SEVENTH FRAMEWORK PROGRAMME

Networked Media

Specific Targeted Research Project

SMART

(FP7-287583)

Search engine for MultimediA environment generated contenT

D7.5 Exploitation Activities and plans

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Summary of the document

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Abstract:	*This document contains the first version exploitation plan. It runs through the approach taken, the market context, the progress made so far and the future plans.*
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1 Executive Summary

1.1 Scope

This deliverable describes the activities and plans of the consortium during the first project period in relation to exploitation. The consortium has analysed the situation and context of the project. Plans have been developed to direct activities throughout the remainder of the project and the partners have converged on several key ideas. Naturally at this stage of the project, there are many open options and the project will be analysing each of these in further detail at the next period.

1.2 Audience

This deliverable is of interest to various stakeholders of the project: individuals in partner organisations not active in the day to day running of the project, but with an interest in the value the project will create for them; project backers, including the European Commission and finance departments of partners who wish to see how a return on the investment will be made; potential users of the system, whether on the search side (end users), input side (sensor owners) or third party developers who will use SMART, who wish to know how they might interact with the project and influence business decisions at this point; and finally programme participants who may wish to share best practice in exploitation activities.

1.3 Summary

This document presents the strategic approach SMART will take towards exploitation. This is based on three inputs: market context; technological innovations and limitations; and partner interests. These are combined to drive two pathways towards exploitation. Pathway one is focussed on the near-term interests of the partners and will seek to found a joint sustainable exploitation vehicle through which the results are made sustainable in their own right and upon which the partners, individually or together, can carry out exploitation of current opportunities. Pathway two takes a longer term view and seeks to maximise the value of the project to the partners and community at large by seeking the optimal model for deployment. This will drive the project complementing the technical team. The rationale, progress and next steps of each is presented, along with a market analysis.

1.4 Structure

The deliverable is structured into four sections: the exploitation strategy; the market analysis; the contents and progress of pathway 1; and the contents and progress of pathway 2. These are accompanied by an introduction, conclusion and references sections.

2 Introduction

This document is the first iteration of the exploitation plan for SMART. The document discusses the approach taken, describes the market around the key innovations and charts progress and plans towards exploitation.

The project's exploitation strategy defines two pathways: Pathway one, a near-term approach focussing on maximising partner's exploitation of existing opportunities and ensuring result sustainability within the project timeframe; and Pathway two, building an optimal commercial SMART designed for the mass market and creating opportunities for partners.

The document is the first in the series of deliverables. Future exploitation plans will not be an update of this document but fresh documents. They will chart progress made in each of the two pathways we define. The next deliverable will include discussion of analysis carried out, updated market analyses, reporting of actions taken and increasingly detailed plans for the consortium. Both individual and joint exploitation plans will be present in subsequent versions.

A full business plan will be provided for the SMART sustainability near term objective in M24, along with partner's plans to build exploitation on top of it. This should be initiated within the final period (pathway one). For pathway two, an optimal business model for SMART will be presented the M24 and this will be developed into a business plan for initiation at M36. The analysis made during pathway two will drive the innovation towards a market solution.

The document is structured as follows:

- Section 3 presents the strategy and rationale for exploitation.
- Section 4 presents a short market analysis focussed only on the areas of innovation of SMART.
- Section 5 presents pathway one: the objective, rationale, approach, progress and next steps.
- Section 6 presents pathway two in a similar fashion and includes a summary of the consortium's lengthy analysis and discussion on the business models apt for SMART.
- Section 7 concludes the document.

3 The Exploitation Strategy

The exploitation outcomes of the SMART project and partners are based on three inputs: the market context; the project capabilities and constraints; and the individual partner's interests and opportunities.

The market context is relevant because it helps project participants identify and evaluate opportunities for their exploitation, puts the project in context with respect to other initiatives (commercial or research) and will help the project guide towards a strong market position vis-à-vis potential competitors and substitutes. Nonetheless, the project will refrain from a lengthy and generic market analysis: awareness of the state of art is implicit in the project objectives and the analysis provided in the description of work will naturally be updated through each of the research activities. Likewise analysis of the general economic climate and recession is also widely known and available. Hence it is not necessary to repeat this information here. Instead the market analysis will concentrate on the specific areas of opportunity for SMART exploitation. The market analysis will evolve through time, both as the market in general develops and as the project identifies clear areas for exploitation. Resources will be reserved for this.

The project's capabilities and constraints clearly have an impact on the exploitation of the project. The performance, capabilities and limitations of the technology dictate what can and can't be done, and the innovation of the components provides the uniqueness which will give the project results potential in a commercial environment. Also included in this input are the limitations of the licensing decisions taken by the project and the ability of the partners to form commercial endeavors after the project end.

Finally, the individual partner's opportunities and interests must drive exploitation, for however appealing a SMART business case might sound on paper, if this does not fall within the broad strategy of the project members, it will be impossible to secure management buy-in and investment. However, in the course of defining the exploitation we do not want to be limited to immediate opportunities but also to explore the potential for more collaborative exploitation. This latter exploitation will be explored communally but must still reflect each partner's position. Consequently the strategy for individual partners is driven by the near-term goals of those partners and the broader term project vision shaped by the partner's long term strategies. This long-term vision is equally important as the near-term vision for guiding the project towards maximum value and impact creation.

In light of this last paragraph we have decided to split exploitation into two paths. The first path seeks to enable each partner, individually or in collaboration with other partners, to take the project results and exploit them to their own ends. The second path seeks to define a longer-term vision for SMART which partners can shape as they see fit. These should not be seen, to use the common project terminology, as *individual* and *joint* exploitation, respectively. Rather both are joint exploitation and the difference stems from the perspective: bottom-up or top-down.

This approach is shown below:

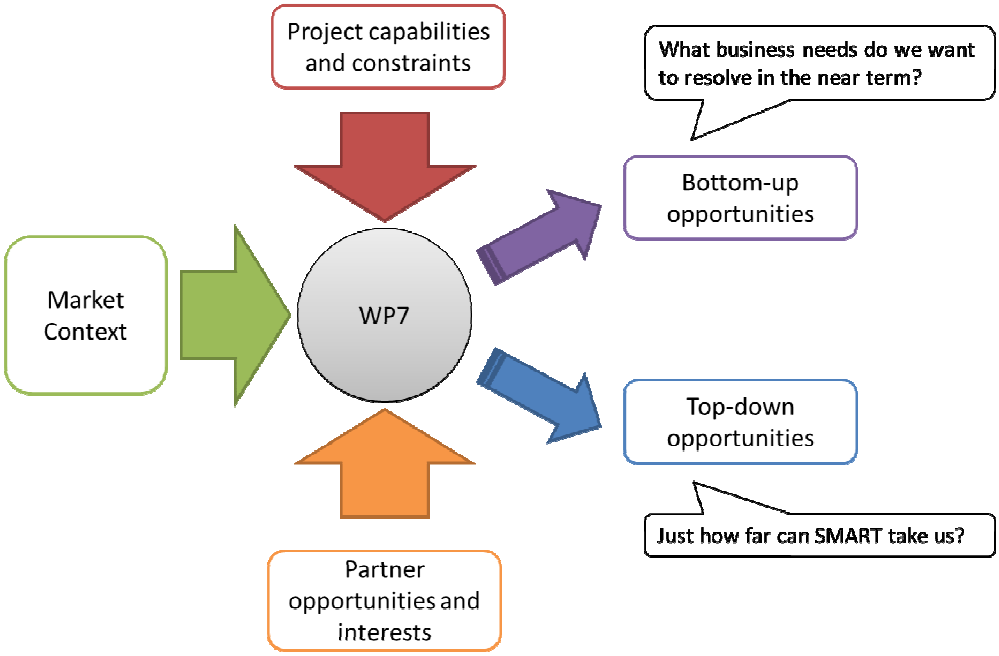


Figure 1: The broad exploitation strategy in SMART

The bottom-up approach

As the bottom-up approach is based firmly on the near-term expectations of the project, the first step towards developing this pathway was to request information from each partner. This was done in the form of a questionnaire. The ensuing answers and the subsequent discussion showed a strong preference for diverse members of the project to have access to a large set of the project's global results.

In some cases, the partners wished to use the technology internally, for enhancing existing business solutions. In other cases partners pinpointed clients to whom they could potentially make an interesting proposal to extend current business. Other partners were more interested in forming part of the value chain upstream (i.e. prior to) the SMART search and retrieval system, for example through providing sensor data or working as consultants and integrators between sensor 'owners' and SMART: for example in one case, a partner envisaged selling a solution to a client which would consist of the client purchasing sensors and using SMART to access them. In this scenario the partner in question wished to treat both the sensors and SMART as off-the-shelf tools, creating value in the design and application of the combined elements (where to place sensors, integration with existing solutions, training on the system, etc.). This in turn implies other consortium partners are offering the SMART core as an off-the-shelf solution to them.

The bottom up opportunities tended also to focus on niche scenarios: journalism, municipal services, event security, advanced farming, etc. The concept was that a core and common SMART system would be built upon and adapted by partners (and potentially also third parties) into bespoke solutions for specific needs.

In the course of the group discussion on this sustainability pathway, it was appreciated that the existing open source approach of the project lent well to this concept. If a common SMART core can be made sustainable and available to all, the individual exploitation opportunities of all the partners can be fulfilled (some active as core providers, others as peripheral providers, and yet more working in other areas of the value chain.

This pathway is depicted below. It shows different companies applying a specific solution based on a SMART core, each taking into account a (different) set of sensors and integrating the solution with a client or sector-specific IT system.

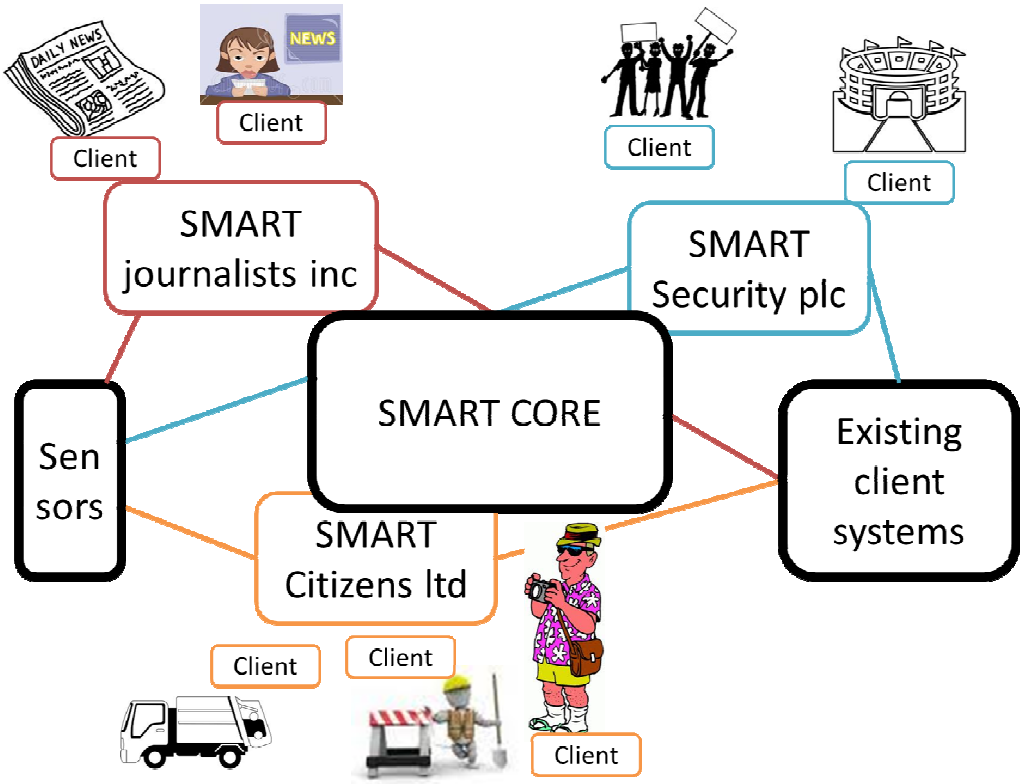


Figure 2: The bottom up approach in practice.

Within this pathway, as commented above, different partners can be active at different points, in the sensor provision or integration, in the core, in the satellite companies or as a client.

The top down approach

The top-down approach is based on taking the global vision of the project and attempting to posture how it could be provided commercially. Encouragingly, all the partners responded in the questionnaires that they believed that (a) SMART had the potential to be a commercial system, and interestingly many also believed that (b) whilst the niche applications were closer to home and to the present, in a longer term vision, the SMART system could be used by the general public. WP7 takes the first statement as a mandate to investigate the long term, broad potential of the system, and the second statement as an ideal to which to strive.

In this pathway we will lay aside for the time-being the constraints of the partners or the initial licensing plan, and first consider the business models through which SMART could maximize its impact, ideally as a commercial, public use search engine. This pathway is more theoretical and much more ambitious than the bottom-up path, but as it matures we will then need to factor back in the partner interests, licensing decisions and other practicalities which may further shape the pathway.

The two approaches and the steps that will be taken are shown graphically below. They will be discussed later in further detail:

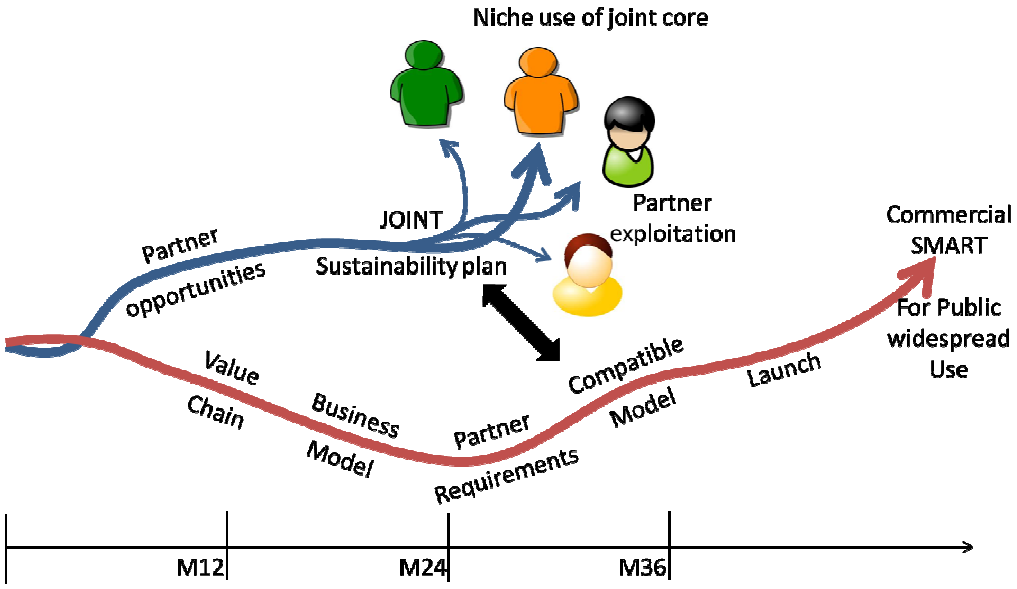


Figure 3: The two pathways.

In Figure 3, above, the blue line shows the bottom up approach focuses on partner opportunities and how together the consortium can enable each partner's exploitation (utilitarian approach), whilst the red line indicates the top-down pathway passing through various modelling aspects (technocrat approach). The two paths must be linked in that the long term vision must build upon the near term vision to some extent, although clearly compromises will be needed.

4 Market Analysis

As stated above in the strategy, SMART does not intend to repeat the work done in other work packages, by describing in detail the state of the art of each of the project fields (naturally each WP is aware of this), nor does it intend to add to the mass of widely available and constantly updated reports on the global economy or established technology markets. We consider this material to both be in general circulation and adequately described by the respective field experts. Instead we concentrate our resources on understanding the context specifically for the potential SMART product. This has been done by breaking down the SMART into the different areas of innovation or value propositions, as identified by the consortium, as this is areas where SMART has the potential to create a unique selling point, as well as the context around overall concept of SMART. At the present time, three main areas of commercial interest have been identified: Search in the Internet of Things (that is, existing search capability for smart objects); exploiting the combination of sensor and social networks data; and social network managers.

The analysis is structured as followed:

First for each of the three areas we look at the value proposition behind the innovation: what does it do and why is it important. Then we look at the supply side, looking at who is advancing on or providing this technology. This is done from the perspective of orienting the project rather than identifying competitors, but as this work progresses, this will become more relevant. Finally we look at the demand side: who is using or demanding this innovation and what propensity do they have to pay for it.

4.1 Search in Internet of Things (IoT)

The need of users addressed in SMART in relation to the IoT is localized search. Increasingly queries to Web search engines are becoming more local[1] and about current event. The key aim of SMART innovation is to allow the searching of real-world events, in real-time, using sensor data from the Internet of Things.

SMART aims to offer a clear architecture of how to search real-world events in real-time, using sensor data. In processing and retrieving sensor data in real-time from the IoT, SMART allows the *high-level* identification and searching for events, based on *low-level* sensor information. This value proposition also has transfer to more restricted domains, such as those addressing security where comprehension of real events and the real world assume a key role.

The Internet of Things is a growing aspect of the Internet. Indeed, there are expected to be 50 billion connected devices by the year 2020[2]. Even in Canada, the growth of the IoT is expected to be a C$400m market by 2015[3]. The growth of the Internet of Things, combined with the increasing locality of information services (facilitated by increasing local information, such as nearby tweets, localized restaurant listings etc.) provides ideal conditions for a growth in SMART application areas and user demand.

Looking at the supply side, local current events search is already addressed by search engines, through the introduction of listings, social media and news within their search results. For example, when a user searches for 'restaurants in Glasgow' in Google, restaurant listings are incorporated into the search results. Likewise, if a user searches for a breaking news event, social media or recent news may be included in the results. In these ways, web search engines such as Google and Bing are *substitutes*[4], in that they address local and current information needs using exclusively textual online data, such as social and news. In contrast, SMART introduces the sensor aspect, to allow it to directly identify events in the real world rather than their indirect effects on the virtual world.

[1] http://www.mobilemarketer.com/cms/news/search/9498.html
[2] http://www.ericsson.com/res/docs/whitepapers/wp-50-billions.pdf
[3] http://www.reuters.com/article/2012/06/04/canada-telecom-rogers-idUSL1E8H47RR20120604
[4] N.B. A *substitute* fulfills a user need served by SMART, but in a different way. A *competitor* fulfills the need in the same way.

However, as noted by VentureBeat.com[5], Google at least is certainly aware of the Internet of Things as a data source and represents a potential competitor. Google is made of many vertical solutions which represents, each one, a crawler. The core of Google compares and correlates information using AI algorithms (NB this is a simplification but represents how Google works).

SMART & co. should be seen not just as a current substitute and future competitor, but also as a potential partner or even owner: SMART could represent a future vertical solution for a search engine, providing data from the real world that could be correlated with existing data to enrich the engine comprehension of the world.

On the non-web scale front, we note the Cosm platform[6] which provides analytics of sensor data, that user/companies can connect their sensors to. While Cosm provides a search service, this only permits the identification of sensors from their database, rather than providing a higher-level recognition of understanding from the sensor values. Similar applies to the iobridge.com platform, which similarly to Cosm addresses all the low-level connectivity issues, however by itself will not offer any search facilities. Similar applies to https://www.thingspeak.com/ the platform which in addition to the functionality offered by low level data collection platforms, offers data processing (setting minimum and maximum value thresholds, for filtering data, time scaling, summing, averaging, and median).

Furthermore, there are already some existing vendors who provide vertical solutions to such problems e.g. Libelium[7] from Spain. At the same time various efforts for handling sensor management over Software as a Service (SaaS) models such as Cosm's pachube.com[8] give a descriptive indication on the future trends. However, as combined in the SMART project, there is currently no deployment that fulfills such a supply.

Precysetech[9] is of course within the competitive landscape of the SMART framework. They offer vertical products. They're strength is a well comprehensible offering made of services, support and technologies. It is a mature solution offering many of the SMART framework capabilities and the platform is already integrated with tens of different king of sensors.

On the demand side, local and current event information needs is experienced *en* masse by general public individuals, who likely resort to search engines and/or social networks at present for this need. There is a raft of potential scenarios where local search would be useful, municipal services, defense, politics, security, major events and so on. These are touched upon in other parts of the document. Currently none of these are analyzed in depth as to do so would be unnecessarily burdensome. In future iterations selected scenarios may be analyzed once a business model is developed.

However, as discussed later in this document, in SMART there are various different business models through which the technology could be deployed. The *client* (defined by "he who pays") could be different to the end user (defined as the end of the SMART value chain) and the client could be any of the different entities within the SMART stack. If we consider a global/regional SMART search engines, then the clients could be the sensor providers, i.e. cities, who want to have localized results for their citizens. Indeed, with the increase in perceived security risks in the last decade, many cities are becoming smarter (aka smart cities) in deploying sensor infrastructure for security reasons[10]. Repurposing this infrastructure for the benefit of its citizens is a primary aim of smart cities.

4.2 Social Networks and sensors

The paradigm of the Internet of Thing and the evolving new infrastructures within smart cities give a new dimension of sensing the physical context and smart sensing. Many small devices, either sensors or actuators, will be surrounding us the next years making it more important to define frameworks that will manage efficiently and exploit this information. SMART can provide a valuable contribution to this direction. It will define a scalable architecture for such large infrastructures and combine the physical

[5] http://venturebeat.com/2010/09/28/google-internet-human-augmentation/
[6] www.Cosm.com
[7] http://www.libelium.com/
[8] https://cosm.com/?pachube_redirect=true
[9] http://www.precysetech.com/
[10] SMART DoW, section B2.

sensing with social networks, here in the context of smart cities.

The value proposition for combining sensor data with social network data revolves around establishing context and providing concrete supporting data:

> Social networks are very good at providing context: who is involved; what is happening where; parallel considerations; building networks of people and initiatives; theories as to why it is happening and so on. However social networks offer little in terms of concrete data. Opinions are often semi-anonymous and subjective. Rumours (either true or false) can travel through the network but are unsubstantiated. Indeed it is the volume of 'data providers' which gives credibility to data taken from social networks: a kind of subconscious wisdom of the crowds ("*that many people can't be wrong*") is at play. Indeed even photographic 'evidence' must be taken with a pinch of salt in today's photoshopped world, and so it is when multiple independent witnesses report the same data that we concede its veracity – yet there are examples abound of both mass hysteria (multiple simultaneous reporting of an untruth) and urban myths (massively parallel reporting of untruths by word of mouth).
>
> Sensors on the other hand tend to the opposite. Excepting calibration errors, we can consider that sensor data is on the whole, true. If the thermometer in Barcelona reads 27℃ or the traffic camera in Paris shows a dense motorway junction, we can take this to be valid. However what sensors don't give is the context: why is that traffic flow at this junction collapsed? Why is the temperature high in an autumn month?
>
> The properties of the data are complementary: Sensor data can substantiate the social network information, helping users judge the reliability of the opinions voiced online. For example in public protests, the estimates of how many attended vary wildly between the protesters and those representing the alternative view. A trusted crowd sensor would resolve the issue and indeed shows variance over time.
>
> Likewise, context can give relevance to sensor data. This context can often be provided by social networks (for example perhaps an accident has cut off a main road, but bystanders are now tweeting about it). This is especially true given that people in Twitter share the contributing-to-the-community spirit, which drives them to offer processed useful conclusions with regard to an observed incident. This adds significant value to sensor data as users can use their own intellect to evaluate how the current circumstances will evolve: if the accident is very serious users can assume that traffic flow will not be restored in the short term. Conversely congestion caused by a mere shunt should be cleared up within an hour.

Thus if we can combine the two sources of data, the value of the information is increased significantly and we are fulfilling the need of users to access reliable and context-correlated information, improving decision making. A price or value on this cannot be accurately placed because clearly we are talking potentially of millions of isolated decisions, ranging from the trivial to government policy or financial investments, and the improvement is not something that can be quantified as outside of experimental conditions there is no way to compare how the decision made would differ without the system.

When looking at the supply side of this area, we can at present identify advances in this area.

Many companies, researchers and analysts are talking about "Big Data" and how to manage, and data mine the vast amount of structured and unstructured data coming from sensors (including RFID) and social media, among others. Big Data is a current theme as storage costs are no longer the major barrier. The major barrier is analyzing and processing it[11]. There is a significant level of research being conducted in this area. However much of this is not directly related to SMART as it is focused on data processing in general, rather than on making the sensor and social network data searchable. Additionally much is focused on corporation-specific solutions.

More concretely in the areas touched by SMART, we can identify certain initiatives showing how the market is developing in this area.

Currently devices can be set up to tweet. For example, Japan-based UC Technology Corp. has devel-

[11] See e.g. :
http://www.sas.com/big-data/
http://www.softwaremag.com/DSN/wwwswmagcom/Content/ClientAssets/SponsorIndex_VMware_WhitePaper2.pdf
http://www.oracle.com/us/solutions/business-analytics/endeca-overview-faq-1844591.pdf

oped a wireless sensor that can automatically post data like temperature, humidity, luminance, or radiation levels to Twitter[12], and this is becoming a trend for hobbyists[13]. Indeed Telesto and AIT are doing this in SMART. This means that the same platform can be used to access both types of data and increases the potential to exploit and search both data types together.

We can already see sensors being "socialized" in the sense that information is crowdsourced. Most prevalently this comes from GPS sensors located in smartphones. This development (termed as "Participatory Sensing") has been occurring over the last three or so years. Two older examples of this come from an MIT project called wikicity[14] and a commercial outfit called Citysense[15]. These mapped user position from GPS and detected trends. The latter based on showing where the most popular city centre nightlife points were. As pointed out back in 2009 by readwrite.com[16], the next step for these was to include social networking. Citysense started down this route, generating 'tribes' of people from behavioral patterns to better suggest nightlife hot spots. However, the company Citysense is now part of Sense Networks[17], a company consulting on mobile and location based advertising and it would appear that Citysense itself is no longer an active product.

Another active project in this area, although with a different slant is SportSense[18]. This uses "people as sensors" to monitor excitement levels during sporting fixtures. This is a research effort between Motorola and Rice University in the US. So far the research has analysed tweets to gauge important moments in NFL (National Football League) games, as well as the excitement generated. Although this is not the same as the concept of SMART, it can be seen as an example of how context from social media and sensor data (in this case people tweeting) can be combined to generate value.

There are many other examples of social media being used this way. Following the earthquake and Tsunami in Japan, March 2011, ESRI[19] quickly overlaid data captured from social media including Twitter, YouTube and Flickr, and trusted sensor data with map data to a generate an interactive map of the zone. This helped the understanding of what had happened and the impact that it was having in realtime.

Waze[20] is an example of an apparently successful company combining social media data and sensor data. Again the sensor is GPS, and here the social network is the Waze platform. The value proposition is a social navigation platform. The user, (more formally prosumer) consumes data compiled from others and provides data for others. The GPS devices allow traffic flow to be measured and consequently users are directed to the fastest route. Users can also add information to explain traffic jams (roadworks, accidents, etc-), amenities (e.g. cafes, restaurants, petrol stations, etc.) and data (prices, reviews, etc.).

We have examined the social network + sensor market for competitors and substitutes, we have not yet found any organization directly competing with the SMART concept of sensor and social media search. Looking at the developments on the horizon it is clear that technologically the combination of sensors and social networks is being done simultaneously in multiple projects. Many of these have interesting and valuable use cases, such a fighting forest fires or assisting rescuers, quantifying social data and advising users. However, few of these identified initiatives are commercial at present. The reason for this could in part be the novelty of the technology advances, and in part the business model. Regarding the business model there are issues in terms of costs and incentives for the different actors, as well as issues on the revenue side: propensity to pay, individual vs. collective value and so on. More analysis in the future is required by SMART to identify whether, in the field of social network and sensor data search, the market size, the user's propensity to pay and the cost of delivery are frequently dissuasive to commercial products and if so how SMART can address these issues.

In terms of demand for this innovation, we have seen that there is a strong value proposition for the theoretical marriage of data from sensors and social networks. We have seen a range of use cases

[12] http://techcrunch.com/2012/01/19/sensor-twitter/
[13] http://howto.wired.com/wiki/Make_Your_Gadgets_Twitter
[14] http://senseable.mit.edu/wikicity/
[15] https://www.sensenetworks.com/products/macrosense-technology-platform/citysense/
[16] http://readwrite.com/2009/04/08/when_sensors_and_social_networks_mix
[17] https://www.sensenetworks.com/
[18] http://www.sciencedaily.com/releases/2011/10/111004121251.htm
[19] https://dev.twitter.com/case-studies/esri-enriches-maps-tweets-and-streaming-api
[20] http://es.waze.com/

where value has been created. However we have not seen any concrete information which would allow us to assess the mass market for it. Specific use cases are limitless in theory and so far no 'killer app' has emerged we can use as a model. When SMART is ready to propose exploitation in specific areas, these will be examined in depth.

4.3 Social Network management

Another key area of innovation in SMART is the Social Network Manager (SNM). This is covering an important aspect of the so called *social sensing* in the era of the new media. This need comes from the rapid explosion of the social media and social networks, and their deployment in the everyday life of the users. It becomes apparent that whenever information needs to be extracted from such social media, different tools are needed, because the interfaces and information structure of these media vary significantly. The SNM in SMART will be responsible for allowing a simplified uniformly-structured interface and management capabilities for interacting with these social media and make use of their valuable information.

In terms of supply of SNMs, there are already some existing solutions by various vendors in the area of social media monitoring and analysis (e.g. Sysomos[21], uberVU[22], etc). Additionally, as it is a hot research topic various universities across globe (interestingly mainly overseas) are pursuing significant research on this topic. A unique selling point of SMART, however, is a social network manager that can be integrated with physical sensing and provide a rich set of services to the end users, by combining both environmental sensing and social sensing, hence performing the value proposition discussed above under section 4.2.

In terms of demand, a broad range of possible SNM users/customers can be found in the market. These include, but are not limited to; reputation management and public relations industry, media & broadcasting, government, security & defense, public administration, smart cities etc. The demand and the applicability of solutions such as SNM will be constantly increasing the next years. Again we find it difficult to generalise outside of specific use cases, and this will be followed up on in the future work.

[21] http://www.sysomos.com/
[22] http://www.ubervu.com/

5 Pathway one: Bottom up

5.1 SMART objective

The objective of the SMART consortium is to establish a sustainable 'SMART core' of technologies, software and knowledge around which partners, and potentially third parties, can build an offering.

5.2 Rationale

The rationale is that this will give the partners the means to follow near-term exploitation interests, including: commercial services, non-commercial developments; internal use; education; and further research. These different exploitation routes have already been identified by the consortium partners.

5.3 Steps to be taken

In order to establish a sustainable "core" the following steps are identified:

1. Partner interests on using the core (what and what for?)
2. Definition of what technology constitutes the core.
3. Terms and conditions for using the core (licensing of the IPR, availability, access to third parties)
4. Definition of the provisioning model (how will the core technology be made available)
5. Understanding of any costs incurred in the provision of the technologies.
6. Business model to permit sustainability, or profit.
7. Governance model to manage the core.

There are many different visions of the provisioning of the solution, and each forms part of a continuum. At the most basic level we could imagine that the partners simply circulate to each other a copy of all software and documentation from the project with a license permitting the use foreseen in the exploitation cases. In this case there would be no provisioning cost, and no business model. A slightly less basic scenario would see a web portal being maintained through which people could download the software and interact with other users. This would have some very modest costs associated which could be assumed by the partners. However, such a hub could also become a site used to promote SMART applications and could become a useful site for partners and third parties to advertise SMART solutions. A potential service could be requests for information (RFIs). Organisations working on furthering the core could potentially conduct business through this (private releases, consultancy, training, etc.) and a support forum could be hosted. If this level of business is being generated then the SMART 'hub' becomes a critical part of the value chain and ecosystem and requires costly and professional management and advertising. As can be seen, as the continuum progresses we can see ´that the complexity and costs increase and so to the need for a solid governance and business model to support it.

5.4 Current progress, content and time plan

At the current stage of the project it is still premature to make significant definition of pathway one. The technology is still under design and construction and it is not realistic for partners to make firm decisions on the manner in which they intend to use the software. Consequently in this period of the exploitation activities we have made a broad pass of the first three steps. In the second project period we will revisit these three steps and then make a first pass of the next four steps. During the final period we will re-examine each of the steps to make a definitive commitment to the joint sustainability, ending with the launch of the core sustainability. Accompanying this will be the individual exploitation plans. These are omitted from this version of the deliverable, pending development of the technology and initial results. In the second and third exploitation plans, the individual exploitation plans will be described, building on the joint sustainability. This is shown below.

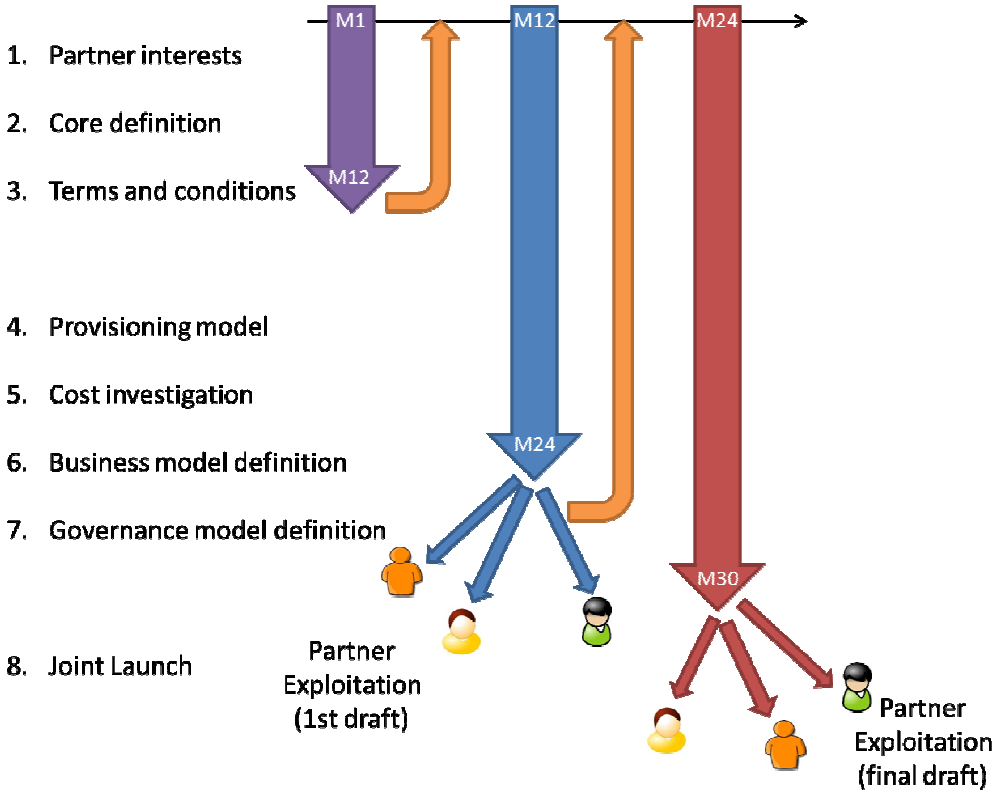


Figure 4: Executing pathway 1 during the project.

At the end of month 12 of the project we have conducted the first pass of partner interests, core definition and the IPR plan.

Partner interests were collected through a questionnaire. These are not repeated here as they are confidential in nature. As this deliverable, and its series, are public deliverables, certain aspects, particularly the individual exploitation plans, may be held as confidential annexes in the subsequent versions.

5.4.1 Partner Interests

As discussed in section 3, the questionnaires showed resounding interest and belief in the commercial exploitation of SMART. This was through both a SMART system used by the public and niche products based on SMART used in specific markets such as journalism, event management, security, defence, municipal services, advanced farming and citizen management and information. The partners identified

potential clients or client segments, including internal clients, who may wish to use SMART products. The partners also identified themselves as sensor data providers or integrators in some cases. The standalone innovations of the project were also identified.

5.4.2 Core definition

The result of the partner survey regarding the parts of the project they most wished to exploit was varied. In some cases partners wished to have access to the whole system, and in other cases were more focussed on particular assets. Consequently, it was decided that for the time being, it was not useful to define what constituted a “core technology” and what was outside of the scope of the joint sustainability plan. We thus consider all SMART assets to be core as default, and this will be revisited as the results mature and the dependencies of components become clear.

5.4.3 Terms and conditions

In full alignment with the project’s stated OS approach from the proposal and later contract, an OS strategy has been decided which covers a large proportion of the project. In brief, the MPL v2.0 license has been selected for the SMART open source framework.

This licensing scheme provides a good balance between openness and opportunities for commercial exploitation, given that it is a business-friendly license. Hence, it satisfies requirements for compliance with background projects, while at the same time ensuring that the companies of the consortium will be able to build exploitable solutions on top of the SMART platform (without having to release their own/proprietary add-ons as open source). Rather than repeat further information here, the reader is directed to deliverable D7.4.

Further work will be carried out in the next period to define other terms and conditions the consortium wishes to impose on the code and derived work.

6 Pathway two: Top-down

6.1 SMART objective

The objective of the consortium is to investigate the potential for a commercial SMART system which serves the public and is delivered as a complete product through a joint exploitation in which different partners perform different roles.

6.2 Rationale

The rationale for exploring this pathway is that, in addition to potentially leading to a lucrative and high-impact legacy of the project, this exercise will help guide the project in technical and business decisions: the conclusions drawn will indicate how SMART can maximise its impact.

6.3 Steps to be taken

Steps to be taken towards defining the top down joint exploitation are as follows:

1. Define the overall value proposition
2. Elucidate the value chain
3. Identify potential business models
4. Analyse the possibility, likelihood, pitfalls and benefits of each model
5. Reconcile the model with the joint sustainability plan and individual plans (pathway 1)
6. Reconcile the model with the technical plan
7. Establish a business plan for delivery (including governance models and financial forecasts)

These steps effectively allow us to identify the optimal way for delivering a large scale SMART product which will maximise impact. The first steps 1-3 are a theoretical exercise in modelling the system. Subsequent steps 4-6 allow us to understand how this model would be brought to life by our organisations and what it would necessitate from us. If the models surpass this reality check and there is a compelling reason for necessary partners to join forces in delivering the model, then the final step, 7, defines the detail of how this will be implemented. If sufficient partners are in agreement of the business plan, this will be implemented in the final stages of the project.

6.4 Progress, contents and time plan

The initial theoretical exercise, steps 1-3 has been carried out within the first project period, M1-M12. The results are discussed below in detail. The subsequent steps, 4-6 will be carried out during the second project period, and the final business plan, step 7, will be presented to senior managers within partner organisations at the end of Q1 of the third period.

The method that is being used in SMART is a novel technique to derive business models from a system value chain. It was developed by Atos Spain through several European projects, which share the properties of being technology and research-driven collaborative projects. It was presented at the eChallenges conference in 2011[23] and subsequently presented at the software and services collaboration

[23] Field, D., Describing and Identifying Business Models from Generic Value Chains for TechnologySystems, eChallenges e-2011 Conference Proceedings Paul Cunningham and Miriam Cunningham (Eds)IIMC International Information Management Corpora-

event later that year. A whitepaper and presentation are available from the EC website or through SCRIBD[24]. The technique has been applied in other FP7 projects[25] with positive results.

Essentially the logic behind the technique is based firstly on the observation that in any given business setup, or business model, despite the providing organisation carrying out several value activities, the 'true client'[26] can be determined to pay the providing company only for specific activities. When we purchase a product from a shop we do not consider ourselves to be paying for transport, warehousing or packaging, although clearly those costs are recuperated from the money we spend on the purchase. Taken from this perspective, we can say that the value activity of "sales" performed by the shop is a revenue generating value activity, and the more sales made, the greater the shop revenues. In contrast, although necessary for sales, the warehousing, packaging and transport are cost-generating activities. This is a useful distinction because it follows that the organisation will do all it can to increase the revenues brought in by revenue generating activities (increased price, increased sales), whilst reducing to the maximum cost-generating activities. In the case of a shop this is a clearly logical statement. However in more complex value chains, such distinction of activities can allow us to better understand company motivations.

Having made this observation, the technique applied in SMART is premised on the consideration that a value chain is, by definition, a series of activities which create value, and so in theory each isolated activity has the potential to generate revenues – to become the revenue generating activity. Each of the possible permutations of cost- and revenue-generation assignations to a given value chain each create a unique "business scenario" which can form, in isolation or combination, a potential business model. The step from 'business scenario' to 'business model' comes from working through the logical implications of the permutation of revenue and cost activities until a vision of how the business would operate is achieved.

6.4.1 The value proposition

The value proposition of SMART is that it offers:

The capability to query data from large-scale, multiple, connected sensors (IoT data) in an easy way and combining this data in real-time with that from multiple other sources (such as social networks). This allows the identification and searching for events, as they happen.

6.4.2 The value chain

A tentative value chain has been developed within the consortium. This was initially derived from the architectural diagram of SMART. This is shown below:

tion, 2011, ISBN: 978-1-905824-27-4..

[24] http://www.scribd.com/doc/66408751

[25] For example: COIN (216256), BonFIRE (257386), Aladdin (AAL-2008-1-061), Cloud4SOA (257953), among others.

[26] The 'true client' may not be the beneficiary of the whole value chain but is instead the actor whose revenues drive the model. For instance: with free newspapers, the true client is the advertiser, not the reader, despite the value chain appearing to deliver news to the reader. (In reality the value chain delivers readers to an advertiser).

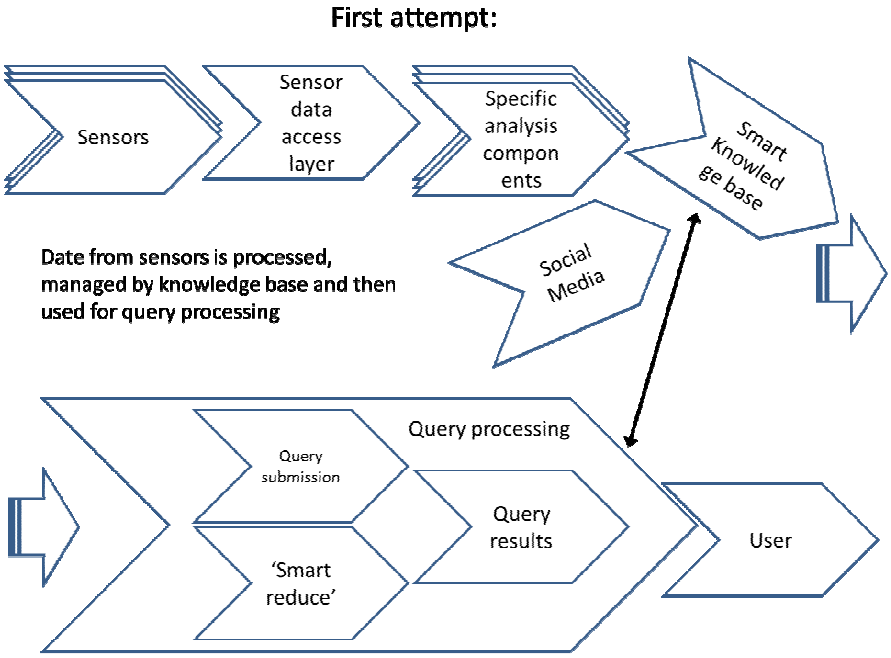


Figure 5: The first attempt to show the value chain of SMART

This first attempt at the value chain was sufficient in terms of explaining the processes involved in SMART. As the flow is perhaps more visually obvious in this version we have shown it here: The sensors provide valuable information which, through the access layer can be analysed by specific analysis components (such as crowd density, colour etc.) This, combined with data from social media, provides the input to the Smart Knowledge base. This is then mined by the query processing activities (query submission, 'SMART reduce' and the query results. It is the output of the query processing that at a first, basic, level, our users consume.

However this rather untidy value chain was then refined in order to better show the boundaries of the SMART system, as well as a more classical and neater format. It was also considered that the data representation and interface of the system was an important value activity to show. The refined value chain is shown below:

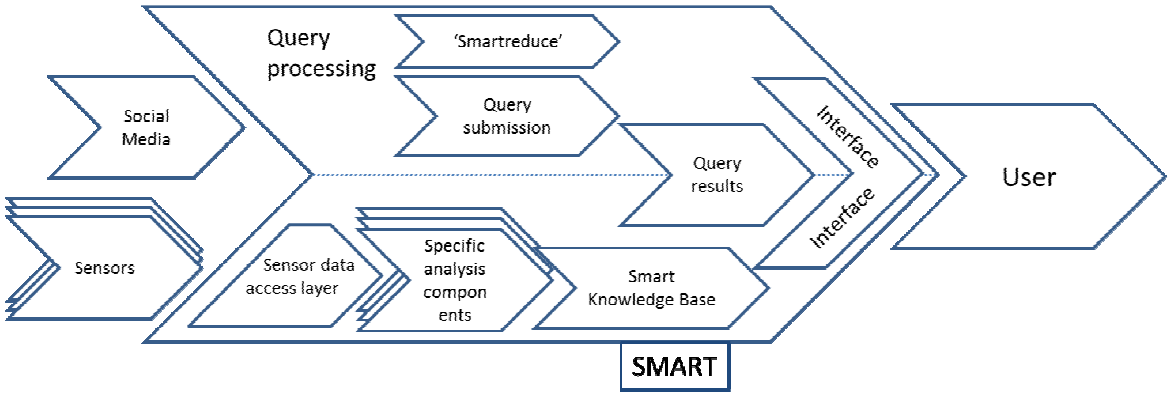


Figure 6: The refined version of the value chain for SMART

This representation shows the same sequence of value activities, but better shows the relation of the query processing components; acting on top of the data management components. It shows the

SMART system as a self-contained activity accessed by the user, and with social media and sensors as input. Note that the separation of social media and sensors can be considered redundant, as we can consider the software that extracts data from social media sites to be a sensor, collecting data as per any other sensor (A/V, temperature, humidity, etc.). Nonetheless, to avoid discarding this aspect, they are maintained apart.

It should also be noted that this tentative value chain should not be considered set in stone. Firstly as the technology develops and so too our understanding of the business system, new roles may be identified. Secondly, this value chain ignores 'typical' value activities around a company such as sales, marketing, management. These are present in the value chain, but it was not considered necessary to depict them at this time. Nonetheless, the reader should bear in mind their anticipated existence. Thirdly, the value chain is not fixed because different business models could introduce new roles: a marketplace, advertising, premium and free features, and so on.

Motivations of sensor owners to share information

The value chain postulates sensor owners providing data to the system through the sensor data access layer. We consider five reasons for the deployment of sensors which can be accessed by the public:

1. The sensor has a (different) primary business function but could be shared

Sensors are often deployed for use by the owners, but could be made available to third parties. For instance, CCTV cameras are used to monitor people and provide evidence for criminal prosecutions. The A/V sensors can also be made available to third parties with little additional cost, and this is done as part of a general trend of increasing open access, open source, free information. Clearly there are ethical and legal consequences in the case of CCTV, but data from other sensors such as temperature are already available through the internet.

2. The sensor is deployed for personal use and shared for 'fun'.

A good example of this type of public data sharing is web cameras. Private webcams owned by individuals are available through the internet. In some cases there may be a niche use: a webcam showing the weather conditions on a beach are used by sunbathers and surfers alike to make decisions on where to go. These webcams are often installed for use by the individual but shared for altruistic reasons. Under the same category we can include webcams which serendipitously become income streams, such as webcams installed in bird boxes which attract large numbers of nature lovers, and with them advertising revenue. The same could be considered true of home weather stations connected to the Internet, for example.

3. The sensor is deployed for a primary reason, but sharing the data is beneficial to the owner.

This category can be considered an extension of the first, with the difference that after the initial deployment, the owner finds it not merely a possibility, but in their interest to divulge the information further. A good example of this is traffic sensors. These are deployed by city transport departments for monitoring real-time traffic conditions and for long term research. However, for instance Transport for London, TfL, shares camera shots and information of public transport with local radio and television so that commuters can alter their journeys on a daily basis in response to roadworks and accidents. In this case TfL increases the value they create (improving London's transport) though sharing.

4. The sensor is part of a crowd sourcing initiative

In this case, the sensor is part of a crowd sourcing initiative in which individuals share information in order to construct something of value to them. Often this is bundled with software and devices using the

aggregated data. A good example is GPS systems and traffic phone Apps such as Waze[27], which use user data to identify traffic jams, speed traps and so on, for use by the owners of the devices.

We can look at social network sensors as part of a crowd sourcing initiative. As suggested by the word *network*, sites such as Twitter, Facebook and LinkedIN create value through connecting people, and are reliant on these users to populate the sites with content. The value of the sites to the users stems from the quality and quantity of information available.

5. The sensor owner monetizes or otherwise creates value from sensor access.

This case is the least well understood by the consortium. It does overlap with scenario 3, the main difference being that public search is the primary function of the sensors. It is based on the prediction that there are sensor data providers who rely on users of the data to fund the business model or where data providers are paid by a third party to provide that information to the users (e.g. a corporation pays for its employees to have data access, or a public body pays for scientists, tourists, residents etc. to have access).

This could be indirect value, such as a restaurant owner using a crowd sensor to show their premises as popular.

One example we do consider is social networks. As commented above, the value stems from use by users. In the case of Facebook, for instance, this is monetized by targeted advertising. By improving the service to the users, for instance by making the data available in more valuable ways to users through SMART, they should improve the value of the service. However, to make this attractive to the sensor owner, SMART must enable in some way that the owner can continue to monetize their asset. Facebook's share price dropped dramatically after floatation when analysts realised that mobile access to Facebook was not monetized yet increasingly this was the dominant access method[28]. If SMART could allow sensor data providers to monetize (e.g. through advertising) sensor data, this may become a powerful sign-up incentive.

6.4.3 Business models

6.4.3.1 SMART and search engines

The exploitation team started the business modelling process considering how SMART fitted into the wider concept of search engines, and by exploring search engines to understand better the wider ecosystem.

This started by posing the question: in a general purpose, public SMART, is the "user" in fact a search engine? (see the value chain depiction of this below).

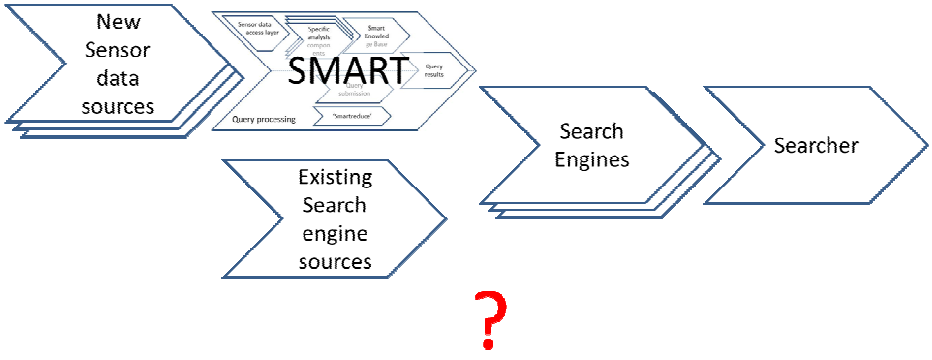


Figure 7: Is the SMART user really an (existing) search engine?

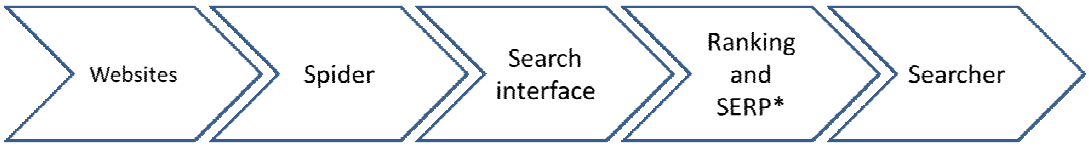
Waze is a free Smartphone app which gives users navigation and aggregated real-time data on traffic conditions and local amenities and services (such as recommended cafes and petrol pump prices. See http://www.waze.com for information. It is financed by location-based advertising.

[28] http://www.zdnet.com/facebook-share-price-continues-to-fall-7000002047/

Interestingly, within the consortium there were different opinions on this question. In some cases it was felt that yes, providing data to a search engine would be a good way to tap into an existing pool of users, saving marketing costs and vastly accelerating the turnover. In other cases it was felt that SMART was itself the search engine and that people using it would want to be able to isolate the sensor and social network data and use it in a different way to, and for different inquiries as for a typical search engine. When the same question was asked replacing the generic term "search engines" with the word "Google", the consortium was much more unanimous: No Google is not the user of SMART. The upshot of this discussion is that we do consider specific, niche search engines may have a role to play in a mass-market SMART system.

The work package then looked at search engines in general to better understand their business model, and whether this was applicable to SMART.

Firstly we identified the most basic value chain for a search engine, considering perhaps the first such engines on the market, still then with no defined business model.



*SERP: Search Engine Results page

Figure 8: The initial value chain for the early search engines.

We then developed this further. After their first appearance, search engines quickly found revenues in the form of paid links and advertising, as shown below:

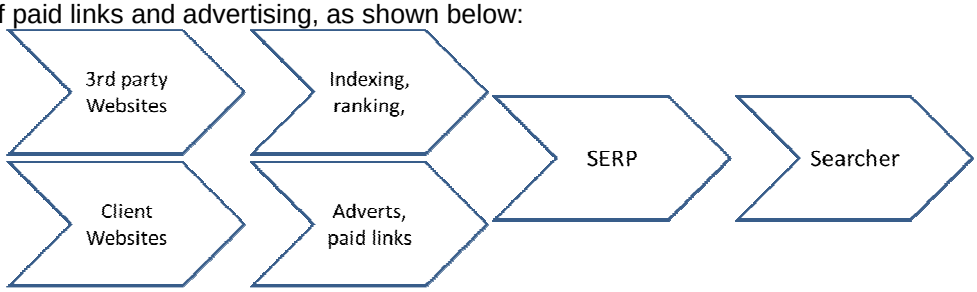
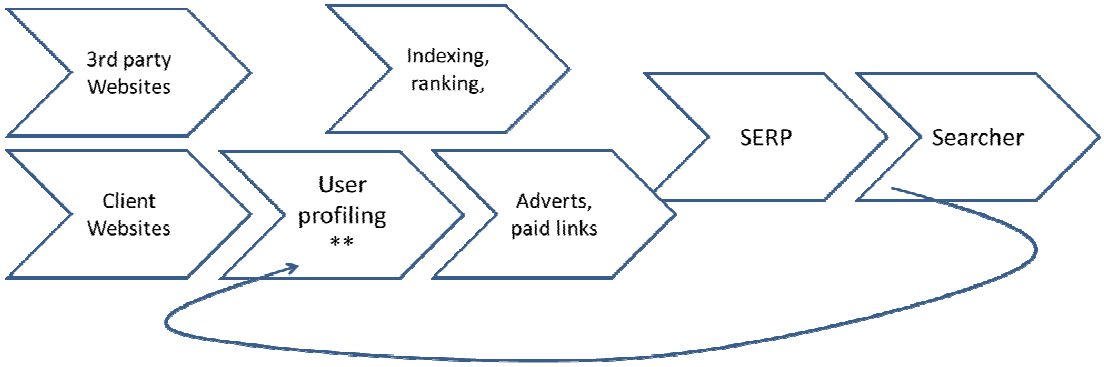


Figure 9: A value chain for an early search engine with paid advertising

Here we see the same basic value chain, with 3rd party websites and their indexing continuing as before, but in parallel to the paid links of client websites. Using our nomenclature defined in the introduction to this section on business models, we could classify the "adverts, paid links" activity as the revenue-generating activity driving this business model. The obvious implication is that to increase profits the companies needed to increase the value of the advertising, which they could do through improving their success rate. The more innovative of the search companies started profiling the searchers so that the displayed adverts were ever better targeted:



** In this first instance, through queries searched, pages viewed, etc.

Figure 10: Value chain for a more advanced search engine with user profiling.

A consequence of this improved profiling and hence success rate was that the more successful companies could move from charging advertisers per impression to charging advertisers per click-through, a much more interesting value proposition, and one which clearly favours those with better profiling capability. The more successful of these search companies, particularly typified by Google have gone on to create more and more products designed in the large part, to improve their knowledge of their users and hence provide them with better SERPs (building loyalty) and to better target advertising at them.

The business analysts thus propose that the value chain depiction of a modern search engine, such as Google, should be as follows:

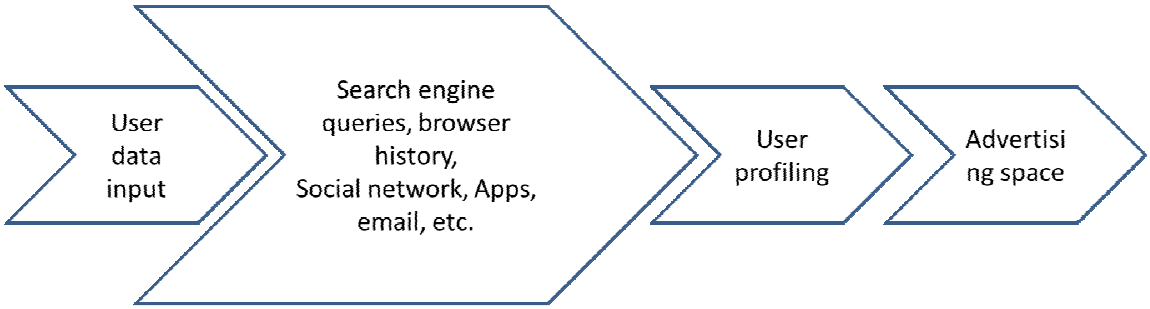


Figure 11: Is this the true value chain of Google?

That is, the value chain delivers profiled users to advertisers. Users are attracted through a set of products which is attractive to a large portion of the market, builds loyalty and permits considerable profiling. In the case of Google these products are generally free, financed through advertising. Interestingly, in today's internet society where users are not so much consumers of data but prosumers: both providing content (tweets, blogs, photos, video etc.) and consuming that of others, the raw input to the value chain are the same users those as being provided, with added value (profiling), to the advertiser.

The conclusion of this analysis within the exploitation group was that this is not a feasible business model for SMART. SMART cannot possibly compete in the general search space with the same business model. SMART must EITHER identify a different business model, taking revenues not from advertisers, but from another actor, OR it must identify a niche where there is sufficient differentiation from general search in order to be lucrative: It must have more valuable users or very specific profiling to compete.

6.4.3.2 SMART Business models

As stated above in the introduction to this section, in SMART we use a technique which creates business models through classifying different value chain activities as revenue-generating or cost-generating. This can be shown pictorially on the value chains. We use the following convention in this document:

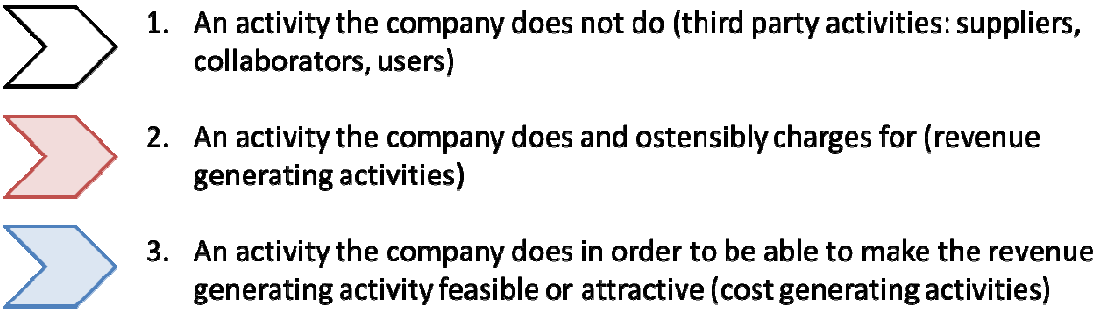


Figure 12: Legend to the business models

The technique was used to generate multiple business scenarios which were analysed. From the scenarios identified, four credible business models were selected as meriting further analysis. These, in order of obviousness are:

- Idea I: Searchers pay
- Idea II: Sensors pay.
- Idea III: Advertising-based model
- Idea IV: Analysis package marketplace

6.4.3.3 Idea I: Let the searcher pay

In this model, we simply consider that the searcher pays for the ability to use the system. This could be done through a variety of pricing models, which are not mutually exclusive: a subscription, pay-per-search, pay-per click-through; a freemium model (some searches are free, others not).

We can see this model being instantly applicable to the niche use of the SMART system, as discussed under 'pathway 1'. For example, in the defence or security sector, the client would almost certainly opt for a subscription package. Journalists would opt for pay-per-use or subscription if consulted frequently, and city citizens or tourists are most likely to attracted to a freemium service (word-of-mouth and positive first experiences are key).

In the case of the general public, in a multi-use search, it will be significantly more difficult to attract significant numbers of users under a searcher-pays model. The public have become used to free products and free information (search engines, social media, online newspapers, blogging, microblogs, youtube, forums) and there is a common assumption that they should be free. Consequently the general public have a low propensity to pay and the conversion rate is expected to be low. For example, until 2010 professional social networking site LinkedIn had converted only 1% of its users into 'premium' (paying) users[29].

The value chain for this model is shown below:

[29] http://www.economist.com/node/14931599

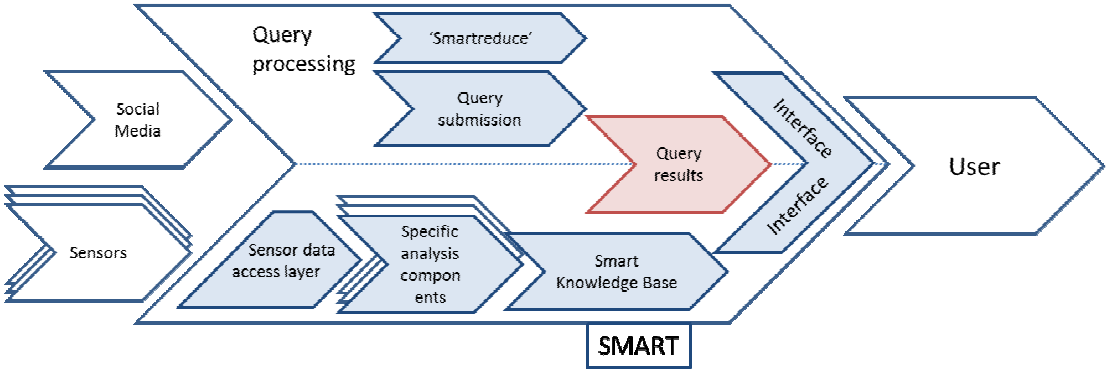


Figure 13: Business model 1: the searcher pays

6.4.3.4 Idea II: The sensor data provider must pay to be included

Under this model, the sensor data provider pays to be included in the SMART system, which gives them access to the SMART user base. This is shown below:

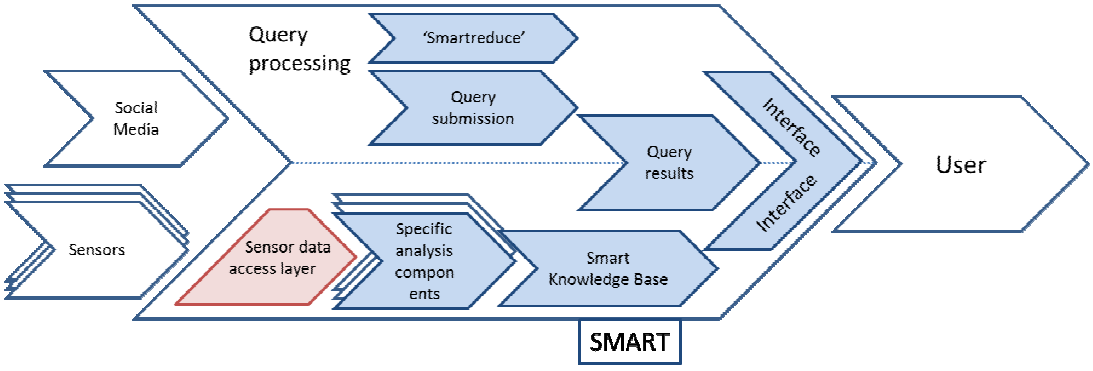


Figure 14: Business model 2: the sensor pays

As can be seen, the system is monetized at the sensor data access layer – as this is the entry point for the sensor data. The other activities are carried out at cost, but are necessary to offer the sensor data providers with a value proposition: a large number of users.

This is a plausible scenario if the sensor owners have a business model for providing information to the users of SMART. This could work in both niche and mass-market deployments (i.e. pathway 1 and pathway 2). However, as is the case of advertising, and was discussed above, the key to generating value with this model is the value of the users. In a niche deployment we can consider the end user to be a specific profile, whereas in a mass-market deployment we need to investigate whether the unique-ness of the SMART system alone is enough to make un-profiled users valuable, or whether there would need to be some profiling in order to be attractive.

In the value chain analysis we considered five reasons for the sensor owners to provide data. The key to this SMART business model is the business model which drives the sensor owners. Of the five cases for sensor deployment for public use discussed, it remains difficult to see a compelling reason for the sensor data providers to pay.

In the first case we don't identify a reason to share, just the possibility of doing so. Under this situation it is unlikely we will find clients.

In the second case the data is shared for altruistic or other reasons. Here we are likely to be dealing with members of the general public. With a low propensity to pay for online services at the best of times, and with no return on the cost, it is unlikely we will find many sensor owners prepared to pay.

In the third case, where the owner generates value, but not revenues through sharing, there is a reason to join SMART. This is likely to be price sensitive and will involve legal and ethical barriers, but we could imagine our example of Transport for London joining SMART if they believe it will improve the capital's traffic and public transport flow.

In the fourth case, the crowd sourcing initiative, we can be dealing with the public, with an aforementioned low propensity to pay, or with companies providing crowd sourced information to users. In the latter case it is reasonable to predict that SMART could build a business case for sensor inclusion, provided this does not interrupt the company's income stream. In the example used above of the navigation data company Waze, SMART would have to be complementary to the free smartphone app and not interrupt with their location-based advertising stream. The same is true of the social networks.

In the fifth case where searches create value, there is clearly a compelling reason to pay SMART, again assuming that the company still generates value from the searches. However the consortium has not yet fully understood this potential market, and work is continuing to better define it.

6.4.3.5 Idea III: Advertising-based model

With a small modification to the value chain, we considered that the system could be funded through advertising.

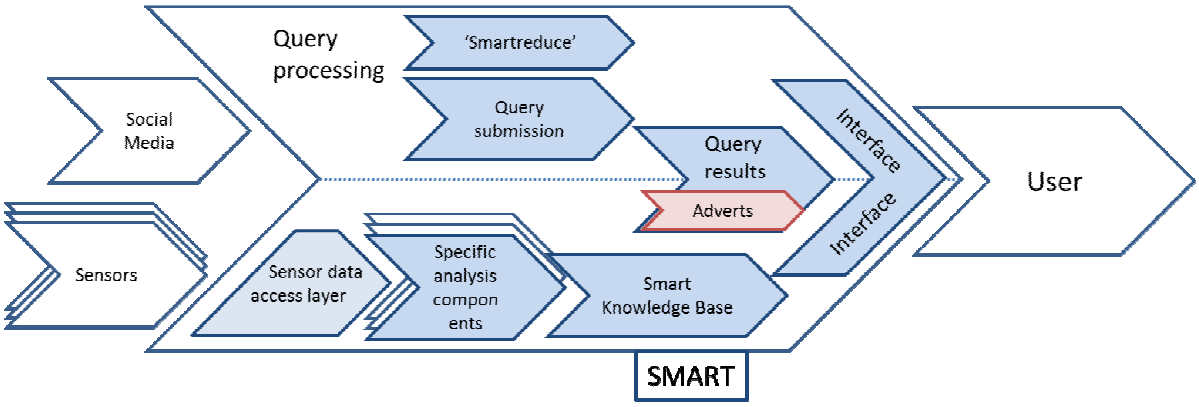


Figure 15: Business model 3: the advertiser pays

This model has essentially been discussed previously when discussing search engines in detail. The conclusion of that analysis was that SMART must provide very significant value to advertisers in order to be able to be competitive against search engines which do not include sensors. This can be achieved through scale or profile. Within the consortium discussion *scale* was quickly rejected: we cannot ever anticipate competing with Bing, Google or Yahoo on scale. Hence for this model to be viable we must ensure that the users are high value and well profiled. This will be explored in the next period.

6.4.3.6 Idea IV: Analysis package marketplace

This idea was the least obvious of the business scenarios we considered to merit further analysis. In this model we aim to crowd source the data analysis components. This is highly interesting. The consortium is developing some tools, but this generates cost and takes time. Moreover it requires ideas. With crowd-sourcing we benefit for free from a large number of tools, developed in a short period of time, for niche or general application, and in fields and for purposes which would not even occur to the SMART consortium.

In this model, the contributors are incentivised through an analysis tool marketplace. This would be modelled on an app store. Contributors would earn from selling tools (although free tools could be allowed) and additionally there could be advertising revenue passed on to the contributors. SMART itself would take a cut of analysis tool sales and/or advertising revenues. This would necessitate a creation and integration of a marketplace in SMART, as shown below.

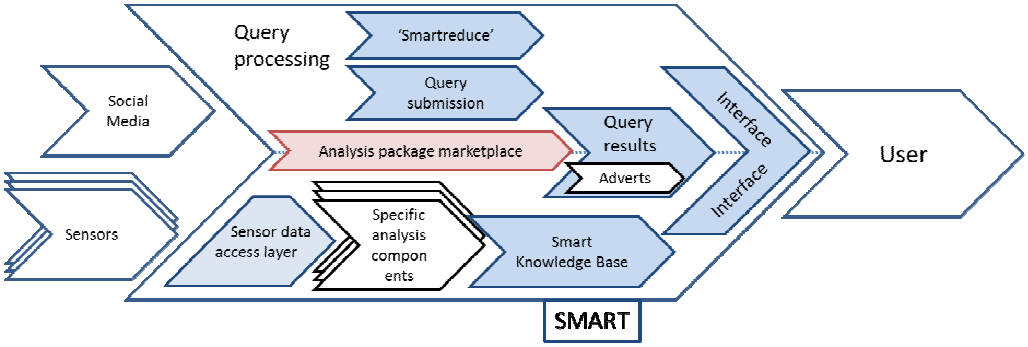


Figure 16: Business model 4: analyst tool provider pays

We consider that users would be able to build simple applications combining multiple analytic tools in order to produce bespoke searches for their own use. Clearly this would appeal to both niche users, but with a sufficient population of tools, the general public could become users of these bespoke searches.

The main issue to investigate in this model is the market for contributors. This includes technical details, such as the ease of use of developing analysis packages as well as thorough investigation of who they are, their propensity to pay us, the value they would generate and so on.

As with all marketplaces, the difficulty in getting off the ground is summarised in a chicken and egg situation: without a strong user base, developers are not going to generate a profit, but without sufficient tools, users will not find use and will not sign up. A “killer app” is needed.

6.4.3.7 Summary of the proposed business models

Four business models are proposed. The main points and next steps are summed up in the following table:

Model	**Main selling point**	**Main stumbling block**	**Next steps**
I: Searcher pays	Fits well in niche deployments. Easy to set up. Well understood model Variety of pricing models	General public have a low propensity to pay for online services	Cost analysis of SMART to allow pricing levels to be estimated. Identification of most interesting niches (market and partner input). Market analysis of searchers (niche and public) to define size and value.
II: Sensor pays	Fits with the general trend of online services being free at point of use.	Difficulties identifying business case for sensor providers except in very niche applications.	Understanding how sensor providers can derive value through SMART. Cost analysis of SMART to allow pricing levels to be estimated.
III: Advertiser pays	Fits with the general trend of online services being free at point of use.	To be competitive users must present a very high value to advertisers, for their profile and/or as they are difficult to target through other means. Additional difficulties come from when the searcher is not required to be registered (one does not need to register for Google, however one is registered in Tweeter and Facebook). If the user is not registered then the profile presents less value to the advertiser.	Further analysis of who users are, how they can be profiled and their value to advertisers. Cost analysis of SMART to allow pricing levels to be estimated. Understand how adverts can be brought into the system, especially if there are third parties between SMART and the end user.
IV: Marketplace	Rapid, free and varied development of analysis tools will add significantly to SMART value.	Need a “Killer App” to bring in users and demonstrate value to developers. Introduction of third parties splits profits between SMART and contributors. Possible legal and ethical barriers to 3rd party involvement.	Need to understand the technical implications of third party developers and marketplace. Need to profile the market of contributors. Need to investigate value generated by users and how this can be profitable to both SMART and the 3rd party developers.

7 Conclusions

In this deliverable, D7.5, Exploitation Activities and Plans, we present to the reader an overview of the activities and plans of the consortium generated in the first period of the project.

The WP is following two pathways towards commercialising SMART and generating value and impact for partners and other stakeholders alike.

The first pathway is based on a joint sustainability for SMART which engenders partner exploitation in the near term. It is hence based on partner feedback of their requirements and seeks to set up a low cost and pragmatic solution as soon as possible. Ideally it will be up and running before the end of the project, depending on technical results.

The second pathway is longer term, looking to develop the optimal deployment of SMART. It is more theoretical in approach, using value chains and a new technique to derive business models. As the analysis progresses it will both affect and be affected by the first pathway, for instance the business models proposed can be adopted by the consortium in niche, partner exploitation, but the overall vision must in turn be tempered by the immediate plans of the partners. It is more risky in nature, but the exercise also serves to direct the technical direction of the project towards its unique selling point and viable use.

Both pathways are supported by the market analysis. The project has shunned a generic market overview of the economic situation and the key technologies in favour of specific analyses in the areas where SMART has identified innovation of the state of the art. It has been noted that there is a lot of activity around the vale proposition of the project (combining sensor data with social media), yet to date there are no direct competitors to SMART. That said, there are solutions which may compete in specific future exploitation scenarios cases. Clearly there is both demand for the solutions and creation of value. Given the number of technological, social and business developments on the supply side, this is something SMART will monitor closely in the duration of the project.

Pathway one has progressed starting with a confidential partner questionnaire to identify perspectives and ideas, with an initial appraisal of the core technologies to be made sustainable, and the initial IPR policy (covered in deliverable D7.4). The initial assumptions and interests are factored into the project, but until results are more mature, it is not feasible for partners to make concrete plans. These will be elaborated in the next period and will drive pathway one to propose a provisioning, business and governance model for joint sustainability. This will be revisited in the third period, and following approval from partner organisations, launched.

Pathway two has progressed with more tangible results. Building on the means through which the project delivers its value proposition, a value chain for the system has been derived, explaining how each of the components and the inputs combine to create the value proposition of SMART. Based on this, four business models have been determined for further analysis. They have been described here and next steps are planned in each. Further definition of the incentives for sensor owners to participate is required.

At the close of period one of the project, the work package has made significant advances towards understanding how SMART can be made sustainable and lucrative. At the time of writing there are still many options on the table, but it the next steps towards quantifying and qualifying them are well understood, and during the next period the work package will propose a joint sustainability model and develop individual plans for pathway one and select the most appropriate model for pathway two. Early in the final period a business plan will be put to partners for ratification and launch, and the post-project joint exploitation of SMART will be initialised.

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