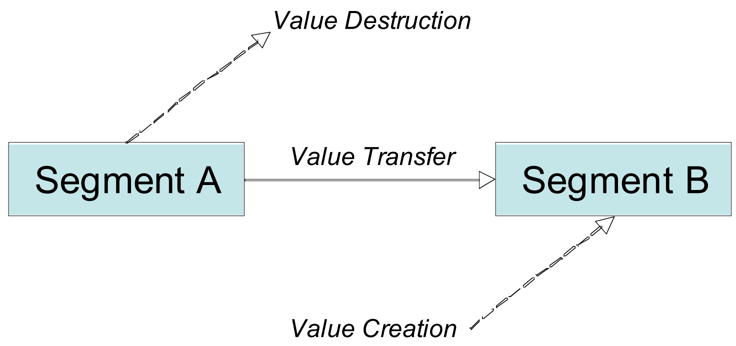
- **Open Source Software** – This force changes the way software is produced: through communities rather than via a single company. OSS models offer viable alternatives to traditional software products. As such its development have strong impacts on the cost of software to end-user companies. It is also playing an important role in the customization of information systems enabling services providers to better address their customers' needs with value added solutions.

- **Virtualization** – This force changes the way IT infrastructure is consumed and will dramatically reduce the cost of IT operations. Virtuallization is also a key enabler of the Software-Based Internet Services (SBIS).
- **Mobility** – This force changes the way Software is used. With more than 3 billion active devices, it represents more and more a new way to access the Internet in general and software in particular. With the mobile Internet and associated software marketplaces, there are countless new opportunities for the software industry.
- **Cloud computing** – This force changes the way IT resources are built and used and consumed. One of the most disruptive trends in the SSBS industry.
- **Offshore** – this force changes the way Software is produced. For IT resources cost and availability reasons, offshore models will have a major impact on the localization of the production forces of software products and services.

The consortium has analyzed these forces from an industry point of view trying to assess the impact each force might have from a technology provider point of view in terms of value transfer from one market segment to another as well as in terms of value creation and value destruction in particular market segments.

This process has been essentially helpful in understanding the complex relationships in between traditional SSBS segments (Licences and IT Services) and the SBIS segments.

It is important to note that from a end-user / customer point of view, consequences are much different. Talking for instance about "Value Destruction" due to price erosion in a particular segment might be a challenge from a provider standpoint, whereas customers benefit from decreasing prices. This in turn can also have a positive effect on the overall market due to a positive elasticity phenomenon observed in the IT industry (cf. p112).



Value transfer (VT): part of the market value is transferred from one segment (traditional) to an adjacent one. This is the case of transfer for instance, from an industry point of view, between the License & Maintenance segment and the Paid Web Based (PWB) segment. From a demand point of view, it means that cloud computing end-users do not pay the software they use in terms of licenses but in terms of outsourcing services.

Value destruction (VD): in the SSBS domain, this is mainly related to pricing disinflation effects. For instance, open source and offshore are important factors of this evolution in the SSBS market. Pricing effects can be direct or indirect in nature:

- Direct impact: the factor replaces a product or service by a new product or service with a lower price tag
- Indirect impact: the development of the disinflation factor is a new competition factor and as such, puts additional pressure on existing prices in the traditional segments. For instance, the development of offshore activities put pressure on onshore prices as well.

Value creation (VC): In the SSBS domain, this effect is related to additional spending coming from new usages: it widens the existing market. For instance cloud computing is conceived as a model that allows end-user SMEs to remove some of the barriers to software technologies.

7.1.4 IMPACTS OF PROMINENT MARKET FORCES

In this moment of change, it is especially relevant to understand the evolution in the current market structure and how prominent market forces will evolve and contribute to re-shaping the products and models under which software is being provided.

We have qualified and quantified such impacts by using PAC's data gathered from providers, information from discussions with large end-users as well as analysis of spending intents from large-scale surveys. Our assessment is also based on PAC and IDATE research and knowledge, and on the evaluation, by the consortium, of 60 interviews conducted with experts to validate the extrapolation of trends. These forces are behind the main assumptions made while building the market model for the 2020 SSBS baseline scenario.

7.1.4.1 Open Source (OSS)

OSS has a negative impact on license costs in general and on commoditized software in particular. It also transfers value from the traditional software segment (License + maintenance) to the associated IT services segment, but this transfer is far from being complete. Ultimately it enables end-users to better allocate their financial resources to the more strategic IT investments. It also creates value by giving access to certain technologies to companies that could not previously afford such technologies.

Main Assumptions

Market force	Impacted Segment	VC	VD	VT	Description
Open Source	License & Maintenance		X		Direct – End-users do not pay for the License to use the software. Maintenance tasks previously handled by independent software vendors are now handled by IT Services firms but remain in the software product segment. Maintenance costs can be somewhat higher than the traditional model costs.
Open Source	License & Maintenance		X		Indirect – Additional price pressure on proprietary software products (licenses prices) from increased competition.
Open Source	Software products (maintenance) and IT Services	X		X (minor)	Widen market perimeter to new user categories: OSS technologies lower the barriers to access software technologies (Community R&D, SME clients). The development of OSS also means more integration services provided by IT services providers. Some (minor) value transfer from License & Maintenance to IT services.
Open Source	Paid Web Based	X			An important techno-enabler of some cloud computing services, OSS does not have any major direct impact on the cloud computing market value. It enables the value creation process proposed by the cloud models.
Open Source	Advertising	X (minor)			More applications being made available for free to end-users allow to rely at least partly on advertising as a complement of revenues. Impact remains minor, as open source is still mostly about B2B applications.

Main impacts

The combination of these assumptions leads to a mostly negative impact on the License & Maintenance segment:

- **Systems Infrastructure Software** (SIS): this is the mostly impacted segment with a -2% effect on the CAGR for the 2013-2020 period. Sub-segments of the SIS segments that are mostly impacted include: operating systems, virtualisation, storage and security.
- **Tools**: -1,5% effect on the CAGR for the 2013-2020 period. Sub-segments that are mostly impacted include: development tools, collaboration tools, enterprise content management and databases.
- **Application software products**: the least impacted segment with -1% effect on the CAGR for the 2013-2020 period. Sub-segments that are mostly impacted include: office automation software, as well as a number of business applications (mostly horizontal such as ERP or CRM) and technical applications.

7.1.4.2 Offshore

Offshore delivery models have both direct and indirect negative impacts on costs of IT Services. Cost reduction is the main driver behind offshore sourcing initiatives, but clients need to be aware of the ‘hidden’’ costs. There is also a risk that the labour arbitrage advantages that the client expects from an offshore sourcing engagement may dissipate over time. The labour market has become highly competitive in mature Indian sourcing locations such as Mumbai and Bangalore, which has led to salary inflation that is expected to reach 10.8% in 2009 (source: ICA Survey, April 2009).

Main Assumptions

Market force	Impacted Segment	VC	VD	VT	Description
Offshore	IT Services		X		Direct – labour arbitrage advantages due to lower wages in offshore countries, where the work is performed. These advantages tend to dissipate over time.
Offshore	IT Services		X		Indirect - the development of offshore delivery models also impacts (although to a much lesser extent) the rates of onshore competences (increased competition)
Offshore	IT Services	X (minor)		X (minor)	To some extent, offshore enables to lower the cost of producing software and as such, lowers the barriers to access software technologies – this effect is much weaker than the negative price effects though. There is also some (limited) value creation in the consulting / project management area since such projects usually require increased governance. Some limited value transfer from License & Maintenance to IT Services such as custom development can sometimes be less expensive than package implementation.
Offshore	Paid Web Based				No major direct impact expected. Pricing of PWB services is linked to the value of the proposed service and not to the cost of software development.
Offshore	Advertising				No major impact expected (mainly for B2B solutions on which advertising is very low)

Main impacts

Project services (consulting and systems integration) as well as outsourcing (application outsourcing, infrastructure outsourcing and application maintenance) are the segments that are impacted by the development of offshore models. PAC has developed an offshore model that takes into account:

- Labour cost differences between EU countries and offshore countries (onshore / offshore ratios going from 1.5 to more than 3, depending on the country of origin and the country of destination)
- Additional overhead costs needed to launch such projects (10-30% of the project cost)
- Productivity losses
- All these elements vary over the 2013-2020 period, especially in terms of salaries : the study team has made the assumption that salaries in offshore locations will be growing twice as fast as onshore salaries.
- Offshore cap: not all IT Services tasks can be offshored in the end: services for SMEs and midmarket companies, public sector, high-end consulting, critical and complex information systems… The study team made the assumption for the baseline scenario that a maximum 25% of core IT Services (project services and outsourcing combined) could be offshored by 2020.

As a result, the estimated impact in terms of growth over the 2013-2020 period is the following:

- **Outsourcing** : this is the mostly impacted segment with a -2,1% effect on the CAGR for the 2013-2020 period. Sub-segments of the outsourcing segments that are mostly impacted include: application management and application outsourcing. Infrastructure outsourcing is impacted to some extent in terms of remote services.

- **Project Services** (PS): less impacted segment with -1.7% effect on the CAGR for the 2013-2020 period. Sub-segments that are mostly impacted include: application related system integration, scientific, technical, embedded and industrial (STIE) related IT Services and to a limited extent, consulting.

7.1.4.3 Virtualization

Virtualisation permits hardware consolidation and hardware independence. Virtualisation will dramatically reduce the cost of IT operations, but will also require exceptional levels of standardisation, specialisation and automation across these traditional administrative functions. It is also a key enabler of cloud computing services.

Main Assumptions

Market force	Impacted Segment	VC	VD	VT	Description
Virtualisation	IT Hardware		X		Direct – Virtualisation technologies will have a strong impact on the number of servers sold, as companies consolidate the number of servers they use, aiming also at increasing the utilisation rate per server. Desktop virtualisation should not have major disruptions on the volume of machines sold, but on the value of these machines (strong development of "thin client" desktops).
Virtualisation	License & Maintenance (SIS) and Hardware Maintenance		X		Direct – value destruction in the operating system segment correlated to the volume destruction in the HW/server segment and the fact that OS software will not be as developed on thin clients as on traditional PCs. Hardware Maintenance segment also impacted.

Market force	Impacted Segment	VC	VD	VT	Description
Virtualisation	Hardware, Hardware Maintenance, License & Maintenance (SIS)		X		Indirect – price pressure on OS software products, hardware maintenance services as well as hardware equipments.
Virtualisation	Licence & Maintenance (SIS)			X	Some value transfer in the Network management system (from the Operating System sub-segment), as virtualised infrastructure are more complex to manage.
Virtualisation	IT Services				No major impact expected. Loss in value from decreased SIS implementations is offset by increased implementation and integration needs in the virtualisation and network management domains.
Virtualisation	Paid Web Based	X			Virtualisation is one of the key techno-enablers of the cloud computing models. As such it enables the value creation proposed by cloud models.

Main impacts

The combination of these impacts lead to a relatively small negative impact on the System infrastructure Software (License & Maintenance) segment as well as Hardware maintenance segments of the SSBS market:

- **Systems Infrastructure Software** (SIS): this is the least impacted segment with a -0,5% effect on the CAGR for the 2013-2020 period. Sub-segments of the SIS segments that are mostly impacted include operating systems, storage, input/output management and security.

- **Hardware Maintenance**: with a -0,8% effect on the CAGR for the 2013-2020 period this segment is the mostly hit by the virtualisation effect (along IT hardware).

7.1.4.4 Mobility

Mobility is a key segment of SSBS that still has some potential for additional growth, beyond the baseline scenario. The development of mobile applications will most likely come as an extension of desktop with a few mobile-only applications rather than as a replacement of desktop applications. Mobility is indeed a growth scenario with limited potential cannibalisation but rather complementarities with desktop applications.

Main Assumptions

Market force	Impacted Segment	VC	VD	VT	Description
Mobility	License & Maintenance	X		X (minor)	More and more mobile applications tend to be available either by download or within the mobile cloud, instead of traditional licenses. In addition, many mobile software applications come from bundles with desktop-based software as an extension, taking a part of the value of desktop applications. This remains minor issue, as a big part of mobile software comes from consumers. Mobile software does not replace desktop software (at least in the 2009-2020 period), but is rather an extension of desktop computing. Mobile and desktop rely both on shared systems and tools (cloud-style or not).
Mobility	IT Services	X		X (minor)	Additional IT integration is necessary to handle the mobile devices that can also connect to the legacy IT systems or to application platforms. This may be bundled with IT services of desktop applications.

Market force	Impacted Segment	VC	VD	VT	Description
Mobility	Advertising	X		X (minor)	Mobile handsets offer additional inventory and occasions for advertising. Some of the revenues may come from transfer or bundles (including discounts for cross-platform campaigns) with online desktop advertising, but the impact is low and there is still overall some value creation for advertising in general.
Mobility	License & Maintenance		X (minor)		Embedded applications have less and less value, as embedded software stack is becoming commoditized and applications are more and more used from download or cloud. That market was small anyway.
Mobility	Paid Web Based			X	More and more mobile applications tend to be available either by download or within the mobile cloud, instead of traditional licenses. Thisshare remains minor, as a big part of the mobile software comes from consumers.

Main impacts

The combination of these impacts leads to a slight negative impact on the System infrastructure Software (License & Maintenance) segment as a small part of the PCs – which currently run mainly on proprietary platforms – are replaced by mobile devices, which should mainly run on Open Source Platforms (Symbian, Android, Chrome OS…). Additional value creation **(positive impact)** is expected on most SSBS segments.

7.1.4.5 Cloud Computing

Cloud Computing is a game changer, like industrialisation, which wipes out most of craftsmanship. It emphasizes Schumpeter's theory of creative destruction. PAC expects that outsourcing will have a big chunk of its activities moving to Cloud Computing, as the concepts enables dramatic cost reductions through the optimisation, consolidation and virtualisation of the IT infrastructure, an important element of IT outsourcing services.

Cloud computing will revolutionise the way applications are developed (through Platform-as-a-Service or PaaS models), with tools such as Force.com, enabling enterprises to develop applications more easily and with less resources (human resources as well as infrastructure and software resources) and with flexible business models.

Cloud computing will also dramatically change the storage and hosting services space, as it offers such capacities for a very low price tag compared to dedicated offerings. Amazon's EC2 is rapidly becoming one on the main worldwide IT storage "facilities". Being an outsourcing-like model, its development pattern will likely follow the one of outsourcing: the model will soon encompass higher added value processes (application outsourcing, business process outsourcing…). And similarly to outsourcing, it will meet its limits in the value it gives to the client, depending on the criticality of the systems and the business processes' nature. Enterprise grade Cloud computing will generate some high level consulting and IT services to build private and public cloud Computing centers, to assess what to put in the cloud, to evaluate security…

The study team has implemented the following assumptions in its market model:.

Main Assumptions

Market force	Impacted Segment	VC	VD	VT	Description
Cloud Computing	IT Services	X			New usages, lowering the barriers to accessing software technologies (SME clients) => new revenue stream in the outsourcing segment. Most cloud models will be made functional in their "private" form, at least until 2015. This will represent an important growth opportunity for IT Services companies building these private clouds for their clients.
Cloud Computing	IT Services		X	X	PaaS (Platform as a service) enables new, more efficient development models leading to a dramatic cost reduction in terms of application development and maintenance.
Cloud Computing	License & Maintenance			X	The cloud model will dramatically change the structure of the market: from License & Maintenance (applications, tools, system infrastructure software) to Outsourcing Services (SaaS, PaaS, IaaS) included in the Paid Web Based SSBS segment.
Cloud Computing	HW, Software and IT Services		X		Cloud models are part of the industrialisation of the SSBS industry. Less ITS requires from software, hardware product implementation to Cloud customisation and integration - Consolidation/optimisation SIS/Tools, due to the "1 to many" model.
Cloud Computing	IT Services (infrastructure)		X	X	It ranges from traditional hosting services to IaaS services. Deflationary impact coming from economies of scale proposed by the IaaS model. Some value creation for infrastructure related IT services.

Market force	Impacted Segment	VC	VD	VT	Description
Cloud Computing	IT Services (applications)		X	X	Application management tasks working on traditional application software (packaged and custom) are handled by the cloud provider.
Cloud Computing	Advertising	X		X	Additional applications and services available online means more inventory that can be monetized through display, search or new forms of advertising. Some of the value should come from offline advertising transfer. Applications for SMEs will most likely be ad-funded or low-cost.

Main impacts

The cloud computing market force is by far the strongest force in terms of impact spread (most SSBS segments are impacted) and importance compared to the other identified market forces:

- **Application Software Products, Tools and Systems Infrastructure Software (SIS):** -1,6%; -2,2%, and -3,6% effects, respectively, on the CAGR for the 2013-2020 period that are due mostly to value transfers as well as price pressure effects brought in by mutualisation effects of cloud computing models.
- **Hardware Maintenance, Project Services, Outsourcing services**: : -2,1%, -0,8%, -0,2% effects respectively on the CAGR for the 2013-2020 period that are mostly due to mutualisation and optimisation effects as well as price pressure brought in by cloud computing models.

7.1.4.6 *Summary of impacts*

The following table summarizes the impacts in terms of compound annual growth over the 2013-2020 period of 5 identified market forces on the 2 traditional SSBS segments (Licence & Maintenance and Associated IT Services) and their 6 sub-segments on the SSBS potential growth model.

Market Forces' impact on 2013-2020 CAGR (%)						
SSBS Segment	**SSBS Sub-Segment**	**Offshore**	**Open Source**	**Virtualization**	**Mobility**	**Cloud Computing**
License & Maintenance	Application Software Products		-1,1%			-1,6%
	Tools		-2,1%			-2,2%
	SIS		-1,6%	-0,6%	Slight negative effect	-3,6%
Associated IT Services	Hardware Maintenance			-0,8%		-2,1%
	Project Services	-1,7%				-0,8%
	Outsourcing	-2,2%				-0,2%