EARLY EXPLOITATION PLAN

Bringing SmartH2O to the market

SmartH2O

Project FP7-ICT-619172

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Table of Contents

Executive Summary

This document is the Deliverable **D8.1, Early exploitation plan**, which, according to the DoW has the following goals.

D8.1) Early Exploitation plan: In this deliverable each partner describes its initial and expected plans to exploit the results and the foreground assets that will be produced during the project. This deliverable will include the identification of the project results and classify them according to their exploitation potential.

The present document reports the preliminary achievements of the Business Development work package (WP8). WP8 aims at the identification and involvement of early adopters in order to ensure post-project exploitation and long-term sustainability and impact of results.

In the first semester of the project, SmartH2O partners have been requested to focus from the start on the business potential of the project and to think creatively about the possible uses of any asset they contribute to SmartH2O.

As a consequence of this effort, this deliverable describes the initial outcome of such an effort. It overviews the reference market of SmartH2O both in the specific area of utility management (Section 2) and in the broader field of gamification of business applications, serious games (Section 3) and user models (Section 4). In particular, a taxonomy of utility businesses is proposed as a methodological tool to understand the potential customers, their operating conditions, objectives and constraints and thus better focus the relevance, added value, and marketing message of SmartH2O.

The document then recalls the main concepts of the SmartH2O architecture (Section 5), as a basis for understanding the technical components that can be considered as the ingredients for the exploitable assets.

Next, it proposes the taxonomy of exploitable assets and uses it to categorise an initial set of these assets (Section 6), which have been derived matching the identified needs of the market players with the functionality and capabilities of the SmartH2O components.

In Section 7, each asset is considered in its specificity and the initial guidelines of its exploitation and marketing strategies are delineated; these will be the subject of much deeper elaboration in the course of the project. In general, assets may be exploited through the deployment of products and services in utility and gaming markets, generating revenues from customers. But they could also be shared with stakeholders for social purposes or be re-used by the partners themselves beyond the project, reducing their costs or improving their know-how.

Section 8 overviews the initial exploitation plans of the consortium, both at the individual level and at the joint level. These plans will be revised in the development of the project, especially after the field validation of the developed solutions with TWUL and SES, which will provide an extremely valuable feedback on the way to best exploit each asset and the whole SmartH2O platform.

Section 9 – An action plan for joint exploitation of SmartH2O motivates the strategy and approach at the base of the creation of the initial exploitation plan.

Finally, Section 10 concludes and outlines the forthcoming activities that will be done in WP8.

1. Introduction

This deliverable presents the initial results of the definition of the exploitation strategy for the results of the SmarthH20 project, as part of the activity of WP8 (Business development), whose temporal organization is recalled in Figure 1.

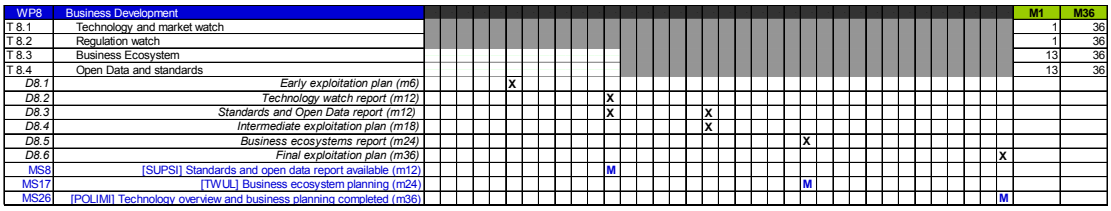


Figure 1: Gantt diagram of WP8 (from the DoW).

It draws content from the outcome of the active tasks of the WP:

- T 8.1 Technology and market watch, for the initial definition of the reference markets.
- T 8.2 Regulation watch: for the initial identification of the regulatory frameworks in the countries that are direct target of the Consortium, which may affect the definition of SmartH2O asset value and marketing strategies.
- T 8.3 Utility business implications and new business models, for the identification of a taxonomy of utilities business models, preliminary to the construction of a methodology form matching SmartH2O results to business needs of utilities of a specific class.

The deliverable will also influence the prosecution of work in WP8 affecting the following (not yet open as of the delivery date of this document) tasks:

- T 8.4 Business Technology Ecosystem, for the initial collection of feedback from players outside the consortium, with respect to the potential value of the MsartH20 proposition.
- T 8.5 Open Data and standards, for the identification of data sets as exploitable assets.

The work that has produced this deliverable has been methodologically organised as shown in Figure 2.

1. In the **Reference Market Identification** activity partners focused on determining which potential adopters exist for the SmartH2O results. Beside the obvious target (the market of water utilities, and more generally of utilities in any sector, e.g., energy), an effort has been done to identify opportunities in other markets, most notably gamification of business applications and user behavioural modelling tools. Results are reported in section 2, 3 and 4.
2. The **Requirements elicitation and analysis** activity addresses the needs of the utilities and of their customers and defines the business scenarios where the SmartH2O results will be deployed and the use cases that will be used to field test their validity for users and companies.
3. The **Architecture design activity**, which runs in parallel to WP8 and at this stage of the project is mainly responsibility of WP2 (for requirements elicitation), WP3-4-5 (for the core technical and scientifically innovations of the project) and WP6 (for the actual packaging of feature into software releases), has been taken as an input. Section 5 briefly summarises the main technical components identified in the mentioned workpackages for the sake of recalling where the identified asset come from.
4. The **Market analysis and need extraction** activity has focused, in this first semester, on an in-depth examination of the core reference market: utilities and water. The idea is to provide an organised model of the market, which could be used

to perform a structured analysis of the utilities businesses targeted by SmartH2O to extract the most promising players that are more likely to be approachable as early adopters of SmartH2O results. Section 2.3 zooms on the proposed taxonomical model and marketing methodology.

5. The **Capability identification** activity is based on the outcome of the technical workpackage, as embodied also in the deliverables: D2.1 Use cases and early Requirements; D6.1 Delivery management plan and testing specification. The goal is to recast the technical components of SmartH2O into exploitable assets, using an external, capability-oriented analysis viewpoint, rather than an internal, technical perspective. The asset categorization scheme proposed in section 6 single out the most promising asset categories, where the SmartH2O results have the strongest differential factors and may exhibit good competitive advantage.
6. The **Asset identification (need - feature mapping)** activity extracts from the technical components of SmartH2O the assets that are candidate to exploitation, in each of the identified categories.
7. The **Initial exploitation planning** activity exposes the preliminary considerations on the potential target customers and the marketing guidelines for each asset; these considerations will be fine-tuned as a consequence of the trial activities performed with SES and TWUL, and consolidated in the second version of the exploitation plan (D8.4 Intermediate exploitation plan, due at month 18).

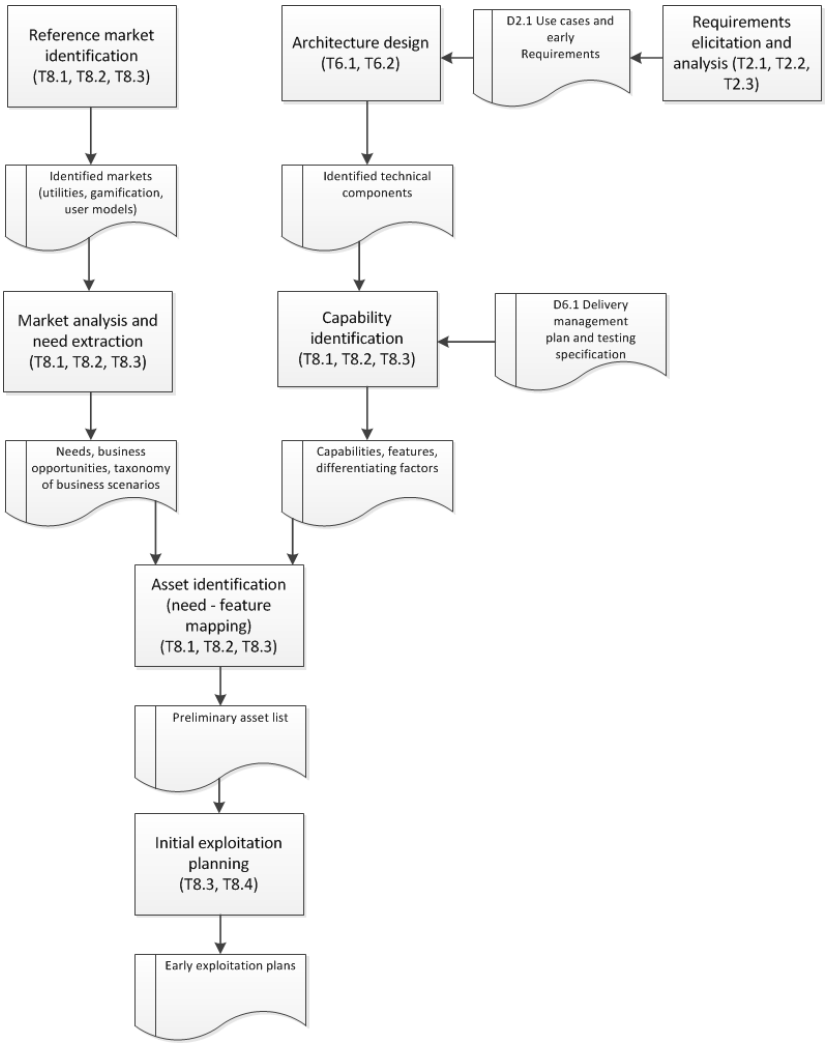


Figure 2: Overview of the methodology for asset identification and initial exploitation plan definition.

2. Overview of the utilities and water market in Europe

This Section illustrates some estimates of the size of water industry and market. While the regulation of European water industries will be presented in greater detail by other SmartH2O deliverables (D5.1 Review of pricing instruments and D8.5 Business ecosystem report), this Section summarizes the main treats of water industry organization for selected European countries. Finally, it introduces a taxonomy of utilities that returns their potential as target users of SmartH2O assets.

2.1 Industry and market size

Water users range from households and small business users, to large industrial users, farmers, power producers, bottled water companies. As a result, the enlarged water industry includes a set of highly differentiated players and supply chains. However, the SmartH2O project focuses on households and small business users, and their providers, i.e. water utilities that supply drinking water and collect and treat wastewater (i.e. sanitation services). Thus, in the remaining part of the Section, unless specified otherwise, "water industry" and "water market" are used to term, respectively, utilities and their upstream market. Thus, water market concerns equipment, plants, works, services and materials that are offered by manufacturers, contractors, consultants, technology vendors and other suppliers.

Available estimates of the water market size are mostly taken from trade journals and information providers. A widely cited estimate of the global water market size reaches 557 USD billion in 2013 (source: [UKWRIP14]). However this figure combines utilities and industrial users, and includes operating expenditures, i.e. costs of labor, energy, materials, and services. A more meaningful indicator is offered by the same source, which estimates global capital expenditures of utilities to be worth 195 USD billion in 2013.

In the European Union the organization of water industries is under the responsibility of each Member State (Section 2.2), although convergence is favored by current EU policies for the internal market and environment. As a general note, official statistics for the European water industry are still highly fragmented and inconsistent, despite recent efforts to harmonize datasets across European countries.

Table 1 reports per capita water consumption by households in some European countries.

Table 1: Households' water consumption.

Country (last available year)	Households' water consumption (m^3 per capita-year)
England & Wales (2009)	53.3
France (2009)	55.1
Germany (2010)	43.7
Italy (2009)	66.5
Switzerland (2011)	70.3

Sources: Italian Institute of Statistics; Eurostat; French Agences de l'eau; UK Environment Agency

The lack of data is even more serious when water tariffs are taken into account. Cross-country pictures of water tariff levels are complicated by the variety of enforced pricing schemes and the large number of utilities in certain countries, e.g. Germany and Italy. Only few countries in the world maintain national databases of water and wastewater tariffs charged by utilities, with England and Wales as a notable exception. Table 2 shows the average domestic tariff, including taxes, for water and wastewater services for a panel of European countries.

Table 2: Average water tariffs.

Country	Average tariffs in 2008 (USD/m^3)*
England & Wales	3.15
France	3.16
Germany	4.20
Italy	1.20
Switzerland	2.05

Source: [OECD10]. Note. *: Adjusted for consumption purchasing power parity

Table 3 shows estimates from the most recent uniform analysis of required investments in OECD countries. Projected expenditures include investments that in 2006 were estimated to be necessary to recover existing infrastructure, to make it compliant with more stringent environment and health regulations, and to maintain service quality over time. All of the selected countries should substantially increase their water spending by about 20% to maintain adequate levels of water services.

Table 3: Expenditure on water infrastructure.

Country	Current expenditure on water infrastructure (USD billion)	Projected expenditure on water infrastructure as % of GDP		Projected average annual expenditure (USD billion)	
		By 2015	By 2025	By 2015	By 2025
Italy	12.150	0.75	0.92	16.83	25.23
Germany	17.932	0.75	0.83	23.38	35.84
France	12.930	0.75	0.83	16.86	25.84
Switzerland	1.725	0.75	0.64	1.97	3.19
United Kingdom	12.499	0.72	0.86	19.14	27.96

Source: [OECD06]

2.2 The institutional setting

2.2.1 UK

The UK water and sewerage industry was privatized in 1989. Before privatization there were 10 publicly owned Regional Water Authorities (RWAs), which were responsible for the supply of water and sewerage services and 33 already privately owned Statutory Water Companies, which were responsible for the supply of water services only. In 1989, the privately owned 10 RWAs formed the Water and Sewerage Companies (WaSCs), whereas the 33 Statutory Water Companies formed the Water Only Companies (WoCs). After mergers and acquisitions today there are 10 WaSCs and 11 WoCs.

Being natural monopolies, WaSCs and WoCs were subject to regulation. There are three regulatory bodies, the Water Services Regulatory Authority (Ofwat), which is the economic regulator and sets the price limits for each company every five years, the Environment Agency (EA), which is responsible for pollution control, licensing and regulation of water abstraction, and the Drinking Water Inspectorate (DWI), which is responsible for controlling and monitoring drinking water quality [M12].

The method of regulation in the water and sewerage industry is the price cap regulation and

has the form of RPI-/+K. RPI is the Retail Price Index and measures inflation in the economy, whereas K consists of two components, an efficiency factor X which reflects the Ofwat's assessment of each company's scope to reduce its unit costs over a five year period, and a Q factor to reflect the higher costs resulting from meeting stricter water quality targets [SP1]. As part of the review of water prices in 2009 (i.e. K factors for WaSCs and WoCs are set every 5 years by Ofwat), new mechanisms were included such as the Capital expenditure Incentive Scheme (CIS) which allows each company to recover its actual capital expenditure plus or minus an incentive allowance that depends on its forecast of capital expenditure and its actual expenditure in 2010-15 [O9]. Other features include the Overall Performance Assessment (OPA) which was a composite measure of the WASCs levels of service, customer service and environmental performance such as customers' complaints, security of supply, pollution incidents [CSM13]. In the future price review, the latter measure is replaced with a new service incentive mechanism (SIM) which would use new measures of customer experience [O9]. In line with the above is the establishment of the customer challenge groups for each water company so that customers are involved in the price setting process [O11].
Since privatization WaSCs and WoCs have invested almost £50 billion to improve capital infrastructure, quality of service and drinking water quality and environmental standards [O09]. Moreover, since 2009 a wide range of reforms have been under consideration driven by recent reports by Cave and Walker in 2009. These reforms, among others, include changes in the current charging system to incentivize efficient use of water resources, increase the metering penetration rate and improve the synergies between water and energy in particular areas such as smart meters and efficiency measures [W9]. Other reforms include for instance retail competition, changes to abstraction licensing, water trading, and mergers between water companies [C9]. Some of the above aforementioned reforms are taking place in the water sector in the future such as the introduction of retail competition for non-households, whereas metering policy was left out of the Water Bill. However, there are companies that opt for metering and smart metering initiatives such as Southern Water and Thames in conjunction with the introduction of social tariff schemes, for instance new tariff trials are in progress by Wessex, South east and others). In addition, information campaigns and technology innovations (such as Thames) are ongoing to raise social awareness for water conservation and foster efficient use of water.

2.2.2 Italy

In Italy, the Galli law in 1994 set a new framework for the water supply sector which lied in the hands of ATOs (Optimal Territorial Areas). The water tariff formula was based on the normalized method, similar to a price cap mechanism. It assumes that tariffs are sufficient enough to ensure that the water companies have adequate revenue to meet their obligations, for instance, make investments in the quality of service, cover capital maintenance costs and depreciation, and a return to capital investments [CCM12].
The latter was abolished by the referendum in 2011 resulting in financial difficulties for water utilities to continue investments for capital maintenance and enhancement. However, the same year, the new government has transferred regulatory competences on the provision of water services to the national independent authority already operating in the electricity and gas sector (AEEG) [ME13]. AEEG set the new rules to provide incentives for investments in order to increase efficiency in the service provision (i.e. reduce leakages, promote innovation, etc.) and within two years, AEEG has to set a new tariff system to connect service quality with tariff level and to make water affordable for "vulnerable consumers" [SS13].

2.2.3 Switzerland

Similarly to the German sector, the water sector in Switzerland is highly fragmented; approximately 3,000 water utilities are responsible for delivering water to the final users [BFM8]. Being a federal state, the management of Swiss water supply is under public law having three levels of institutions responsible for the supply of water; the federal, the cantonal and municipal levels [LM5]. The municipalities are responsible for water pumping and

distribution; the cantons have to make sure that the water delivered to households is of sufficient quality; the federal Government establishes the legal framework for the protection and conservation of water resources as well as quality standards for drinking water [S13]. No central water regulator exists in Switzerland although there is a Price Supervisor who can judge about water price levels [BFM8] and [FB14]. The tariffs charged for water supply and the connection and user fee for sanitation are the most significant source of financing of the sector and are set by the cantons, which they normally delegate to municipalities [LM5].

2.2.4 France

The operation of French utilities in general differs from the European norm. Whereas assets remain in public ownership, in most cases their operation is contracted out to large private water companies [SAMT13]. There is no national regulator and municipalities are responsible for the provision of water services, reviewing prices, entry and exit of firms in the market, organizing competition [LLP13].
Alternatively, municipalities may choose between contractual arrangements with private operators (Public-private partnerships (PPP) or delegated management contracts) that differ according to the operator's investments in the service and the allocation of risk across the two parties [HP12].
[BLB7] quotes three types of PPP or delegated management contracts whose are renegotiated every five years: *régie intéressée*, where the delegate operates and maintains the assets built by the public authority and receives a proportional fee based on the volume sold; *affermage*, the most frequent type of delegation, where the delegate operates and maintains the assets built by the public authority, but receives its revenue from the users and transfers a fee (*surtaxe*) to the public authority in accordance with the depreciation of the assets; and *concession*, where the delegate builds, operates and maintains the assets and receives its revenue from the users.
Moreover, data on the performance of the operators and in general on the water and sewerage services are publicly available and are collected by the French National Agency for Water and Aquatic Environments (ONEMA). As far as water charges in France are concerned, [SS13] reported that price is 27% and 23% higher on average when the water service is managed by a private operator in cities supplying less than 10,000 inhabitants and more than 10,000 residents, respectively.

2.2.5 Germany

Contrary to England and Wales, in Germany the water sector is highly fragmented as 6,211 water utilities operated in 2007, of which 5,972 delivered water to the final customers [Z13]. The water supply is the responsibility of municipalities; however, different organizational arrangements within the water and sewerage sector exist such as municipal department, semi-autonomous municipal agency, inter-municipal agency, public-private partnership and other arrangements under private law [W9].
Water and wastewater charges are stipulated by the Local Rates Acts of the German Länder and by the WFD at EU level [ZW11]. In 2007 the costs of water supply and sewage services amounted to €213 per year for the average customer, water losses had the lowest rate among EU countries, whereas the customer satisfaction with the public water supply was high mainly driven by the high quality of tap drinking water [W9].

2.3 Water industry and the SmartH2O platform: A taxonomy

This Section illustrates a taxonomy of water utilities as possible targets users of SmartH2O platform. The instrument is then applied to some utility examples in order to show its logic.

2.3.1 Taxonomy overview

The taxonomy leans on four dimensions that will be discussed in detail by Section 2.3.2, i.e.

Operational needs, *Economic sustainability*, *Quest for legitimacy & reputation* and *Financial health,* and one moderating factor that will be discussed by Section 2.3.3, i.e. *Management style.*

The first three dimensions are associated with factors that are external to the water utility and provide larger or smaller incentives to invest in water conservation:

- *Operational needs* refer mainly to those characteristics of the served geographical area that call for water conservation efforts (e.g. water stress or water sources distance).
- *Economic sustainability* refers mainly to the opportunity for water conservation efforts to enhance returns (e.g. additional regulated revenues or targeted public subsidies).
- *Quest for legitimacy & reputation* refers to pressures towards water conservation exerted by stakeholders who prevail in the country.

The external opportunity to invest has to be balanced with internal factors. The fourth dimension is associated with financial constraints that may inhibit the utility's willingness to invest:

- *Financial resources* refer to the utility's capacity to invest in water conservation (e.g. financial health, lack of alternative investment obligations).

Finally, once each dimension has been assessed, the final investment likelihood is determined by the subjective attitude of utility management.

- *Management style*, i.e. business-like, civil-servant, discretionary, refers to the nature of managers' objectives and their autonomy in decision making.

Table 4 and Table 5 summarize the necessary steps to apply the taxonomy to a given utility. Particularly, Table 4 describes a preliminary check of utility's financial health and predictability. Once the utility is acknowledged to be worth an in-depth analysis, Table 5 illustrates how to combine management types and external dimensions in order to assess the utility's significance as a target user.

Table 4: First step: Is the utility worth analyzing further?

	Financial resources (Utility)	
Management style (Utility)	***Fair or good***	***Poor***
Business-like or Civil servant	**Further analysis**	~~**Financially constrained**~~
Discretionary	~~**Unpredictable**~~	~~**Unpredictable**~~

Table 5: Second step: May the utility be a target user?

	External dimensions		
Management style	***Operational needs (Local area)***	***Economic sustainability (Country)***	***Quest for legitimacy & reputation (Country)***
Business-like	**+**	**++**	**++**
Civil servant	**++**	**+**	**+**

2.3.2 Taxonomy dimensions

This section defines more in detail individual external and internal dimensions of the taxonomy, and illustrates qualitative checklist of underlying drivers.

Operational needs

The water supply operations determine the utility's need to invest in water conservation. They may be dependent upon a number of factors related to the traits of each served area:

- *Water scarcity*
- *Topology of the network*
- *Maintenance costs*
- *Energy costs*
- *Water treatment costs*

Local *Water scarcity* is the deficiency of available water resources to meet water usage demand in a given served area. Water scarcity can involve *water stress* (i.e. a situation in which the demand for water exceeds the available supply during a certain period or when poor quality restricts its use) and *water shortages* (caused by altered weather patterns, including droughts). *Water scarcity* can be assessed through public-domain indicators. See for instance Water availability and Water exploitation measures (source: European Environment Agency, http://www.eea.europa.eu/themes/water/water-assessments-2012).

Topology of the network refer to the geographical characteristics of the region where the network operates, which may influence the operational and maintenance cost, due to such aspect as the presence of different altitude levels in the network, possibility of storing excess water, and need of pumping. In particular, variable altitude profile may induce over/under pressure in the network, which may in turn cause degradation of the infrastructure or service.

Maintenance costs refer to the need of replacing or repairing infrastructure elements, especially pipes and pumps, which may have degraded over time due to use, overpressure or corrosion, and can cause water leaks, reduction or even interruption of the service.

Energy costs are related to water extraction, treatment and supply via a system of pumps and pipes for use by customers. The amount of energy needed depends to a great extent upon local geographical and hydrogeological conditions and raw water quality. Accordingly, the energy required per each cubic meter of supplied freshwater is very site specific. According to the European Benchmarking Co-operation, power consumed by utilities to supply water from different sources may vary between 0.3 KWh/cubic meter at the 10 percentile and 0.9 KWh/cubic meter at the 90th percentile. To sum up, *energy costs* can depend upon:

- ✓ *Energy prices*, which are mainly country-specific; their effect may be counterbalanced in case of multi-utilities, which can self-produce or even sell energy as well.
- ✓ *Distance to water sources*, i.e. the distance between the nearest water source and the distribution points;
- ✓ *Territorial topography*, i.e. the surface shape of a geographical area, including not only relief, but also other natural and artificial features;
- ✓ *Raw water quality*, which depends upon the concentration of pollutants into the sourced water, e.g. agricultural contamination with nitrates and pesticides, and entails advanced energy-using treatment.

Water treatment costs are related to the treatment of the raw water at the source to remove pollutants and include expenditures on materials (chemicals and replacement parts), labour and energy for the acquisition and treatment of water (see last point above). Depending on the water source (surface or ground water) treatment processes can vary as long as the associated cost. Labour and chemicals generally cover together more than 40% of the overall

treatment cost.

Economic sustainability

The economic sustainability of utility's investment, i.e. the investment capability to produce a positive payoff, is mostly determined by economic regulation. Water utilities' revenues and, even though to a lesser significant extent, costs results from different forms of regulation. The most significant are:

- *Delivery choice*
- *Incentive regulation*
- *Public subsidies*

Delivery choice refers mainly to the degree to which the State or sub-national and local governments that are legally responsible for the provision and control of water services rely on in-house provision (own departments) or instead outsource service provision to independent public enterprises or private companies. Different delegation contracts can be used, according to which different risks are transferred to the utility. If new plants and networks have to be built, a concession arrangement is used, while other arrangements prevail if the utility is requested to manage services. If the delegation contract is centered around management tasks and encompasses a short time horizon, investments are less likely.

Incentive regulation refers mainly to rules that may link allowed revenues and margins to water conservation efforts or performances:

- ✓ *Price regulation*, which can provide higher incentives to water conservation efforts, e.g. though increasing block rates or higher returns to certain asset classes;
- ✓ *Quality regulation*, which can set water conservation targets and combine them with a system of rewards and penalties.

Advanced price regulation combines cost and price efficiency with quality achievements. For instance, the economic regulator for England and Wales water service, OFWAT, has introduced two water efficiency indicators (the *base service water efficiency*, BSWE, and the *sustainable level of water efficiency*, SELWE) which measure utility-level performance related to water efficiency improvements induced in customers. Targets are established for both the indicators, and SELWE enters the formula used to compute the regulated tariff.

Public subsidies and transfers from EU, national and local public budget may source additional resources for investment in water conservation, and relax financial constraints and/or lower debt service costs. Public finance instruments take different forms (e.g. from traditional grants to more innovative project finance schemes). Nevertheless public subsidies are decreasing in most countries due to public budget constraints and regulation of State aids.

Quest for legitimacy and reputation

Several surveys and public consultations suggest that satisfaction with value for money in the water sector is low, even more so when the water utilities are privately-owned. Accordingly, water utilities have to make efforts to strengthen their relationship with institutional and social stakeholders.

Legitimacy refers to public acceptance of recent regulatory reforms and the institutional setting of water management. *Reputation* refers to stakeholders' opinion about the water utility itself. An investment in water conservation may be a source of legitimacy and reputation among stakeholders with positive effect on its long-run profitability. Water conservation efforts could be part of a strategy to shape the public opinion and to seek political support and/or promotion in the press and media.

In order to assess the utility's quest for legitimacy and reputation, a focus should be made on pressures that are originated by various groups of stakeholders:

- ✓ *Customers (citizens),* who can perceive the investment as responsive to their needs (bill savings related to water conservation) and/or aimed at providing an additional valuable service, as long as they are environmentally aware (e.g. see attitudes of European citizens towards the environment in: http://ec.europa.eu/public_opinion/archives/eb_special_379_360_en.htm#365);
- ✓ *Professional audiences and the media*, most notably the press, financial community and engineering professionals, who can assess water utilities' performance, especially if quality performance benchmarking, i.e. scoreboards of country utilities, are implemented and published by regulators (see OFWAT's measures of level of service for UK water utilities).
- ✓ *Other stakeholders,* such as local and regional governments, and third parties such as nongovernmental organizations, political parties, media and so on.

Financial resources

External factors, such as operations, economic sustainability and quest for legitimacy and reputation can incentivize an investment in water conservation, but internal finance may act as a constraint. Financial resource slack or capacity is necessary to enable the investment. Financial resource capacity is related to:

- *Financial health*
- *Alternative investment obligations*

Financial health refers to the utility's overall capacity to generate cash flows, to ensure shareholders a fair return, and to serve the debt. Relevant indicators, i.e. income, operating margins and cash flows, ROE, debt-to-equity ratio can be drawn from annual reports and other financial statements that water utilities have to post.

Alternative investment obligations refer to high-priority investments, e.g. the modernization and extension of wastewater works and plants according to policy obligations on water quality. For instance, Italy and other EU countries have been prosecuted for the infringement of EU Directives on wastewater treatment and are currently engaged to invest in this sector. In the short-medium term alternative obligations can compete with investment in water conservation and, in the worst case, displace them.

- ✓ *Compliance with policy obligations*, generally available via water utilities' annual reports and the media. Country-level measures of the implementation rate of the EU Directives on urban wastewater treatment are available at the following link: http://ec.europa.eu/environment/water/water-urbanwaste/implementation/implementationreports_en.htm.

Table 6 summarizes the external and internal taxonomy dimensions, underlying drivers, and related checklists.

Table 6: External and internal dimensions and their drivers.

Dimensions	Drivers	Checklist
Operational needs (Local area)	• Water scarcity	✓ Water stress indicators ✓ Water shortages indicators
	• Energy costs	✓ Distance to water sources ✓ Territorial topography ✓ Raw water quality ✓ Energy prices
	• Topology of the network	✓ Variability of altitude ✓ Over/under pressure ✓ Water storage capacity ✓ Pumping required

Dimensions	Drivers	Checklist
	• Maintenance costs	✓ Type of pipes ✓ Age of pipes ✓ Over pressure ✓ Sub-network topology
	• Water treatment costs	✓ Type of water sources ✓ Number of water sources
Economic sustainability (Country)	• Delivery choice	✓ Delegation contract
	• Incentive regulation	✓ Price regulation ✓ Quality regulation (water saving performances)
	• Public subsidies & transfers	✓ Still in force?
Quest for legitimacy & reputation (Country)	• Attitude of stakeholder groups towards conservation	✓ Attitude of customers / citizens ✓ Professional audiences and the media ✓ Other stakeholders
Financial resources (Utility)	• Financial health	✓ Economic and financial indicators
	• Alternative investment requirements	✓ Compliance with other high-priority policy obligations

2.3.3 Management style

Management style refers to managers' objectives as compared to owners' objectives. In fact managers may enjoy a certain degree of autonomy in decision making with respect to public and private ownership. Management discretion is contingent upon water utility's ownership, governance, size, and is great if (top) managers can pursue their own objectives, and behave according to own systems of norms and standards. Three fundamental management styles can be identified:

- *Business-like*, i.e. managers are aligned to private ownership's objectives
- *Civil servant*, i.e. managers pursue citizens' interests
- *Discretionary*, i.e. managers exert autonomy in decision making

The *business-like* management style is typical of private organizations that are characterized by a great emphasis on performances and efficiency, business sustainability also in the short run, profitability and shareholders' value. Alignment between managers and shareholders is ensured by a well-functioning governance. Ideally, corporate governance requires markets for managerial labor and for corporate control to be efficient, i.e. managers are recruited for their professional merits and are concerned for their internal and external career, and stock prices reflect managers' performances. Additionally, managers are monitored and controlled by independent directors, and the overall organization leans on the measure and management of managers and employees' performances.

The *civil servant* management style is typical of State- or municipally-owned (or nonprofit) organizations. It emphasizes a broader set of objectives, such as the city development, equity through universal service and improved access to public services, security and safety, and so on. While the corporate control is not contestable and the recruitment of managers may be subject to political influence, public ownership (e.g. municipality) is active in monitoring and controlling the utility management. Inter-municipal joint ventures are avoided to maintain a close control on management. The market for public managers is efficient and managers are monitored and controlled through the board of directors and performance management systems strategies.

The *discretionary* management style is related to the utility governance more than to ownership. It is characterized by the dominance of internal managers with respect to the

Board of Directors and, hence, ownership. An excessive emphasis is placed on actions and activities that are legal yet aimed at serving own interests, e.g. increasing staff expenditures, sustaining high-visibility actions, revising managerial emoluments, and so on. Management strategies are empire-building oriented and may fail to create shareholder value and to enhance public welfare. Top managers may be only weakly career-concerned.

In order to decide upon the management styles described so far, a second set of drivers can be checked. They refer to:

- Ownership structure
- Size of the organization
- Corporate governance

The drivers are summarized in the second column of Table 7. The last three columns report the characterization of each driver for each type of management style. A private water utility cannot be characterized by a civil servant management style. Obviously, it should be quite difficult to find water utilities that fit perfectly one of the three types of management style. Therefore, this table should serve as a checklist to qualitatively assess the degree of correspondence of the target water utility to each type.

Table 7: Management style dimensions and drivers.

	Ownership		**Size**	**Corporate governance**				
Management styles	***Nature***	***Fragmentation***	***Large, medium, small***	***Market for corporate control***	***Market for managerial labour***	***Outside directors***	***Political recruitment***	***Performance management systems***
Business-like	Private	High or low	Any	Yes	Yes	Yes	No	Yes
Civil servant	Public	Low	Small or medium	No	Yes	Yes	Yes or no	Yes
Discretionary	Any	High	Large	No	No	No	Yes or no	No

2.3.4 Taxonomy application: Steps

In order to apply the taxonomy to a given utility and to learn about its potential for investments in water conservation, inference should first be made on the utility's management style and its financial resources. As discussed at length by Section 2.3.3 (see also Table 7), if the management style of the focal water utility is discretionary, managers' decisions are by far more uncertain, because they respond to logics that are highly individual. If investment decisions are unpredictable, a further application of the taxonomy is of limited use, and ad-hoc evaluations are necessary. If the management style is business-like or civil servant instead, in order to conclude on the utility's capacity to bear costs and expenditures related to the investment, a check should be made on its financial resources, as defined by Section 2.3.2 and Table 6.

The first step outcome is a statement on the utility's potential as a target user: *Unpredictable*, *Financially constrained, Further analysis*. The first step logic was summarized by Table 4.

Secondly, if the utility turns out to be worth *Further analysis,* an assessment of more objective drivers should be made, i.e. *Operational needs, Economic sustainability and Quest for*

legitimacy & reputation. The external dimensions can be assessed according to Section 2.3.2. Table 6 provides the checklist of drivers for each dimension. Each dimension should be evaluated separately, at local or country levels. Once the relevance of each dimension has been assessed, it can be weighted as illustrated by the following examples. It should be remarked however that the effect of external dimensions on the decision to invest in water conservation systems is moderated by the utility's management style, i.e. *Business-like* or *Civil servant*, as *Discretionary* was ruled out by the first step.

- *Business-like* managers are expected to put greater emphasis on economic sustainability and the quest for legitimacy and reputation. Operational needs, e.g. water scarcity, are still considered but have a smaller influence on the investment decision.
- *Civil servant* managers first of all concentrate on operational issues and only secondarily pay attention to economic criteria. Legitimacy and reputation are taken into account to a more limited degree than by business-like managers.

Table 5 summarized the significance attached to each dimension by both management styles. The weight attached to dimensions can be High (++) or Medium (+).

2.3.5 Taxonomy application: Some examples

This section illustrates how the taxonomy is applied to a set of fictitious utilities. Table 8 summarizes the first step outcome, and illustrates how the final assessment is formulated for each utility case, after having evaluated individual dimensions and weighted them by management styles.

Utility A

Utility A is a quite large private water utility. Its shareholding is traded on the stock exchange, and the main shareholders are institutional investors. Effective corporate governance is in place (e.g. outside directors, performance management systems). The market for utility managers is well functioning. As a result utility managers are unlikely to behave discretionally, and their attitude can be assumed to be *Business-like*. As a result they will attach a great importance to economic sustainability and legitimacy & reputation. In addition, the utility does not undergo high priority obligations for alternative investments, and its financial health is *Fair*.

In sum, according to Table 4, the utility is worth *Further analysis.*

The served area is quite arid. A large part of the users are located in touristic cities that suffer from water stress conditions during holiday seasons. Energy prices are quite high in the country. As a result, operational needs can be assumed to be *Important*. The utility is *Likely* to seek greater legitimacy and reputation through water conservation actions, in order to respond to citizens and NGOs who challenge traditional water management strategies. In the country utilities supply water and wastewater services based on long-term delegation contracts by the government, but price and quite regulation are pretty traditional. Tariffs do not ensure greater profits if energy costs are saved, nor they award efficiency-enhancing investments with greater returns. Quality regulation virtually does not exist. Economic sustainability is likely to be *Poor*.

Utility A is not a *Target user* for the SmartH2O project assets, mainly because of poor regulation.

Utility B

Utility B is a private water utility. Management style and financial resources are the same as in Utility A.

In sum, according to Table 4, the utility is worth *Further analysis.*

Social and institutional pressures are similar to those exerted on Utility A, i.e. same quest for legitimacy and reputation. Operational needs are *Slightly important,* however, because the only challenge to meet are water stress conditions during holiday seasons. At the same time a quite advanced quality regulation is enforced, and tariffs are designed to award customers' progress with conservation if suitable actions have been carried out by the utility. Economic sustainability is likely to be good.

Utility B may be a *Target user* for project assets.

Utility C

Utility C is a quite large inter-municipal joint venture (i.e. municipal ownership is fragmented across some cities). Corporate governance is rather poor, with internal managers sitting on the board of directors and any or very obsolete performance management systems. Utility managers' hiring and careers are traditionally dominated by politics, and are only weakly linked to professional expertise and performances.

In sum, according to Table 4, the attitude of utility's top managers can be assumed to be *Discretionary*, even though financial resources are as fair as in Utility A

In principle, water conservation investment could be highly likely, because operational needs and quest for legitimacy and reputation are the same as in Utility A, while economic sustainability is the same as in Utility B. Nevertheless a supplementary ad-hoc investigation is necessary because managers' attitude is *Unpredictable* due to their discretion.

Utility D

Utility D is a small-medium municipally-owned utility (i.e. ownership is held by only one city). Effective corporate governance is in place (e.g. outside directors, performance management systems). The market for public managers is well functioning, and politics only very rarely makes pressures on the utility. As a result the attitude of utility's top managers can be assumed to be *Civil servant* (i.e. they do not behave discretionally). Financial resources are *Fair*.

In sum, according to Table 4, the utility is worth *Further analysis.*

Operational needs are as *Important* as in Utility A, and managers attach a great weight to this contingency. Quest for legitimacy and reputation is *Likely*, and Economic sustainability is slightly better than in Utility A (*Fair)*, because the pricing scheme in force ensures a higher return if investment has sizeable water saving impacts.

Utility D appears to be a *Target user* for project assets, mainly because of the push of operational needs and the civil-servant mind set of managers.

Table 8: Examples of taxonomy application.

			Dimensions						**Outcome**
Cases	**Management style**	**First step**	***Operational needs (Local area)***		***Economic sustainability* (Country)**		***Quest for legitimacy & reputation (Country)***		
A	***Business-like***	Further analysis	Important	+	Poor	++	Likely	++	~~**Not now**~~
B	***Business-like***	Further analysis	Slightly important	+	Good	++	Likely	++	**Target user**
C	***Discretionary***	~~**Unpredictable**~~							
D	***Civil servant***	Further analysis	Important	++	Fair	+	Likely	+	**Target user**

3. Overview of customer behaviour analysis and water demand models

In this Section we overview the recently emerged markets of user models and data sets, originating from the diffusion of smart meters in the water sector.

3.1 User models

Urban water demand patterns mostly depend upon water consumers' behaviours, which, in turn, are affected by external determinants (e.g., climate conditions, calendar dependencies [OMHS7; WZC10], social factors (e.g., age, income level, households features) [FMJ9; SSPC4], and reciprocal influence [RMB7]. The mathematical modelling of such individual and collective behaviours is a fundamental step to build accurate estimates of water demand at the urban level and, consequently, to design effective management strategies.

Before the advent of smart meters (i.e., meters able to record water consumption at a sub-minute scale), user models were based on billed or low-resolution data (i.e., resolution lower than a minute) for the following purposes: i) assessing the users' elasticity to water price at the city level [Y73; HL67; SW91], ii) studying the impact of water efficient devices [LTB11], and iii) inferring the influence season and calendar dependency have on residential water use variability [OMHS7; WZC10].

In the last twenty years, smart meters allowed the development of several detailed, high-resolution studies, which comprise the following phases:

- Water consumption data disaggregation (see Section 3.1.1) that performs a classification of water flow data into different water end use categories. Algorithms performing this operation are needed because the direct measurement of water consumption at each fixture is considered unfeasible for a real-world, large-scale implementation (the number of sensors that should be used would be too resource intensive, costly and intrusive);
- User profiling and modelling (see Section 3.1.2) that includes the identification of the main determinants of residential water consumption, water demand forecasting and identification of potential water saving actions.

Among these studies, we mention:

- The *Residential End Uses of Water Study* (REUWS), funded by the *American Water Works Association Research Foundation* (AWWARF) from 1996 to 1999 [MDO99];
- The *Water End Use and Efficiency Project* (WEEP), funded by the Building Research Levy, New Zealand, from 2005 to 2007 [H7];
- The *California Single-Family Water Use Efficiency Study,* funded by the *California Department of Water Resources*, from 2005 to 2010 [AQUACRAFT11a];
- *Albuquerque Single-family Water Use Efficiency and Retrofit Study,* funded by the *American Recovery and Reinvestment Act* (ARRA) in 2009 [AQUACRAFT11b];
- The *South East Queensland Residential End Use Stud*y (SEQREUS), funded by the *Queensland State Government*, Australia, from 2009 to 2011 [BS11];
- The *H2ome smart* project, funded by the *Water Corporation,* Western Australia, from November 2010 to February 2012 [ABP12].

3.1.1 Disaggregation algorithms market

The market on this kind of algorithms is widely developed in the electricity sector, as the first studies about energy consumption determinants date back to the 70s [S92] and the research upon disaggregation algorithms for non-intrusive metering has also recently met new developments [KBN10; GOGMVV14; FRDA14].

In the water sector, the research and market on these algorithms developed more recently.

The most widely used algorithm for water consumption data disaggregation has been, since

the 90s, a software called *Trace Wizard*©**:** it was developed in 1996 by Bill DeOreo and Peter W. Mayer [DOM96] for some experimental studies in Colorado (USA) and, since that moment, many studies relied on this algorithm also in recent years (e.g., [H7; WSGTMJ11]).

Figure 3. Aquacraft Inc. logo. Source: http://www.aquacraft.com/.

Trace Wizard© is owned by Aquacraft Inc (http://www.aquacraft.com/). Recently it is no more available as "*Aquacraft has decided to switch from providing Trace Wizard software to a web based service that uses the latest version of the Trace Wizard*© *program (that has never been released). […]. This project is under development, and we hope to have it ready for release in the first half of 2013* (http://www.aquacraft.com/products)". The software is currently being replaced by an on-demand service developed and managed by Aquacraft, which still has a corner on disaggregation techniques both in US and in Australia, where most of the state-of-the-art residential water consumption studies were based (see Figure 4).

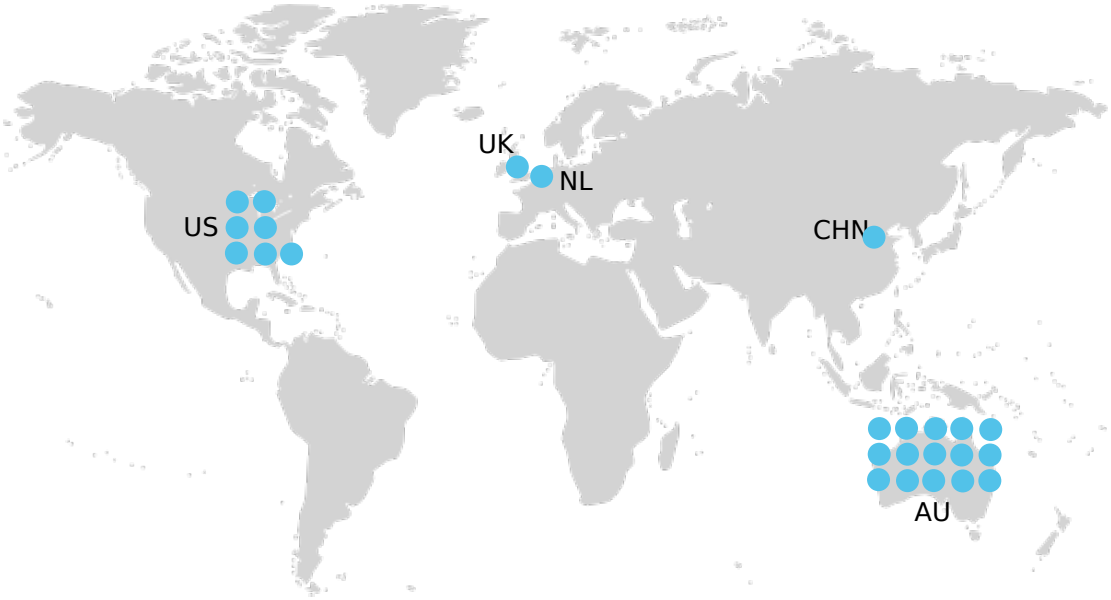


Figure 4: Location of residential water consumption studies conducted between 2009 and 2014.

Other disaggregation software tools have been recently proposed in order to achieve higher levels of accuracy (*Trace Wizard*© achieves accuracies slightly higher that 70%), in an automatic way, without involving expert interventions in the process (*Trace Wizard*© is indeed not fully automated and requires an intense use of time and human resources [NZS13]. However, these methods are at the stage of academic research projects:

- Identiflow: developed in the UK in 2003 [KM3] it is based on a decision-tree approach, and is able to attain high levels of accuracy but is highly dependent on the parameters describing water consuming devices. It was developed and used only in one experimental case study;
- Nguyen et al. [NZS13] developed in 2013 an automatic algorithm for end use categorization, based on Hidden Markov Models, Dynamic Time Warping for pattern

matching and Time-of-day probability functions, in 2013 in Australia. High levels of accuracy were obtained for the majority of end uses, without the need for expert intervention and dependency on fixtures parameters. However, shortcomings on classifying overlapping events still remain.

3.1.2 User models market

Models describing water consumers' behaviour have been especially developed within academic researches. Their main purpose of this operation consists in identifying the predominant variables affecting the total water consumption and, when available, also the disaggregated ones, in order to characterize and forecast users' water demand, thus better informing urban water policies. Among the considered drivers, not only exogenous variables, such as climate [GTJR11] and season [GC91], or controllable economic variables, namely the price of water [BCLCSB80; TS88] are considered, but also users' personal attributes, including economic and socio-demographic factors [GWTK11; WSGTMJ11], such as income or family composition.

Two macro-classes can be identified among the existing works about water user modelling: *single-user* and *multi-user*.

Most of the existing works belong to the single-user models class:

- Most of them limit their field of study to user profiling and characterization phases, without performing demand prediction.
  Among these, some focus on building and understanding the breakdown structure of water end uses, thus they stop at the disaggregation phase, in order to build a consumption profile of the user and identify consumption patterns and trends [LGCJH2; R5].
  Some others look for correlations and dependencies between a set of variables belonging to a particular domain (e.g., dwelling features domain, economic domain, social domain) or to many domains and water consumption, for instance using multivariate analysis and ANOVA techniques.
- Few pilot projects perform demand forecast and are thus suitable tools to inform demand management. Among these, we mention Blokker et al. [BVD10], who developed a stochastic end-use model to predict water demand patterns at the residential scale, and Bennett et al. [BSB13], who proposed another forecasting model built upon smart metered end-use data gathered during a two-year end-use study in South East Queensland (Australia). Yet, the validation of these studies in space and time represents a very challenging task, as the novelty of the topic implies a lack of historical high-resolution water consumption dataset matched with psychographic variables datasets.

Finally, few studies belong to the multi-user group and they generally rely on multi-agent models: these models make a step forward with respect to single-user models, as they consider dynamic interactions among users, thus including the social aspect of the problem.

Rixon et al. [RMB7] explored the use of multi-agent models to compare the effects of a fixed-price or variable price policies, showing the importance of social network structures and mechanisms of mutual interaction and mimicking have on the final water consumption. However, this was simulated through an artificially generated community, thus lacking of validation in a real case study.

In contrast, Chu et al. [CWCW9] proposed an application of multi-agent modelling to a real case study at the urban scale, in Beijing (China): even though it remains an experimental application, this study strengthens the usability of multi-agent systems as tools for estimating the impact of different water saving measures on the community, as they provide a flexible framework that can be calibrated according to each specific context considered.

4. Overview of gamification market and serious games applications

In this Section we overview the recently emerged sectors of gamification of business applications and of digital games applied to non-entertainment tasks.

4.1 Gamification

Gartner defines gamification as

> "the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals" [Gartner1].

The key elements of the gamification are:

- Game mechanics exploits elements such as points, badges and leader boards that are common to many games.
- User experience design describes the journey players take with elements such as game play, play space and story line.
- Gamification is a method to digitally engage, rather than personally engage, meaning that players interact with computers, smartphones, wearable monitors or other digital devices, rather than interacting with a person.
- The goal of gamification is to motivate people to perform tasks, change behaviours, develop skills, or drive innovation.
- Gamification focuses on enabling players to achieve their goals. When organizational goals are aligned with player goals, the organization achieves its goals as a consequence of players achieving their goals.

An exemplary case of gamification is Nike+: launched in 2006, it has more than 11 million users and supports a suite of products. In the first year after the launch, Nike+ FuelBand users racked up 409 billion NikeFuel points, which is the equivalent of running 44 million marathons. Similarities and differences exist among **video games**, **rewards/loyalty programs** and **gamification**, which all share some similar constructs, such as points, badges and levels. Gamification, video games and rewards programs are similar in a few ways:

- They engage "players" voluntarily.
- They use game mechanics such as points and levels.
- They are interactive.
- They incorporate progression to move players to the next level.

But the differences are more important than the similarities. Video games, rewards programs and gamification engage people on very different levels, and they have entirely different purposes:

- **Games** primarily engage players on a fanciful level to entertain them.
- **Rewards/loyalty programs** primarily engage players on a transactional level to compensate them.
- **Gamification** engages players on an emotional level to motivate them.

Table 9: Comparison of gamification with video games and reward/loyalty programs [Gartner1].

	Gamification	Video Games	Rewards/Loyalty programs
Engagement model	Emotional	Whimsical	Transactional
Value offer	Motivation	Entertainment	Compensation
Value Exchange	Shared values	Player pays provider	Provider pays player

4.1.1 Market size, projections and segments

The impact of gamification on businesses and governments is a consolidated reality.

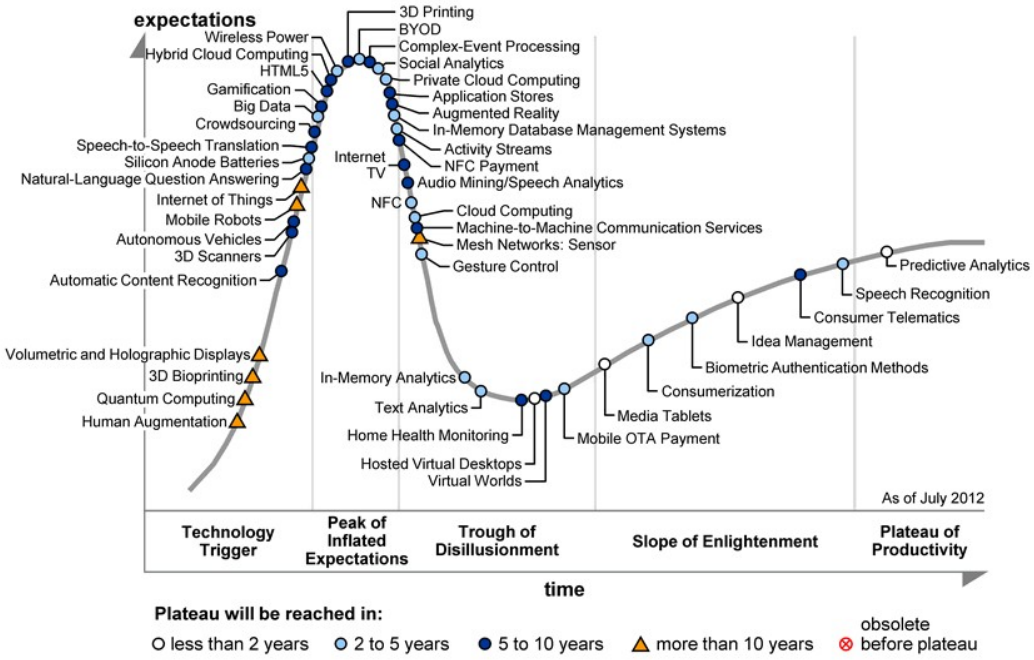
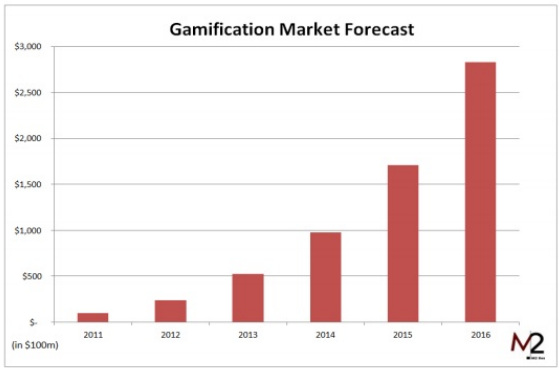


Figure 5: Gamification in Gartner's technology hype curve.

Gartner places gamification in the Peak of Initial Expectation phase of the technology hype cycle curve (Figure 5). Gartner has also forecasted that 50% of corporate innovation will be "gamified" by 2015. Deloitte cites gamification as one of its Top 10 Technology [PEW]. Key vendors dominating the gamification market include Badgeville Inc., Gigya Inc., Bunchball Inc., and BigDoor Media Inc. Other relevant and emerging vendors include PunchTab Inc., IActionable Inc., Gamify Inc., PugPharm Productions Inc. A study of M2 Research performed in 2012 projects the gamification market to reach 2.8 billion in 2016 (as shown in Figure 6).

Market Size and Projections



(in millions)	2011	2012	2013	2014	2015	2016
Total	$100	$242	$522	$980	$1,707	$2,830

Source: M2 Research

Figure 6: Market trend prediction for gamification (source: M2 research).

The key findings of the research are as follows [M2]:

- The size of the gamification market, estimated in 2012 at around $100 million, will grow to more than $2.8 billion by 2016.
- The enterprise represents the largest vertical segment of the gamification market, accounting for nearly 25% of the share.
- Top gamification vendors are projecting 197% growth in 2012, up from 155% in 2011.
- Gamification vendors report that 47% of client implementations revolve around user engagement, with brand loyalty accounting for 22% and brand awareness 15% of implementations.
- Vendors also report that more and more clients are renewing subscriptions and are looking to add more features focused on motivation and training of employees.

According to a different, more recent, report [M&M13], the gamification market is estimated to grow from $421.3 million in 2013 **to $5.502 billion in 2018**. This represents a compound annual growth rate (CAGR) of 67.1% from 2013 to 2018. In the current scenario, the 'Consumer Goods and Retail' vertical continues to be the largest adopter of Gamification Solutions.

M2 Research on market segmentation reveals that, as with many emerging approaches, gamification has quickly gone from a horizontal market to a more vertical orientation.

The primary vertical markets include: Entertainment, Retail, Media & Publishing, Enterprise, Education and Healthcare/Wellness. All these markets employ both consumer and employee-level engagement initiatives.

Figure 7: Gamification market segmentation according to M2 Research.

Government and utilities have still a minor quota of the gamification space, which suggests a positively growing adoption rate (Figure 8).

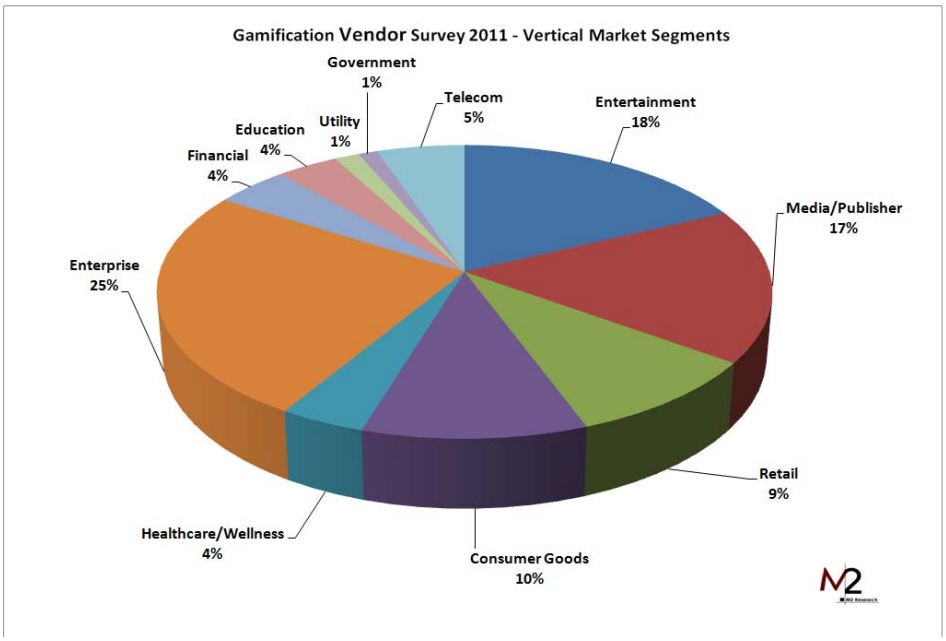


Figure 8: Gamification applications per sector according to M2 Research.

M2 research also focused on how clients were measuring ROI for their gamification projects. The results summarized in Figure 9 show that gamification project can result in substantial improvements to many key metrics used to qualify customers' engagement:

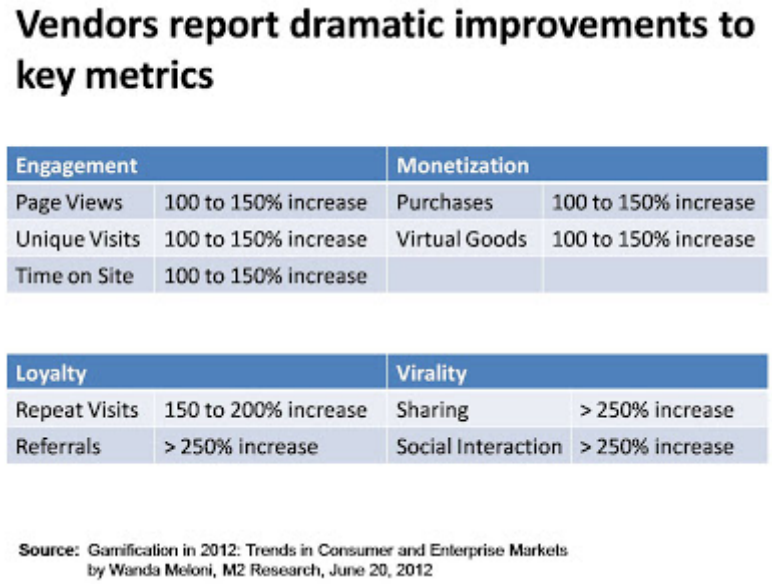


Figure 9: KPIs improvement measured after the introduction of gamification [M2 research].

4.2 Games with a Purpose / Serious Games

One actual definition of the term Serious Games could be:

> "Games designed to serve purposes other than purely entertainment" [VB13].

In this context, "serious games" becomes a very broad concept, which can embrace a lot of different games, with several applications and main objectives. To clarify the possible applications to serious games, [DD11] created a market partition that divides the serious games, according to that main purpose, in thirteen categories: Education, Ecology, Military, Culture, Corporate, Advertising, Scientific, Religious, Politics, Media, Humanitarian, Healthcare and Government.

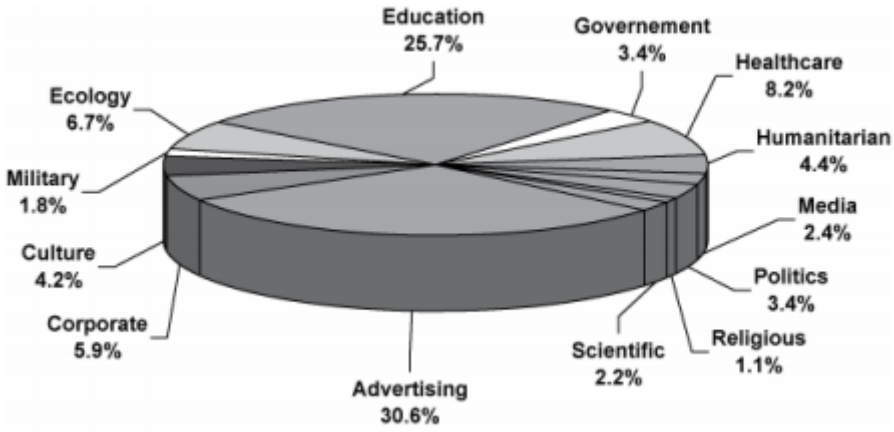


Figure 10 - Serious games market repartition between 2002 and 2011 (1256 games) [3].

On the point of view of market size and value, a forecast by Ambient Insight in 2012 predicts the Serious Games market. It divides the serious game market in two categories, according

with the approach used for the game: game-based or simulation-based learning. The game-based learning will grow from $1.5 billion in 2012 to $2.3 billion in 2017. The larger simulation-based learning market, which includes corporate training games, is expected to grow even more, from $2.3 billion in 2012 to $6.6 billion in 2017. Altogether, the learning games market will grow from $3.9 billion in 2012 to $8.9 billion in 2017. Much of the growth will come from apps that target the mobile market [VB13].

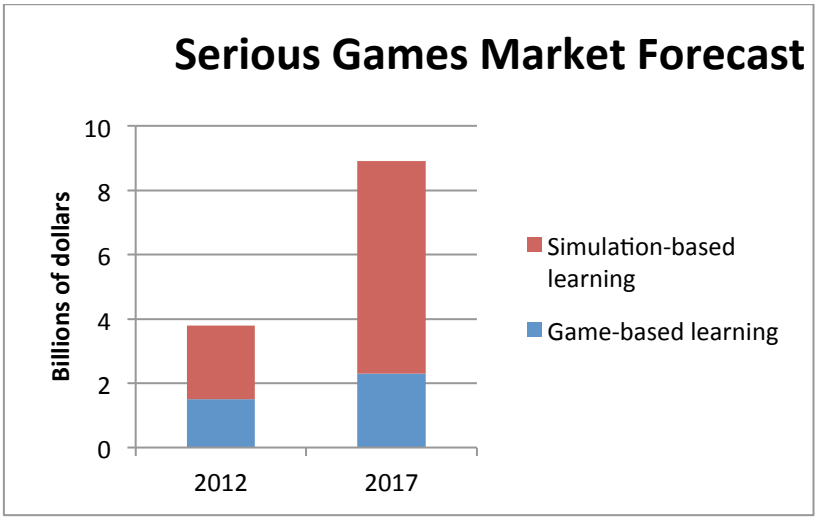


Figure 11 - Serious Game Market Forecast [DD11].

Yet according to Sam Adkins, chief research officer at Ambient Insight, game-based learning companies raised more than $111.7 million. The larger educational game market — including corporate training and educational consumer games — raised more than $1.5 billion in venture capital [VB13]. A forecast by GSV on the educational sector, shows Edu Gaming (serious games aimed to education purposes) with a market size of $2.0 billion in 2012 and with an expected growth to $4.4 billion in 2015 and $7.4 billion in 2017. These data results in a compound annual growth rate of 30%, in the period of five years, which corresponds to one of the biggest growths on the whole educational sector [GSV12].

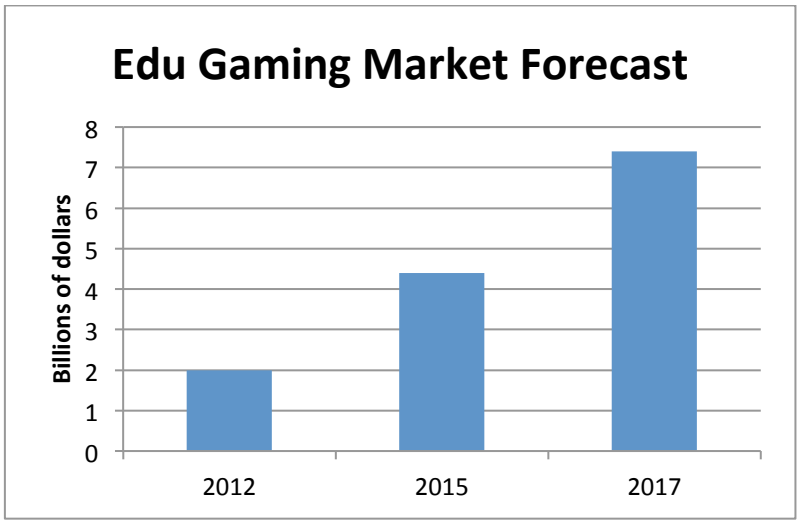


Figure 12 - Edu Gaming Market Forecast [2].

Much of the growth of the serious games market will come from apps that target the mobile market [DD11]. In fact, cases of success in commercial serious games are widespread

especially in the mobile market. Nintendo's DS 2005 game "Brain Age: Train Your Brain in Minutes a Day", together with its variants, sold more than 37 million copies. JumpStart's Math Blaster game has taught children about math for years, and now it has a mobile version. Today, companies like Lumos Labs (maker of Lumosity), MindSnacks, Tiny Tap, and Vivity Labs (maker of FitBrains) are carrying on that tradition. Across the spectrum of learning companies, there are hundreds of start-ups. That includes games such as Teach With Portals, which provides a way to teach physics based on Valve's Portal and Portal 2 video games [VB13].

4.3 Gamification in the public administration and utilities sector

Government and public administrations aim to increase employee productivity and improve citizen participation and relationships. Gamification techniques have proved effective tools to help citizens and employees to change behaviour, engage in innovation and public utility tasks and develop skills [Peg12].

The city of Stockholm gamified speed cameras into a lottery game to reduce traffic speeds, and the U.K.'s Department for Work and Pensions gamified its suggestion box to allow employees to contribute ideas and trade stock in those ideas for workplace innovation [Gartner3].

Some other examples of gamification in the public and utilities sectors include:

- The **Gaming for Good** initiative, a partnership between Al Gore's Climate Reality Project and PSFK, where people designed innovative gaming applications to address sustainability and climate change challenges, generating more than 60 entries from around the world.
- British Gas's **EnCon CITY©** educational initiative, which illustrates the benefits of conservation by teaching players how energy is consumed and where it might be wasted.
- Danish energy firm Vestforbrænding and advertising agency Anew created a pizzeria whose output depended on the amount of energy being saved by local residents. Consumers were first sent information on steps they could take to reduce energy usage, and energy consumption was then measured over a period of time. The less energy consumers used, the more free pizzas were available at the pizzeria.
- San Diego Gas and Electric and Simple Energy launched the **San Diego Energy Challenge** in which consumers could compete against each other to reduce their energy consumption during the summer months, when air conditioners, pool pumps and other seasonal devices can put significant strain on the energy system.

The IDC Energy Insights report [IDC104] explores the potential for gamified applications in the energy sector by analysing real-world innovative gamification projects. It reveals how gamification has been leveraged to:

- engage consumers to realize energy efficiencies;
- improve peak response;
- build customer loyalty;
- acquire new customers in energy competitive markets.

By 2014, IDC Energy Insights expects **worldwide utilities IT spending for gamification tools, applications, and services to be approximately $13.5 million, rising to $65 million in 2016**. IDC Energy Insights also expects that **by 2016, 60% of progressive worldwide energy retailers will utilize at least one gamified application.**

4.3.1 Gamifying the bill

An interesting finding reveals **how gamification can be applied also to the process of bill payment**, one of the sectors where SmartH2O is designing gamification solutions for utilities customers.

As Forrester has outlined [For14], banks have employed gamification to engage customers and employees. Banks like BBVA have used gamification in online banking. Fiserv's current version of the Fiserv CheckFree RXP electronic billing application uses gamification to

increase digital bill pay adoption among its bank clients. The research of Forrester shows that online bill pay is a critical secure site feature on banks' websites. The Fiserv design team considered that better helping end users understand “what they could do” was a key objective. The application redesign found inspiration in one of the most basic, yet popular, mobile games of all time: Angry Birds. Fiserv’s use of gamification added other game mechanics including a clear and prominent progress meter, tutorial elements for new users (e.g., help-bubble popups when a user accesses an often-misunderstood field, explanations of terms, etc.), and a starter screen that explains what an online bill payer will need to accomplish his or her goals.

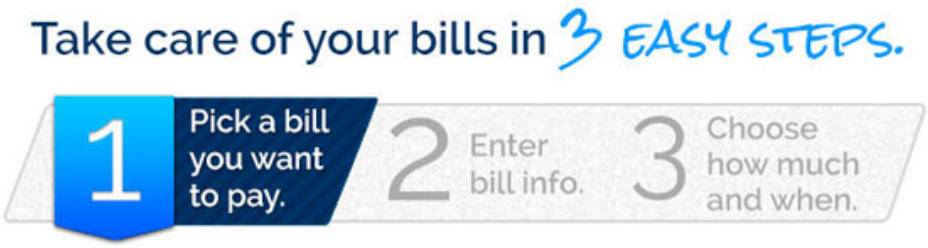


Figure 13: Elements of gamification in the CheckFree RXP application.

In the short time since the new version of CheckFree RXP launched, Fiserv has seen a 4% to 5% drop in online bill pay abandonment among end users.

A better and more user-friendly implementation of the electronic bill of utilities is recognised as a key driver for customer awareness and consumption reduction, especially when coupled with fine grain consumption data availability, as provided by smart metering.

In the US, an initiative called **Green Button**, backed by the White House and by several national utilities, advocates for “Green Button-compliant” utilities to advertise their support with a green button on their customer Web portals. People can then click this to download their personal usage data. Third-party developers can write apps and services that interpret this information without having to worry about supporting different formats. The **common data format problem is a key issue**, which has already jeopardized such products ad Google's PowerMeter and Microsoft's Hohm.

Figure 14: The Green Button logo placed in web portals to certify utilities compliant with the initiative.

The Green Button initiative is expected to foster the growth of an ecosystem of third-party apps, delivering services that take smart meter data, e.g., take hourly and 15-minute increment data, and suggest actionable improvements to the consumer.

However, as a 2010 study from the Netherlands found, *"initial savings in electricity consumption of 7.8 percent after four months could not be sustained in the medium to long term"*. To see significant gains, people need to change their routines more fundamentally, which calls for the introduction of persuasive technologies, such as of game elements and social sharing mechanisms in the digital consumption and bill applications.

In Boulder, Colorado, a company named **SimpleEnergy** updated its Facebook app to

support Green Button data. The app lets users compete with friends for spots on a leader board and earn badges. **A trial in San Diego found that customers who used only energy-management monitors provided by San Diego Gas & Electric trimmed their consumption by a 9%, but those who also competed in SimpleEnergy's game cut theirs by 20 percent**.

5. Overview of the SmartH2O architecture and technical components

As presented in the Project Description of Work (DoW, see Figure 15), the original concept of the SmartH2O architecture indicates the components and the processes that will be implemented in order to achieve individual and collective behavioral response to specific water conservation policies.

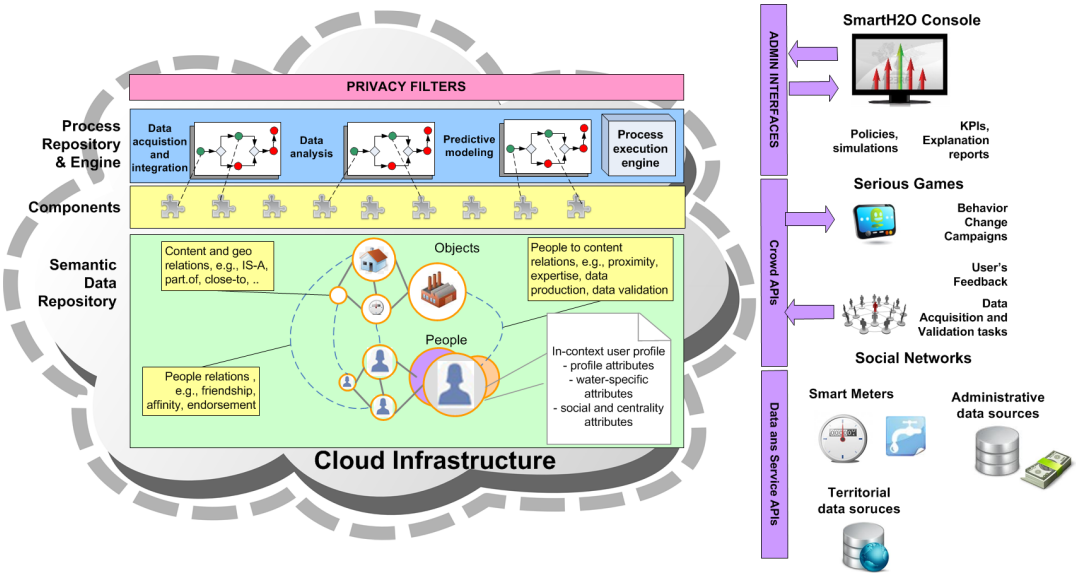


Figure 15: Overview of the SmartH2 architecture (DoW – SmartH2O).

Analyzed as a system, the SmartH2O platform can be seen as a *negative feedback control system*. *A negative feedback control* is specific to a system in which the output of the main process related to a proposed objective is fed back into the input with the purpose to reduce the effect of increasing the input. This kind of feedback control generally induces stability over a proposed objective.

In the real world of the SmartH2O project, the purpose is a sustainable water conservation policy, while the negative control feedback consists of inducing a shared understanding and motivation by the water users, thus leading to a reduction in water consumption, while not compromising the quality of life.

Following this social objective, Smart H2O Platform architecture is designed with respect to the main data flows:

- **Input flow**: user behavioural data (usage metering, social game and social media profile);
- **Control flow**: social game incentives and price signals. This flow is supposed to trigger changes in user behaviour according to Water Utility objectives.

Besides the main data flows, the Platform must also accommodate subscriber profile data coming from Water Utility portals and reporting and analysis tools for Water Utility companies.

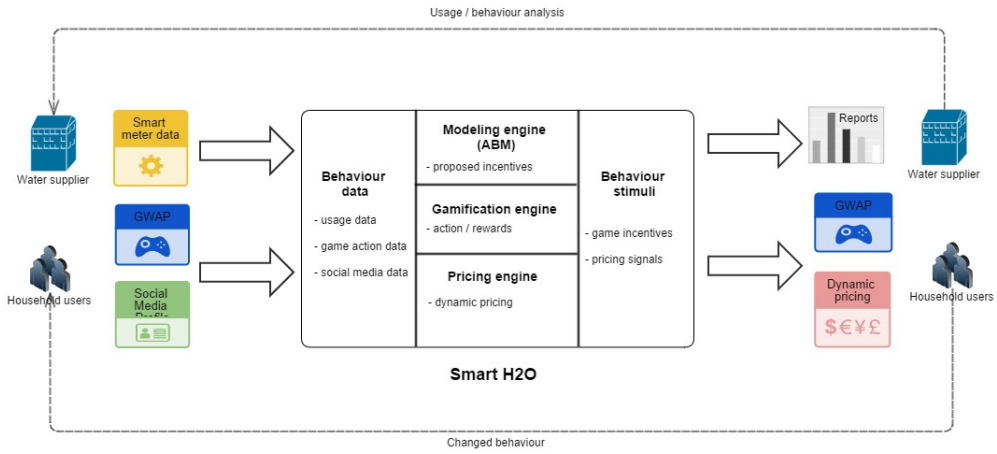


Figure 16: SmartH2O as a feedback system.

The high level design shows that SmartH2O Platform relies on **collecting data** from water utilities, end-consumers gaming actions and social media, **processing data** using data analysis instruments such as gamification, agent based modelling and price modelling, then **measuring and exposing** user behavior changes.

5.1 Platform functional components

The current set of software components that make up the SmartH20 platform design are reported preliminary in deliverable D6.1 DELIVERY MANAGEMENT PLAN AND TESTING SPECIFICATION, which is due, together with the present deliverable, at month 6.

The list of components and their specification will be consolidated in deliverable D6.2 PLATFORM ARCHITECTURE AND DESIGN, due at month 9.

5.2 Layers of the SmartH2O architecture

The technical implementation of Smart H2O Platform and of its constituent components is based on a layered architecture. Each layer was designed with respect to separation of concerns principles. The proposed architecture is organized in four distinct layers:

- Data integration layer
- Data/object layer
- Business process layer
- Consumer layer

5.2.1 Data integration layer

This layer is responsible with bulk data acquisition and bulk data delivery. Inputs of this layer are:

- raw usage data files from Water Utilities. Parallel processing of raw data files will be performed by open source technology such as Apache Hadoop / PIG platforms;
- social media user data;
- other REST based data sources, user portals of Water Utilities.

This layer plays the role of a mediation component that handles raw data aquisition, transformation and storage in a format that can be used be upper layers.

5.2.2 Data/Object layer

This layer is responsible for data storage in SQL (and NoSQL formats where needed for efficient processing). This layer will expose services for upper level for basic access to data. It will store data like:

- Water usage data.
- User profile data.
- Gamification model data.
- Social media data.
- Agent-based modelling data.
- Price modelling data.

5.2.3 Business Process layer

This layer is responsible for implementation of business logic. This layer will expose business services for Consumer layer. Business level components are:

- Gamification engine. This component will provide game scenarios and will handle user interactions with the platform through social game clients.
- Pricing engine. This component will be able to offer dynamics pricing to Water Utilities parameters.
- ABM. This component will only be controlled through the API of an existing ABM package like Repast, for example.

5.2.4 Consumer layer

This layer consists of client applications for Services exposed by the Business Process Layer. Consumer of platform business services can be:

- GWAP client application.
- Modelling client applications.
- Platform administration and configuration application.
- Water utility subscriber application.

6. Identification of exploitable assets

The SmartH2O project is building a platform to support innovative applications in public good (especially water) sustainable consumption, with a focus on the innovative integration of human and machine data collection and processing. To successfully exploit project outcomes and create a Business Ecosystem around them, the main results and elements of the SmartH2O platform with high exploitation potential have been identified and described as **SmartH2O Assets**.

Assets in SmartH2O are project outcomes, elements of the SmartH2O Platform or combinations of elements with a specific exploitation potential; they include software applications and components, methodologies, as well as vertical applications and the platform as a whole.

In this initial version of the exploitation plan, we overview the SmartH2O Assets, as identified at this stage of the project, and explain how these assets are being used as a foundation for the business exploitation plans and the business ecosystem.

As a result **9 Assets** of various types, structured in **4** main topical categories and **5** technical categories have been defined.

Different types of asset include frameworks, components, software elements such as service functionalities, applications, methodologies and algorithms which are defined and explained in detail in the next sections. For some assets overlaps between categories may exist, because they are all strong focus areas of the project: in this case the most relevant category was chosen.

The asset topical categories are:

1. Gamification / GWAP

These assets pertain to the domain of gamification and Games With a Purpose (GWAP). **Gamification** consists in the use of game design elements in non-game contexts to increase user's activity and participation. Such an approach rewards user's actions within one or more existing applications with virtual or real goods, as an incentive to contribute to some business goals of the enterprise.

Games with a purpose (GWAPs) employ established games mechanics and embed within the gameplay some task, such as the performance of a useful action or the acquisition of some piece of knowledge. Both the gameplay and the task can vary, with different emphasis on the educational aspects or on the pragmatic goals to achieve. **Persuasive** games are a subclass of GWAPs where the educational aspect is predominant and the desired effect is changing the user's behaviour durably.

2. Data collection and fusion components

Assets in this category relate to the harvesting of raw data from hard sensors (e.g., smart meters) or "soft" sensor (e.g., human social network activity traces) and the subsequent extraction of low and high level information from such raw digital data. The fusion and enrichment of data is based on the correlation of multiple heterogeneous data sources and on the creation of metadata associated to the collected objects. In case of sensitive data, e.g., data about user's consumption pattern, assets in this category also embody the processing for privacy preservation and compliance with regulations.

3. Modelling, prediction tools and Decision Support Systems

The assets in this category support the exploitation of data sets in order to train and calibrate models capable of predicting water consumption at the household level. Specifically, in SmartH2O, the first model aims to predict the demand of the users/households/neighbourhoods/districts through the analysis and classification of users' behaviours on the basis of their demo/psychographic data as well as their end-use patterns, estimated via disaggregation techniques. The second model focuses on the reaction of users' demands after a change in the pricing strategies of the water utilities or to incentives, such as freebies and rewards in the gamification system. The Modelling and prediction tools along with the collected data sets will offer a high level interface for supporting the decision making

processes of the stakeholders and water utilities.

4. Model calibration/Training data

The assets in this category are the outcome of Data collection and fusion components applied to specific water consumption scenarios, bounded in time and space. They are anonymised and made compliant to privacy regulations. They can be exploited by third parties to train/calibrate predictive models.

Assets that span different categories constitute a special case which we have defined as **Cross-category**.

The Asset technical categories are:

1. **Applications and frameworks**: software which can be run independently and in a stand-alone manner or as a consistent self-contained framework.
2. **Methodologies and algorithms**: assets which represent different forms of intellectual capital or knowledge that precedes specific technological implementation and that have the capacity to create impact as independent and exploitable entities such as the Methodology for creating Crowd Sourcing tasks or the Troll Detection and Privacy Detection algorithms
3. **Components and Libraries**: software that provides specific functionalities and features and can be integrated in different applications, even external to SmartH2O and thus hold value and are exploitable independently. For example the Social graph visual interface
4. **SaaS**: Software as a Service is software that is physically hosted and running on a cloud with users accessing the service through a client (usually a browser). An example is the 'Cool hunting' multimedia content crawling and analysis.
5. **Data sets**: collections of data downloadable from a service portal.

The Table 10 gives an overview of assets per category and per type. The description of each asset (in Section 7) includes a clear definition and description comprising specific value propositions (related to unique selling points) as well as concrete planned and/or performed exploitation actions towards relevant actors in the ecosystem.

Table 10: SmartH2O Assets per category and type.

Asset Category	Asset	Asset Type	Main users
Gamification / GWAP	Gamified online water bill	Application / SaaS	Consumer
	Board Game & customer loyalty relations	Application	Consumer
	Digital Game (extension)	Application	Consumer
Data collection and fusion components	Real time data stream processing, storage and retrieval framework	Component / SaaS	Utility
Modelling, prediction tools and Decision Support Systems	Dashboard for customer behaviour analysis and water demand planning	Application	Utility
Cross-Category	SmartH2O Platform	SaaS	Utility and Consumers

7. Preliminary asset marketing strategy

This section illustrates, asset per asset, the preliminary approach to the exploitation of the identified assets, as understood during the first semester of joint project work.

At the current stage of the project, exploitation strategies do not name specific customers or technical and commercial partners yet. Rather, customer and partner categories have been identified as targets of the actions and strategies.

Obviously, marketing actions would require the availability of at least prototypes of the SmartH2O functionality or, even better, of the result of evaluating such prototypes in the SES and TWUL case studies.

The intellectual property rights (IPR) for the exploitation of the assets is regulated by the Consortium Agreement. The main guiding principle is that “who develops owns”. Non-owning partners are entitled to use **free of charge** the **project results**.

7.1 Gamified online water bill

7.1.1 Asset description

The gamified water bill is an application that transforms the customer bill of a company into a gamified solution.

In principle, the application can be considered applicable to any customer-facing web or mobile platform; for the sake of SmartH2O, the asset description will be focused on the bill application of a water utility or of a multi-utility company.

The main business drivers of the gamified online water bill are:

- Inducing a better relationship with the customers (high value of the driver: quest for legitimacy and reputation).
- Providing customers with easy and understandable access to their water consumption data (smart meter data).
- Raising customers’ individual and collective awareness of more sustainable water consumption.
- Improving customers’ behavioural patterns, such as water consumption; (high value of the driver: economic sustainability).
- Acquiring and dispatching useful information for operations optimization, such as input about quality of service, household profile, behavioural patterns, leaks, and water saving recommendations in stress periods; (high value of the driver: operational needs).

7.1.2 Task producing the asset and IPRs

The gamified online bill will be based on the gamification engine component of the SmartH2O platform, which will be either wrapped with ad hoc customer-facing interface or integrated as a back-end service into an existing application (e.g., the traditional online bill portal of a utility).

The tasks relevant to its production are:

- Task 2.1 Use case descriptions.
- Task 3.1 User data collection and analysis.
- Task 3.3 Algorithms for user profiling.
- Task 4.1 Social games for smart water management.
- Task 4.4 Incentive models and algorithms.
- Task 5.2 Developing new dynamic pricing models.

The core contributors to this asset will be shared among the consortium partners. IPRs will be settled among the exploiters and the contributors parties based on the actual final structure of the asset and its internal usage of the foreground produced by the Project, following the rules

established in the Consortium Agreement.

7.1.3 Target customers and users

This sub-section offers a preliminary description of possible target customers and users for the Gamified online water bill.

Table 11 summarizes information on customers / users.

Table 11: Customers and users of the Gamified online water bill.

Customer / user	Benefits
Water Utility customers	Obtain a one-stop application for managing all the interactions with the water utility Obtain easy and understandable access to one's water consumption data (smart meter data) Receive instant alerts for water flow irregularities, e.g. broken pipes, open tabs, etc. Be rewarded for the interactions, virtually (leader board, badges), and materially (redeemable points) Receive feedback on one's behaviours in terms of water consumption sustainability Optimize water consumption, reduce bills without reducing quality of service Receive special offers (e.g., pilot pricing schemes) Improve one's status in the community as a "green" water consumer
Water Utility commercial and administrative personnel	Improve timeliness of bill settling by customers (e.g., by integration of online payment and rewarding of user's online activity, timeliness, etc.) Obtain commercially useful data Learn about users' attitude towards new pricing schemes
Water Utility operations managers	Better understanding/forecast of water demand and therefore improve operational efficiency Improve regulatory outputs Obtain data on quality of service, pressure level, potential leaks
Water Utility customer relations managers	Improve customers awareness about water consumption behaviours Establish a friendly interface to customers Improve the image of the company Differentiate image from competitors Exploit green values in the communication with the customers Exploit social sharing of achievements among customers to build a friendly corporate community
Water Utility financial managers	Reduce operation and maintenance costs thanks to better demand management
Municipalities	Promote water saving actions through integrating municipal incentive instruments in cooperation with the water utilities into the gamified bill

7.1.4 Exploitation strategies

This section illustrates the strategies and actions envisioned at the early stage of the project. These guidelines will be refined in the next edition of this deliverable (D8.4 due at month 18).

Table 12: Exploitation strategies.

Customer / user	Actions / strategies
Large urban utility	The strategy is to demonstrate the value and ROI of incorporating the Gamified online water bill into the existing online customer portal of the utility. Businesses of this type have a consolidated customer relationship strategy and a well-established IT backend infrastructure. The envisioned strategy is to show the ease of integration of the gamification elements of SmartH2O into a current IT customer facing portal, and the immediate value and ROI that is achievable thanks to the flexible and adaptable concept of SmartH2O. Further element of the strategy is the stress on the holistic approach to customer's relationship, which embraces both gamification of the bill and serious games for brand and customer relationship management. This unique proposition of SmartH2O is deemed attractive for large companies, especially multi-utilities, which struggle in a competitive market and need an end-to-end solution addressing both operational and customer relationships needs coherently. Actions include the building of a quick prototype of the gamification functionality and its embedding in a mock-up customer facing water bill application. Such a prototype will be shown to large utilities inside the project (TWUL) and outside.
Small territorial utility	The strategy for this class of adopters exploits the same messages and business levers as the one for large utilities but with an important difference. Given the small size and possibly the limited investment capacity of the adopters, the focus can be on the SaaS deployment model, which may reduce up-front investment in IT infrastructure, and enable scalable payments methods, such as pay-per-use, pay-per-customer, and similar.
Software service provider	The strategy for this class of adopters is a business partnership where software houses and technology integrators can enrich their offer to utilities with a cutting edge and highly innovative product/service offer. Also in this case, two sub-strategies are possible: the incorporation of SmartH2O functionality physically in a third party application, which may require a license agreement for the incorporated software component; or a SaaS deployment, whereby the third party application calls remotely the gamification services of SmartH2O, which is amenable to more flexible business agreements, such as subscription and pay-per-use.
Digital / Board Game developers	The strategy towards digital, but also board, game developers is the extension / porting of their offer to the market of "cleanweb", "green" applications. These companies could enter a new market by developing games that complement the SmartH2O gamified bill, for example branded for a specific utility company. This case does not require necessarily a licensing, but is an example of partnership for cross-selling and for strengthening/opening new market positions.
Municipalities	The strategy for municipalities involves the development of cooperative incentive models with water utilities (which are frequently controlled, co-owned or co-regulated by the municipalities) into the gamified bill, in order to induce water saving actions by the inhabitants of the municipality. This could for example include the provision of special offers or discounts on specific communal services for users who achieve specific water saving goals.

7.2 Board Game & customer loyalty solution

7.2.1 Asset description

This asset will grant a unique offline experience for the water consumers who are customers of a utility company adopting the SmartH2O concept and customer loyalty solutions, in the form of a **board game**, and to be more precise of a card game (called **Drop!**).

The card game will be revolving around the "push your luck" concept, which is a quite common and famous mechanism in classic game design (the most common example is Blackjack).

The game set will be composed of a deck of 60 high quality cards with custom graphics, possibly tailored to the utility company's visual identity, the point tokens, and the rule book.

The card deck will contain two main types of card: the virtuous and the wasteful ones.

At the beginning of the game the youngest player around the table starts and bets on how many virtuous cards he will be able to draw before picking a wasteful one.

After doing so he draws the number of cards he guessed and if he does not draw a wasteful card the he is entitled to keep all the cards he guessed correctly. Summing up those cards will result in the actual score for the user since those cards will have an attached value on it.

If the user draws a wasteful card he loses all the cards he guessed upon and he needs to distribute them to the rest of the players at his choice. The wasteful card will be kept by the player who draws it to be used in the "mobile app phase", where the players can decide to continue playing online, thus leading them to an interaction with the digital games and eventually with the gamified water meter readings.

The game goes on with the next player till the end of the deck.

The board game will convey the difference between virtuous and wasteful water actions and also promote the image of the utility, by customising the packaging based on the visual identity and brand guidelines of the company.

7.2.2 Target customers and users

This sub-section offers a preliminary description of possible target customers and users for the 7.2 Board Game & customer loyalty relations. Table 13 summarizes information on customers / users.

Table 13: Customers and users of the board game and customer loyalty solution.

Customer / user	Benefits
Water Utility customers	Have a playful experience, with the family and friends. Get useful information of sustainable water behaviour, tailored for both adults and kids. Be rewarded for the playing the game, virtually (leader board, badges), and materially (redeemable points)
Water Utility customer relations managers	Improve the image of the company Possible distribution of the game to customers. Differentiate image from competitors Exploit green values in the communication with the customers Exploit social sharing of achievements among customers to build a friendly corporate community.
Municipalities	Improve the municipality image and citizen relations by distributing the game as award for desired kind of water saving behaviour and actions Promote green values in communication with the citizens Differentiate image from other municipalities, making the municipality more attractive for new citizens and/or green

Customer / user	Benefits
	businesses

7.2.3 Task producing the asset and IPRs

The board game and loyalty solution will be based on the SmartH2O social game design and incentives, studied in WP4. The tasks relevant to its production are:

- Task 4.1 Social games for smart water management.
- Task 4.4 Incentive models and algorithms

The core contributors to this asset will be MOONSUB. IPRs will be of MOONSUB and usage rights will be transferred to third parties by licensing, e.g., for defining branded versions of the game or distribution in specific countries.

7.2.4 Exploitation strategies

Table 14 reports the actions and strategies for exploitation of the board game to be adopted by the different players, from utilities to developers to municipalities.

Table 14. Exploitation strategies of the different customers/users.

Customer / user	Actions / strategies
Large urban utility Small territorial utility	The strategy is to demonstrate the value and ROI of the SmartH2O holistic approach to customer's relationship, which embraces both gamification of the bill and serious games for brand and customer relationship management. The presence of a board game, target to families, is a clear distinctive factor, which may be used in several ways by an utility: as a reward item redeemed by the users of the gamified bill platform after a given achievement, as a standalone customer loyalty tool, as a product in an ecommerce section of the customer portal, etc. Marketing actions include the building of a full-fledged edition of the board game and its field trial. Such an edition will be shown to large utilities (TWUL) and small utilities (SES) inside the project and outside.
Digital Game developers	The strategy towards digital game developers is the extension of their offer to the market of "cleanweb", "green" applications, through a clear differentiating factor: a physical game coordinated with their digital game. These companies could enter a new market by developing games that complement the SmartH2O board game concept, for example branded for a specific utility company. This business opportunity can be pursued by licensing the board game concept, or by defining a partnership for cross-selling the board and digital games.
Municipalities	The strategy for this kind of actor involves communication and PR campaigns involving the distribution of the board game as a means of promotion of and/or reward for sustainable behaviour and socially aware water consumption. This can be integrated into existing communication activities of the municipality such as local municipal events and media campaigns. This opportunity can be pursued by licensing the board game concept or by defining a partnership with the game provider for the promotion of the board game.

7.3 Digital Games (extension to the board game)

7.3.1 Asset description

The truly innovative idea of SmartH2O gamification approach is the connection between the board game concept and the digital game apps. This connection will be integrated in the

game play and realized as follows: as soon as the board game finishes, all the players that ended up with a wasteful card may try to convert it into points, so reverting the ultimate outcome of the game with a “last bet”. The game play requires that the player scans the card he wants to convert with the smartphone camera and integrated app. The app reads the QR code and lunches a mini digital game.

The digital games that challenge the user in the final bet will be defined based on the target gamer (kid, adult, etc.); there will be multiple game mechanics, such as:

- Skill game: the water monster listed in the wasteful card is the character of the mini game; he was not a great water saver buddy and now his fur is full of water. To recover the water and save it, the player will need to perform a skill task (e.g., tap as fast as he can on the moving monster’s avatar). At each action, some water from the monster’s fur will be squeezed into a tank. Saving at least 80% of the water will give the player points.
- Trivia: As soon as the skill game ends or in alternative to it after scanning a wasteful card, the trivia mini game will pop up and a question will be asked with 3-4 answers. Giving the correct answers will grant the user points. Trivia will be personalised if the user logs in to the digital game app and provides profile information.

By exploiting the wasteful cards in last bet challenges, the player may obtain a given amount of points resulting in a possible game tactics about risking and gathering bad cards in order to convert them, augmenting the thrill and unpredictability of the game.

7.3.2 Target customers and users

This sub-section offers a preliminary description of possible target customers and users for the digital game extending the board game concept. Table 15 summarizes information on customers / users.

Table 15: Customers and users of the digital games.

Customer / user	Benefits
Water Utility customers	Have a playful experience, with the family and friends. Get useful information of sustainable water behaviour, tailored for both adults and kids. Be challenged with water sustainability trivia questions. Be rewarded for the playing the game, virtually (leader board, badges), and materially (redeemable points)
Water Utility customer relations managers	Improve the image of the company Differentiate image from competitors Exploit green values in the communication with the customers Exploit social sharing of achievements among customers to build a friendly corporate community.
Municipalities	Improve the municipality image and citizen relations by distributing the game as award for desired kind of water saving behaviour and actions Promote green values in communication with the citizens Differentiate image from other municipalities, making the municipality more attractive for new citizens and/or green businesses

7.3.3 Task producing the asset and IPRs

The digital games will be based on the SmartH2O social game design and incentives, studied in WP4. The tasks relevant to its production are:

- Task 3.1 User data collection and analysis
- Task 4.1 Social games for smart water management.
- Task 4.4 Incentive models and algorithms

The core contributors to this asset will be POLIMI and MOONSUB. Usage rights will be transferred to third parties by licensing, e.g., for defining branded versions of the game or distribution in specific countries.

7.3.4 Exploitation strategies

Table 16 reports the actions and strategies for exploitation of the digital games to be adopted by the different players, from utilities to developers to municipalities.

Table 16. Exploitation strategies of the different customers/users.

Customer / user	Actions / strategies
Large urban utility Small territorial utility	The strategy extends that of the board game. The presence of a digital extension permits to augment the gaming experience with such features as: high-tech allure for young and kids, user's profiling and data collection, updatable information and educational content, direct integration between the game and the gamified online bill for the immediate and seamless reflection of the game achievements of the user in the online profile and gamified bill application. Marketing actions include the building of several instances of mini digital games and their field trial. Such mini games will be shown to large utilities (TWUL) and small utilities (SES) inside the project and outside.
Board Game developers	Game developer companies will be approached, as mini game providers. Especially game development SMEs will find it convenient to ally with large utilities for promoting their game concepts in the highly competitive mobile gaming market and boost their visibility in online app stores.
Municipalities	The strategy for this kind of actor involves communication and PR campaigns involving the distribution of the board game as a means of promotion of and/or reward for sustainable behaviour and socially aware water consumption. This can be integrated into existing communication activities of the municipality such as local municipal events and media campaigns. This opportunity can be pursued by licensing the board game concept or by defining a partnership with the game provider for the promotion of the board game.

7.4 Smart meter data management component – SMDMC

7.4.1 Asset description

Acquiring and processing water counters is one of the actions at the core of the SmartH2O platform. Water counter processing is a repetitive task that can be called by the business logic on hourly, daily, weekly or monthly basis. However the frequency of the water counter acquisition and processing is a key factor in delivering accurate data for correct decision making.

This represents a determining reason to individuate the task of water counter acquisition and processing as a reusable component (Smart Meter Data Management Component SMDMC) in the architecture of the SmartH2O platform.

The primary usage of the SMDMC component is within the SmartH2O platform, but there are no technical issues to reuse this component outside the SmartH2O platform.

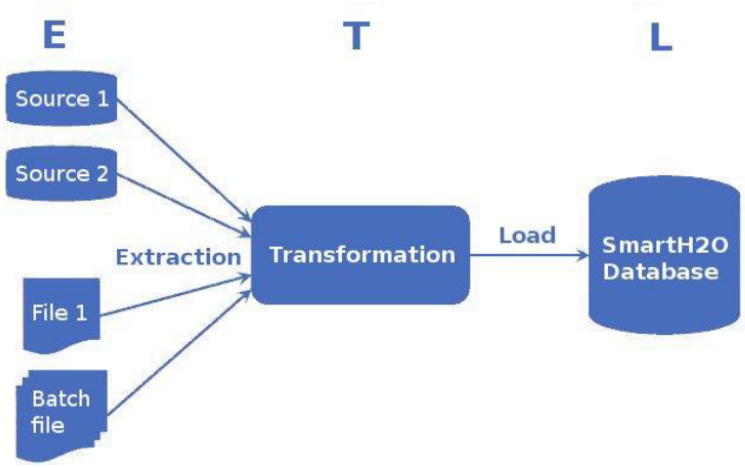


Figure 17: the ETL approach implemented by the SMDMC.

SMDMC component implements the ETL (Extract, Transform, Load) process with no assumption of the utility of the data. The correctness of the output only considers the type and the format of the data being processed. Therefore the SMDMC component can be reused in different real world business logics such as electricity, gas or vending machines counter acquisition and processing.

7.4.2 Task producing the asset and IPRs

The SMDMC component is an outcome of T6.3 - Implementation of the SmartH2O platform.

According to SmartH2O Consortium Agreement, article *9.8.4 Software licence and sublicensing rights*, point *9.8.4.1.1 Foreground - Rights of a Party*, asserts the fact that the Intellectual Property Rights belongs to the developer of the component which has the right of selling, packaging and distribution. However all the other consortium parts are entitled to have Access Right to the SMDMC component Object Code.

7.4.3 Target customers and users

The SMDMC component can be reused in different real world business logics such as:

- Utility companies delivering not only water but also electricity, gas;
- Vending operators auditing and processing vending machines counters, which is an alternative market where SETMOB operated previously.

7.5 Dashboard for customer behaviour analysis and water demand planning

7.5.1 Asset description

The development and implementation of the dashboard for customer analysis and water demand planning will represent a key tool for supporting water utilities in designing and testing alternative water demand management strategies.

The main business drivers of the dashboard are:

- Disaggregation algorithms for the identification of end use patterns, which produce key information for providing feedbacks to the users through the gamified online water bill and for the classification of user behaviours.
- Monitoring customer behaviour and consumption data provided by smart meters and the gamified online water bill platform.
- Agent-based user behavioural models, which allows predicting water demand at the household level while also considering social dynamic interactions among the water users.

7.5.2 Target customers and users

This sub-section offers a preliminary description of possible target users for the implementation of the dashboard for customer behavioural analysis and water demand planning, which are summarized in Table 17. Target groups include: water utilities and regulators at national and EU level, and academic community and researchers.

Table 17: Target users of 7.5 Dashboard for customer behaviour analysis and water demand planning.

User	Benefits
Water utilities and regulator	- Identification of end-use patterns - Accurate feedbacks for water users - Classification of users behaviours - Understanding of individual/household profile - Detecting/fixing water leakages - Testing water demand management strategies
Academic community	- Additional scientific information and data in the field of blind identification (i.e., disaggregation algorithms) and users profiling.

7.5.3 Task producing the asset and IPRs

The dashboard for customer behavioural analysis and water demand planning will be based on the modelling engine component of the SmartH2O platform, which will rely on both the identified end-use patterns as well as the classified individual/household behaviors.

The tasks relevant to its production are:

- Task 2.1 Use case descriptions
- Task 3.1 User data collection and analysis
- Task 3.2 Algorithms for user profiling
- Task 3.3 Modelling future user behaviour
- Task 3.4 Agent-based models of user behaviour
- Task 4.2 Social network data collection and analysis
- Task 5.3 Integrated water supply-demand modelling including dynamic pricing
- Task 5.4 Experimental economics-based tests of pricing policies

The core contributors to this asset will be POLIMI, SUPSI, UOM. IPRs will be settled among the contributors parties based on the actual final structure of the asset and its internal usage of the foreground produced by the Project, following the rules established in the Consortium Agreement.

7.5.4 Exploitation strategies

Table 18 reports the actions and strategies for exploitation of the utility dashboard to be adopted by the different players, from utilities to developers to municipalities.

Table 18. Exploitation strategies for the different users.

User	Actions / strategies
Water utilities and regulators	- Raising awareness on the potential of end-use data analysis for supporting the design of water demand management strategies - Support the water utilities through multi-agent simulation platforms to test alternative water demand management strategies
Academic community	- Publication of the project results in journal articles - Publication of the project reports in the website so that they can be accessible to a wide audience - Participation in national and international conferences - Programme meetings to foster collaboration among relevant

User	Actions / strategies
	projects

7.6 SmartH2O Platform

7.6.1 Asset description

Besides the specific assets described in the preceding sections, SmartH2O will also deliver an integrated, end-to-end solution for socially-enabled, smart-meter powered, gamified water management.

The platform will permit a water utility to:

- Enrol customers in an online portal.
- Interact with customers with business applications (e.g., electronic water consumption bills), extended with gamification tools and social games.
- Engage users by means of achievements and rewards systems, based on both the metered consumption or on actions performed by users in the business applications and in educational digital games.
- Promote awareness and sustainable behaviour as a result of the interaction with social games and gamified business applications.
- Collect data from users thanks to the engagement tools provided.
- Obtain feedback on alternative pricing schemes from customers using the social engagement tools provided.
- Correlate psychographic and consumption data in a water demand prediction model at the level of the household.
- Predict water consumption patterns in different scenarios thanks to the water demand prediction model.

7.6.2 Target customers and users

The target users are the union of the users of the various components making up the platform. The end-to-end nature of the platform makes it particularly suited for small-to-medium size utilities, with a limited provision of online digital tools for customer interaction, and mid-to-low IT investment and infrastructure.

This target can be reached with either a traditional on-premises software licensing approach or with an off-premises cloud-enabled, Software as a Service (SaaS) approach.

7.6.3 Task producing the asset and IPRs

The SmartH2O platform is the ultimate output of the technical work performed in the entire project, so all the technical and evaluation workpackages will contribute to it (WP2-WP8).

7.6.4 Exploitation strategies

In order to exploit the business potential of the SmartH2O platform, several marketing actions can be foreseen in the preliminary stage, such as:

- **Creating the *Terms of Service*** document and adapt it for each country or territory targeted for business operations. This document will ensure the right of the SmartH2O Consortium to sell the SmartH2O platform in respect to the local laws.
- Preparing the **list of possible prospects** of the targeted market. This is a necessary step to figure out which companies would be interested in acquiring the SmartH2O platform. This will represent the targeted audience that would be focused on for marketing the platform.
- **Doing a research dedicated to water utilities** operating on the local market in order to discover their strategy regarding an efficient usage of water resources and consequently to promote SmartH2O platform as a starting point for getting an improved interaction with the end-consumers. The research will also address the impact of local regulation on

adoption likelihood.

- **Evaluating the market** in order to find out how much competition is on the market and who are the main competitors. An important action to perform during this step is **setting the price** of the commercial offering. In order to set the price some methods can be applied, such as: analysing the potential benefit obtained by the customer after implementing SmartH2O platform and proposing a price that would be paid from the future benefit, or comparing the SmartH2O platform services with similar services already offered on the market and determining a worthy price.
- Preparing a **marketing brochure** to describe the SmartH2O platform. The document will describe the main benefits brought by the Smarth2O platform to the water utilities, end-users and to the urban water ecosystem. The brochure will represent an "off-the-shelf" material, ready to be used in warm or cold calls. Also, because of the strategic significance of the SmartH2O project, the brochure is an useful material for accompanying some commercial bids for projects regarding directly or indirectly the water utilities or water user communities.
- Setting up a **website for offering Demos over the internet** of the SmartH2O platform and allowing the prospects to schedule on-site Demos, along with providing preliminary information describing the prospect (e.g. name of the business, type of the business, number of water users, business address, contact details) .
- **Going live with the marketing plan** and adapt it based on the market feedback.

8. Individual/Joint exploitation plans

8.1 SUPSI

8.1.1 Contribution to the project

SUPSI coordinates the project and it also leads (besides WP1, the management work package) WP3 User Modelling. SUPSI also contributes to most work packages. Overall the major technical contributions are focussed on:

- Design and implementation of algorithms for user profiling, based on water consumption and on socio-demographic data of the services. SUPSI is committed in the acquisition of socio-demographic data of the water users through questionnaires and iterations with the water utilities taking part at the project (i.e., TWUL and SES).
- Design and implementation of disaggregation algorithms for the identification of end use patterns.
- Design and implementation of agent based models.

8.1.2 Involvement and return expected

The SmartH2O assets will be exploited by SUPSI in its ongoing and future research activities as follows:

- The development (jointly with POLIMI) of **disaggregation algorithms** for the identification of the end-use patterns will be generalized into a fully-automated, non-intrusive software, which can be used in other sectors, such as energy or gas. Furthermore, the developed disaggregation algorithms can be also used to solve other challenging data-driven modelling problems where the inputs of the system has to be reconstructed from the observed output signal (e.g., identification of the seismic input at depth and the characteristics of the travel path of the seismic waves based on a recorded seismic motion).
- The development (jointly with POLIMI) of the **agent-based user behavioural models and water demand prediction at the household level** will be generalized into flexible tools supporting water utilities in designing and testing alternative water demand management strategies.

8.2 POLIMI

8.2.1 Contribution to the project

POLIMI leads WP4 Saving water by social awareness and WP9 Dissemination. It will also be involved in all work packages. As such, POLIMI's key technical contributions comprise:

- Design and implementation of a common data model for hosting the heterogeneous data enabling the SmartH2O platform services.
- Development of social network analysis, trust, incentive and user profiling techniques, in support of the gaming and gamification approach of SmartH2O.
- Design and implementation of a software gaming framework helping application developers inject gameplay elements into existing applications, so to rapidly turn them into gamified applications.
- Design and implementation of disaggregation algorithms for the identification of end use patterns, which represent key information for providing feedbacks to the users through the gamified online water bill (jointly with SUPSI).
- Design and implementation of agent-based user behavioural models predicting water demand at the household level in order to support water utilities in designing and testing alternative water demand management strategies (jointly with SUPSI).
- Design and development of integrated water supply-demand modelling tools,

including dynamic pricing

8.2.2 Involvement and return expected

POLIMI is fully committed in exploiting some of the SmartH2O assets in its ongoing and future activities:

- All the assets and results of the project will be exploited to strengthen POLIMI's position as one of the internationally recognized excellence centres for research in such areas as:
  - Gamification, serious games, crowdsourcing and human computation.
  - Water management and control, data-driven modelling, and agent-based modelling
  - Price and non-price measures for resource efficiency.
- The **Real time data stream processing, storage and retrieval framework** will be reused in research and technology transfer activities related to data stream processing, Internet of Things architectures, data fusion for mobility management, and social network data mining for expert-based and community-based crowdsourcing. Activities and contacts in this direction are already ongoing in the in FESR project Proactive, http://www.proactiveproject.eu, where POLIMI is partner.
- The **Gamified online water bill** and the **Digital Game** will be generalised into a horizontal Gaming Framework, so to make it applicable to general purpose gamification projects. Specifically POLIMI plans to use a generalised version in other utilities and public administration sectors besides water (e.g., energy, transport). Both funded projects and projects with industrial customers will be approached with a demo purposely constructed to show the power of the gamification concept in animating the community of customers via education al games, achievements, challenges and redeemable points.
- The development of **disaggregation algorithms** for the identification of the end-use patterns will be generalized into a fully-automated, non-intrusive software, which can be potentially used by other water utilities as well as in other sectors, such as energy or gas.
- The development of the **agent-based user behavioural models and water demand prediction at the household level** will be generalized into flexible tools supporting water utilities in designing and testing alternative water demand management strategies.
- Future and ongoing exploitation of **Water demand models** and **Innovative pricing schemes** will be undertaken jointly with UoM. More general results and lessons learned about demand drivers and price impacts can be re-used for advisory research contracts with utilities and regulatory authorities, while econometric methodologies and conceptual frameworks can be reused for exploratory research in the broader field of resource efficiency.

8.3 EIPCM

8.3.1 Contribution to the project

EIPCM leads WP2 (Requirements, design and specifications), provides a major contribution to the research work package WP4 (Saving water by social awareness) and plays a major role in the impact work packages WP8 (Business development) and WP9 (Communication and dissemination). It also contributes to WP3 (User modelling) and WP 5 (Saving water by dynamic water pricing). EIPCM's key technical contributions include:

- Conceptualization and specification of user stories and use cases that will drive the development of the SmartH2O platform
- The definition of the intended usage and outcomes of the SmartH2O platform and the Social Awareness App
- Specification of functional and non-functional requirements guiding the system

design and development of the SmartH2O platform
- Conceptual design of the Social Awareness App based on the Gamified Bill metaphor and of the Dashboard for customer behaviour analysis and water demand planning
- Development of techniques for the analysis of community roles, people influence and trust in social networks, in support of the social awareness and gamification approach of SmartH2O
- Development of incentive models for stimulating users to cooperate in the execution of smart water management tasks
- Design of the user-centered evaluation methodology for the case study validation methodology

8.3.2 Involvement and return expected

EIPCM will exploit specific SMARTH2O assets in its current and future activities in the following way:

- The main assets and results of the project will be exploited to strengthen EIPCM's position as an internationally recognized centre for applied research in the areas of:
  - Social computing, crowdsourcing, human computation and gamification,
  - Participatory media, user-centered design and knowledge visualization
- The Social Awareness App based on the gamified bill will be exploited in research, teaching and technology transfer activities related to gamification of business processes, expert-based and community-based crowdsourcing and social innovation. The app will be used as a demonstrator when approaching SMEs, industry, utilities and public administrations to illustrate the potential application and transfer of SmartH2O gamification and crowdsourcing techniques to other domains (e.g. energy, human resources, fashion).
- The social network analysis techniques being developed, in particular for the analysis of community roles, people influence and trust in social networks in support of the social awareness and gamification approach of SmartH2O will be generalized to make them applicable to different kinds of gamification projects. An exemplatory area of general purpose application of these techniques could be the identification of specific core user groups suitable for cold-starting user acquisition and participation in a given gamification or community-based crowdsourcing application – a challenge that needs to be solved by every new application of this kind.
- The Dashboard for customer behaviour analysis and water demand planning will be exploited as demonstrator in the acquisition of new public funded projects and projects with industry customers in the area of collective intelligence, visual analytics and sustainability.

8.4 SETMOB

8.4.1 Contribution to the project

SETMOB leads WP6 Platform implementation and integration. Also, SETMOB contributes to all work packages, except for WP3 – User Modelling. As a technical partner specialized in software development and integration, SETMOB contributes to the project with:

- Designing and maintaining the software architecture of the SmartH2O platform during the development of the project. As a principle, the SmartH2O software platform is an open system, therefore SETMOB will pay attention to offering an agile approach toward scaling and adapting. This approach is valid both
- Development and integration of specialized software modules: components, services and applications. As the core services will be developed as part of the skeleton of the platform, the design of the platform will allow to plug-in external components developed by other partners of the project as well as by external partners or future

clients of the SmartH2O platform.

- Testing and quality assurance of the SmartH2O software platform. As a standard for development and testing SETMOB will implement Continuous Integration standards and best practices of merging all developer working copies with a shared mainline on very frequent time base.
- Business development related to the SmartH2O platform. According to the Consortium Agreement, SETMOB plans to market the software platform as well as specific components developed within the project.

8.4.2 Involvement and return expected

SETMOB takes as a long-term objective to make full use of the gaining brought by participating to the SmartH2O project. The main benefits foreseen are:

- **Creating new software assets** to be used as a new revenue stream for the company. Such assets are the SmartH2O platform and the Smart Meter Data Management Component (SMDMC - detailed to in the present document)
- **Enlarging the knowledge base** of the project managers and software development team by refining, further learning and applying software technologies such as: Agile Project Management, Continuous Integration, Cloudification, services and component integration through Web-Services
- Significantly **improving the quality of the internal processes** of the company regarding both the technology side but also the project management.
- Using the technical gaining for **improving other ongoing projects** of the company therefore so being able **to further transferring the benefits to our local business ecosystem** (clients, partners, users).
- Gaining **reputation benefits** in the local business ecosystem by associating SETMOB with reputed academic and business partners.

8.5 TWUL

8.5.1 Contribution to the project

Thames Water Utilities Limited (TWUL) is the lead of WP8 (Business Development). TWUL is one of the two water utilities, which will contribute to the development and validations of the SmartH2O platform. For this purpose, TWUL has contributions in most work packages, in order to provide support in the specification of requirements and design in the provision of data for the R&D parts. Being the UK's largest water company, TWUL will prove to be invaluable to the success of this programme. TWUL have an enviable track record of working with leading UK universities, the UK Government Technology Strategy Board, national research partners, e.g., UKWIR, WRc, and implementing novel technologies.

8.5.2 Involvement and return expected

TWUL will provide smart metering data from its existing Fixed Network Trial areas, which have been running for over two years, covering around 5,000 customers that include metered and unmetered customers (customers not being charged on the consumption recorded by the meter installed, which is solely for the purposes of the fixed network trial).

TWUL will also provide customer communication and engagement to recruit customers to take part in the trial and enable the development of an ICT platform.

This project aligns closely with Thames Water's Water Resources Management Plan (WRMP) of serving our customers better, implementing the progressive metering and promoting water efficiency. Also, TWUL has now decided to install a fixed network for all customers and aim to reach a meter penetration of 56% by 2020 (from the current 31%) and that every building in TWUL region will have a meter by 2030.

As part of our WRMP, TWUL is expecting the outputs of the project will help TWUL engage

better with customers, understand the drivers for behavioural change towards water consumption, understand the design of effective incentives and identify campaigns to positively modify the customers' behaviour, through the use of a smart app/website and integration with the existing systems.

8.6 SES

8.6.1 Contribution to the project

SES is leading WP7 SmartH2O Validation, where the various elements composing the SmartH2O platform are demonstrated and validated. Also, the impact on water reduction is measured and assessed.

SES also contributes to other workpackages, especially providing experience and knowledge related to analysing the customer needs and requirements, and extracting information about their behaviour with respect to water consumption.

SES is in charge of setting up a validation test site by providing the SmartH2O project with access to data measured by 400 smart water meters and integrating the data into the SmartH2O platform, providing the water consumers in the Swiss case study with the opportunity to use the social awareness apps to manage their water use behaviour.

8.6.2 Involvement and return expected

SES is willing to position itself as a provider of integrated energy solutions. Traditionally a power utility, SES perceives the need to see the water, gas and electricity nexus as a unity, in order to manage such resources in an integrated and effective manner.

The assets that SES expects to develop in the context of SmartH2O are:

- Acquiring the knowledge to provide multi-metering solutions, integrating measurements from water, gas and electricity meters and aggregating them in the company database.
- Improve the efficiency of billing customers, even in remote areas.
- Develop methods for enhancing consumer involvement and fidelity.
- Acquire methods to profile user consumption and behaviour, including the response to stimuli such as incentives to save energy and/or water, and to variable pricing structures.

8.7 Moonsubmarine

8.7.1 Contribution to the project

MOONSUB contributes competence in board and digital game design, which will be applied mainly in WP4 Saving water by social awareness. MOONSUB leads T 4.1 Social games for water management, where the board game and its digital extensions are implemented.

8.7.2 Involvement and return expected

The exploitation plan for Moonsubmarine ltd is composed by two main strategic lines:

- Board Game exploitation
- B2B opportunities for the Drop! Environment, made of digital mobile games.

The first action is mainly about the exploitation of the board game itself sold in shop.

The first round of production will end up delivering 6000 sets to be used within the Consortium for Customer Loyalty programs and Marketing in general.

After this first round, we plan to print more sets with our associate company (Kaleidos Games) and sell them to the public via the standard retail stores.

The second round may be forecasted in about 5000 sets to be sold.

The second exploitation strategic line is about generalising and then selling the game-based physical-digital model designed within SmartH2O to all the businesses that want to provide a valuable reward to their users.

The games and board game market is now mature and regards the board game as a great business value. The physical objects are perceived as valuable assets and so they can be used as a strong marketing and retention product.

The game concept produced in SmartH2O will be packaged and made into a product and we plan to gather at least 3-4 clients in Europe interested in investing their marketing budget in an object that will showcase fine craftsmanship coupled to cutting edge digital innovation.

9. An action plan for joint exploitation of SmartH2O

In this section, we expand the deliverable in order to describe our action plan to perform a joint exploitation of the SmartH2O assets, enabling all partners to be in the position to transfer in the real world the results and the products of this project. We also detail our Open Source based approach and its motivation.

9.1 Action plan

The actions that have conducted to the present deliverable are part of an action plan extending beyond the lifetime of the project, schematized in Figure 18.

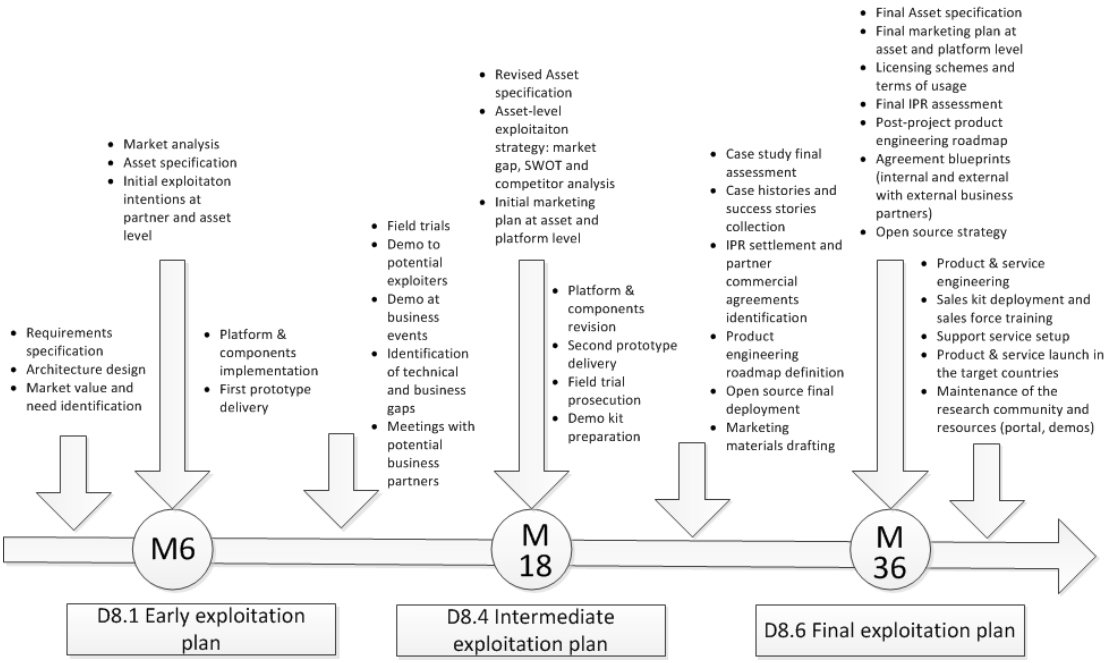


Figure 18: exploitation planning roadmap of SmartH2O.

9.1.1 Performed actions

In view of the exploitation of the results, contacts with technological and business partners have been taken in order to:

- Create an initial nucleus of the SmartH20 ecosystem, in collaboration with WP9, by contacting actors of different types interested in the project results.
- Identify components from past projects that could be reused and adapted to SmartH20 requirements.
- Understanding future options for exploitation by direct talks with potential adopters and partners.
- Broadening the view of exploitation potential beyond water utilities, to other utilities and the game industry.

Following is a list of the activities that were conducted:

- Contact with water utilities:

    - Contact with PROACTIVE water utility partners (Metropolitana Milanese, Milan and TEA spa, Mantova) to show them the SmartH2O concept and plan a possible test with their customers.
    - Contact with the Salt Lake City Utility, as this utility relied on Aquacraft for consumption data disaggregation and end uses characterization.
    - Contact with Studio Fantozzi, a professional water services firm with many connection in Italy and Europe in the water sector.
    - Contact with EMIVASA, the water utility of Valencia, with more than 400'000 installed smart meters. Following the contact, EMIVASA will join the project in Y2 and Y3.
- Contacts with other projects
    - Contact with the CUbRIK project, for the reuse/exchange of results/methods experience in serious gaming.
    - Invitation of WebRatio (CUbRIK partner) to the kick-off meeting for a demo of their gamification framework, which was judged useful as a starting point for the gamification of the Water Utility Consumer Portal.
    - Signing of a MoU with CUbRIK and WebRatio for the reuse of the CUbRIK gamification engine in SmartH20 and for the customization of the gamification framework to show its potential in the water saving domain.
    - Contacts with the COBHAM ERC (Massimo Tavoni and Giovanna Dadda) research grant (https://sites.google.com/site/massimotavoni/Home/awards-honors) to agree on the exchange results and methodologies for the validation of the awareness techniques in the utility sector.
    - Contact with the Proactive Project to understand potential for integration of SmartH2O results in their People Watch demonstrator.
    - Continuous contacts with the project in the ICT4Water cluster, working together at common dissemination and exploitation activities.
- Contacts with other utilities:
    - Visit to British Gas in Reading (UK), to understand their interest in the SmartH20 gaming concept for energy utilities.
    - Contacts with the service business unit off WebRatio to understand the link they can provide to other utilities and multi-utilities (e.g., Trentino Servizi, A2A).
    - Contact with Stadtwerke Haßfurth (German municipal multi-utility for electricity, gas and water) and acquisition as partner in new project proposals based on the SmartH2O gamification concepts and its transfer to energy saving (one proposal in the EU CAPS programme, another in the EU EE programme); this multi-utility has an installation of base of 10.000 smart meters in the City of Haßfurth and delivers completely renewable energy.
- Contacts with game industry players:
    - Contact with an Italian board game producer to understand the options for distributing the SmartH2O games in Italy, to support the utilities in advertising their approach on sustainable water usage.
    - Review of several mobile/web game development frameworks and libraries (including Play!) as part of a preliminary competition analysis.
    - Test of Titanium Framework (http://www.appcelerator.com/titanium/) with the Platino plugin specifically designed for game development. (http://lanica.co/products/platino/engine/), as a potential community to engage in the ecosystem.
    - Exploration of Unity 3D and its community as an alternative for multi platform 3D game engine.

- Contacts with technological players:
    - Contact established with Bill De Oreo from Aquacraft, to explore the possibility to try/purchase the TraceWizard software for water consumption disaggregation. This software has been used by many water utilities for data

disaggregation and end uses characterization: it is therefore considered the benchmark software for water consumption data disaggregation.

- Contacts with environmental associations and municipalities:
    - Contacts with and presentation for NABU - Nature and Biodiversity Conservation Union (the biggest German environmental association with 520.000 members) and acquisition as partner in new project proposals based on the SmartH2O gamification concepts and its transfer to energy saving (one proposal in the EU CAPS programme, another in the EU EE programme).
    - Contacts with and presentation for BUND – Friends of the Earth Germany (the 2nd biggest German environmental association with 480.000 members and one of key policy influencers on sustainable energy consumption in Germany) and discussion of opportunities for collaboration in strategic dissemination and future joint projects at EU and national scale.
    - Contact with municipal governments of the cities Haßfurth and Rostock regarding the exchange of best practices and the transferability of gamification methods and applications to energy saving scenarios for public buildings and behavior change of municipal employees'; letters of endorsement were acquired from both municipal governments for transfer and exploitation for a new project proposal exploiting SmartH2O results.
    - Letter of endorsement from the German Association for School Energy Education (3.500 schools, 1,4 Mio pupils, 65.000 teachers) regarding the transfer of gamification methods and applications to energy saving for public schools was acquired for a new project proposal exploiting SmartH2O results.

9.1.2 Next actions up to month 18

The next period before the consolidation of the second version of the deliverable D8.4 Intermediate exploitation plan will be characterised by the following action plan.

Field trials: this activity **is the WP8 viewpoint over the use case activities managed by WP7**. Field activities will start after the deployment of the first prototype of SmartH20 at M12.

The WP8 activity will address actions to:

1. Monitor time and effort of deployment and integration of the various SmartH20 assets in the IT infrastructure of the partner utilities, which will permit an estimation of the adoption cost by future customers of the platform of an asset.
2. Exploit the presence of three different utilities with different technical infrastructures and water network management standards in order to evaluate alternative deployment configuration of the SmartH2O products and services (e.g., hosted vs in-house).
3. Interview partner water utility managers to elicit feedback on the impact and added value of SmartH20 w.r.t. their current water network management and customers relations.
4. Interview a sample of the water consumers population, together with the water utility managers, in order to ascertain the customer-perceived benefit and detect possible barriers to adoption.
5. Collect, to the maximum extent possible, both episodic evidence and systematic data, on the economic value for the adopting utility of SmartH20, e.g., in the area of leak detection and prevention and network pressure management though better demand management.

All these observations will be transferred to the SWOT analysis of the SmartH2O assets.

Demo to potential exploiters:

This activity exploits the first prototype to present the SmartH2O concept to a selection of

potential adopters.

The current list of such adopters includes:

Water utilities:

- Metropolitana Milanese (IT).
- Tea Acque (IT).
- Trentino servizi (IT).

Energy, gas, and multi-utilities

- ENI (IT).
- Repower (IT).
- Eon (IT).
- A2A (IT).
- ATM (IT).
- Stadwerke Haßfurt (DE).
- AIL (CH).
- AMB (CH).

Demo at business events:

This activity exploits the first prototype to present the SmartH20 concept to potential adopters and business partners gathered at water-specific and utility-specific business events. The following events have been already identified for a participation of SmartH20:

- Aquality Forum (IT): http://www.gruppo183.org/images/files/P5867.pdf.
- Expo APA (RO): http://www.araexpoapa.ro/ .
- Innovation and water service (IT).

Identification of technical and business gaps:

This activity will exploit the meeting with potential adapter to refine the definition of the SmartH2O product and service offer and identify the missing features that can be covered with strategic partnerships, so to obtain a complete solution fulfilling all the market requirements.

Meetings with potential business partners:

This activity will focus on meetings with complementary technology, service and content providers, in order to prepare the ground for post-project strategic business agreements that could complete the commercial offer of solutions based on SmartH20 assets. The current list of contacts comprises:

- WebRatio (Italy, US): software tools for mobile IoT and gamified applications.
- Red Hat (IT): open source software services.
- Vodafone (IT, UK): data analytics business unit.
- ESA Automation and ESA energy (IT): automation, smart metering.
- VEA global (ES): utility engineering services.
- Pipetech (IT): water and gas technology provider.
- LSI Lastem (IT): smart metering solutions.
- Lifegate (IT): environment and sustainability media company and content provider.
- DHI Italy (IT): utility water management software and services.
- Maddalena spa (IT): smart meters.

Index of deliverable D8.3 Intermediate exploitation plan (provisional)

For concreteness, in this section we outline the index of the deliverable D8.3 Intermediate exploitation plan envisioned at his stage.

1. Introduction
2. Overview of the utilities and water market in Europe (UPDATED)

3. Overview of customer behaviour analysis and water demand models (UPDATED)
4. Overview of gamification market and serious games applications (UPDATED)
5. Identification of exploitable assets (UPDATED)
6. SMARTH2O PLATFORM
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
7. Exploitation strategies GAMIFIED ONLINE WATER BILL
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
8. BOARD GAME & CUSTOMER LOYALTY SOLUTION
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
9. DIGITAL GAMES (EXTENSION TO THE BOARD GAME)
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
10. SMART METER DATA MANAGEMENT COMPONENT – SMDMC
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
11. DASHBOARD FOR CUSTOMER BEHAVIOUR ANALYSIS AND WATER DEMAND PLANNING
    a. Asset description
    b. Task producing the asset and IPRs
    c. Market definition
    d. Product/service definition
    e. Competition analysis
    f. PEST/SWOT analysis
    g. Marketing and sales strategy
12. INDIVIDUAL/JOINT EXPLOITATION PLANS
    a. Joint exploitation plan for the SmartH20 platform
        i. Definition of IPRs
            1. Identification of background knowledge
            2. Identification of foreground knowledge

9.2 Joint exploitation

Joint exploitation is clearly an option for bringing the project results to the market. This option was implied also in the original version of this deliverable, which contains a jointly-developed asset: the SmartH20 platform.

Joint exploitation options will be assessed based on the individual business plans of the

industrial partner and on the research continuation objectives of the academic partners.

The assessment of joint exploitation options will proceed along the following steps for a SmartH2O jointly-owned asset

- Definition of IPRs:
    - Identification of background knowledge.
    - Identification of foreground knowledge.
- Evaluation of joint exploitation options:
    - Internal research.
    - Collaborative research.
    - Internal product development.
    - Internal service creation.
    - Licensing.
    - Joint-venture.
    - Spinoff.
    - Standardization.
    - Consultancy.
- Result protection.
- Background knowledge management.
- Agreements with third parties.
- Confidentiality management.

D8.3 intermediate exploitation plan will report the **preliminary** findings on all the abovementioned aspects of joint exploitation, which will be **finalised in D8.6** Final exploitation plan, **when all the exploitation potential and business factors of SmartH20 have been examined at depth**.

Furthermore, beyond the joint exploitation of the integrated SmartH2O platform asset, also multi-lateral joint exploitation of individual assets by a smaller number of contributing partners (e.g. for specific components, algorithms or modules involving only a few partners) is foreseen and will be reported in D8.3 and D8.6 respectively, as the list of exploitable assets is updated and refined. Such flexibility in the different forms of joint exploitation is enabled by the chosen asset-based exploitation approach that allows versatile exploitation modalities: the exploitation of both individual assets as well as compositions of assets can be targeted for specific customer groups in addition to the platform as a whole. Such a strategy is also especially suited for European projects with multiple partners with different degrees of integration of their contributions in specific elements of the platform. Beyond the joint exploitation of the platform as a whole by the consortium, it allows for flexible arrangements of multilateral cooperation (and IPR regulations) between partners in the exploitation of individual assets that are most related to their exploitation interests.

9.3 Open Source

The Consortium has identified the release of the software in the Open Source, as a measure for maximising impact at the international level.

The Open Source deployment of SmartH20 will be implemented in such a way not to jeopardize the joint and individual exploitation plans of the partners.

This will entail a careful examination of the available OS licensing schemes and the comparison between their terms of usage and the dissemination and exploitation goals (and obligations) of SmartH2O.

The open source strategy design will proceed along the following steps:

- Specification of the IP protection requirements.
- Identification of the components amenable to open source release.
- Identification of the applicable open source business models, including e.g.,
    - Embedded.

    - Dual.
    - SaaS.
    - Transaction.
    - Advertising.
    - Patronage.
    - Consulting.
    - Support.
    - Optimization.
- Assessment of the relevant open source licensing schemes, including e.g.,
    - LGPL.
    - BSD.
    - EPL.
    - MIT.
    - Apache.
    - ECL.
    - ..
- Mapping between business models, FOSS licensing schemes and SmartH20 exploitation requirement.s

The open source strategy of SmartH2O **will be described preliminarily in D8.3** intermediate exploitation plan and then **will be finalised in D8.6** Final exploitation plan, when all the exploitation and business constraints of SmartH20 have been examined at depth.

10. Conclusions and Future work

This deliverable has presented the current status of the work about the exploitation of SmartH2O results, which is the output primarily of WP8 Business Development, but has requested coordination and integration of input from all the active work packages.

The ongoing actions involve the establishment of contacts with third parties outside the consortium. This initiative is producing:

- Contacts and agreements with other research projects that deal with citizen innovation, smart cities, water and energy services; these contacts aim at exchanging research results, methodologies, and experiences, so to capitalize on previous research and technology transfer achievements.
- Contacts with user groups (e.g., schools), in order to prepare the ground for the extensive testing of the game concepts with representative samples of the population.
- Contacts with other water utilities, to double check the business and technical viability of the SmartH2O concept beyond the boundaries of the Consortium.
- Contacts with energy or multi-utilities, to double check the business and technical viability of the SmartH2O concept beyond the water domain.
- Contacts with software houses to understand the potential of integrating SmartH2O in existing solutions targeted to the utility market or more general aimed at the gamification of customer-citizen applications.

Future work will mainly address the prosecution and systematization of these preliminary contacts, to substantiate the marketing strategy of the SmartH2O assets with the feedback and experience of third parties operating in the markets identified and described in this deliverable.

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