# The Contribution of Smart Cross-Border e-Gov Systems to Life Sciences and their Applications

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**Abstract.** The latest technological advances in e-Government systems, that were only made available in 2016, have taken advantage of readymade platforms of e-Authentication, e-Signature and e-Identification, and can offer considerable benefits in important areas of Life Sciences and their applications; such as e-Agriculture, e-Forestry, e-Environment, e-Food, etc. The emphasis, in this paper is placed on the use of Smart Cross Border e-Government Systems, including all the latest emerging techniques (Big Data, Cloud Computing and Internet of Things). Such smart systems, offered via innovative and reliable services to producers, can for example further facilitate the transport of agricultural products beyond national borders. These benefits can be accrued by reducing bureaucratic cross border barriers and thus increasing the speed of transport and reducing the final cost of agricultural products in reaching distant markets, to the benefit of consumers. The motivation behind this research is drawn from the long-term plans and efforts of the European Commission, since 1993, in supporting Single Market of trade and business on a grand scale. The application of such Cross-Border systems will enhance the benefits of the European Single Market on demand as their availability and applicability support further integration at federal state level. This emulates the situation in the USA where all trade movements are conducted freely between States, based on the same currency and governed by the same laws and regulations.

**Keywords:** E-government, e-Agriculture, Smart Cross-Border e-Gov Systems, e-Identification, e-Authentication, Smart Applications in Agriculture.

## 1 Introduction

The evolving role of ICT (Information and Communication Technologies), as well as the continuous improvement in the security of Internet systems have resulted in the development and implementation of a number of e-Government standards to support integrated services in almost all areas of human activity. The core aim of the evolution of e-Government standards is the improvement of the quality of life, the commercial activities and the relations between the State and its citizens.


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Globalization of the economy and the creation of state or local associations, such as the European Union (EU), the USA, ASEAN, TURKPA, etc., in which integration and free movement of citizens and goods are permitted, require the development of e-Government Services in cross-border environments (Sideridis, 2017). This kind of services are primarily developed by the Public Administrations to Citizens (G2C) and Businesses (G2B) as well as private businesses (B2B) with the ambition of providing eHealth and Banking Services, Trade and Customs Transactions (E-Custom, e-Commerce) and, agricultural products (e-Agriculture) quite recently (Sideridis, 2013; Sideridis and Protopappas, 2015; Sideridis et al., 2015). In order to limit these time-consuming formalities of the above mentioned services, the EU has launched IT projects such as STORK 1.0 and STORK 2.0 to create specific e-Authentication (e-AU), e-Identification (e-ID) and e-Signature (e-SIGN) platforms (Tauber et al, 2012). These platforms have been implemented to serve initially areas of e-Banking, e-Health, e-Commerce, e-Custom, etc. However, it has also been suggested that they should be used in other areas, such as in migratory agricultural products, where the import or export activity becomes challenging or even impossible due to rigorous customs controls and trade formalities (Nielsen S., 2001).

The exploitation of the STORK 2.0 platforms simplifies and automates the existing e-Health, e-Banking, E-Commerce and e-Crime Services and enables the development of these Services for (E-Agriculture, e-Environment, e-Forestry, e-Food) in cross-border environments. The combination of innovative Big Data, Cloud Computing and Internet of Things (Zhang et al, 2010) and STORK 2.0 readymade platforms for E-authentication, E-signature and E-Identification has made it easy to design intelligent Systems and support advanced e-Government Services (a) Governments of EU Member States (EU) to citizens (G2C), (b) Governments of EU Member States to businesses (G2B) and (c) Business to Business (B2B) (Sideridis et al., 2017). According to relevant legislation and decisions of the European Commission, the proposed schemes simplify and automate the relevant procedures for the movement and establishment of citizens, products and businesses within the borders of the European Union.

It is clear that the flexibility and speed which is provided by the proposed Smart Cross Border e-Government Systems (SCBeG) in export / import activities of agricultural products between EU trading partners and in the automatic processing of the relevant banking services (Sideridis et al., 2015). The benefits of developing SCBeG systems are also evident in further deepening and realization of the EU objective of creating a Single Digital Market in the EU, which encourages the governments of the Member States, through the launch of various projects, to adopt the existing platforms for the development of Government to Government (G2G) and Administration to Administration (A2A) systems (Pimenidis and Georgiadis, (2014).

The cross-border eGovernment system model and its enhanced structure within the eAU, eSIGN and eID platforms, which achieve the cross-border utilization of the proposed ED systems, are described in the second section. The section 3 describes the applications of SCBeG systems in the fields of Electronic Agriculture. Finally, in the fourth section it is attempted to draw conclusions from the adoption at the level of productive use of SCBeG systems in applications of Electronic Agriculture (ITU, 2016).

## 2 Smart Cross Border e-Government Systems (SCBeG)

In October of 2015, results were published regarding the achievement of the major project of the European Commission called STORK 2.0. Meanwhile, efforts have been made to activate various national scientific teams of the EU Member States to exploit the technological platforms that were earmarked through this project for eAU, eSIGN and eID, for exploiting existing eGovernment systems and enabling them to support national and cross-border Intergovernmental Services to citizens and businesses (European Commission (c)). The design and implementation of cross-border e-Gov systems is now imperative and primary systems in e-Health, Justice (e-Justice), Commerce (e-Commerce), Customs (e-Customs) and Education (e-Education) have already been developed. The proposed SCBeG systems involve artificial intelligence components and are combined with innovative Big Data, Cloud Computing and Internet of Things technologies, which can support a variety of security-sensitive areas such as Life Sciences (e-Agriculture, e- Environment, e-Forestry, e-Food). Efficiency, speed and cost savings of the proposed SCBeG systems are ensured by the new platforms for automating time-consuming bureaucratic procedures, Document Authentication, Electronic Signature and Electronic Identification, provided by STORK 2.0. (STORK 2.0 (b), (c)).

The development of SCBeG systems and their dynamics depend on numerous factors; with the most basic being security and privacy. The EU, through various programs, has reached the adoption of a multilevel security framework (Figure 1), for safeguarding the security and reliability of services (Kefallinos et al, 2012).

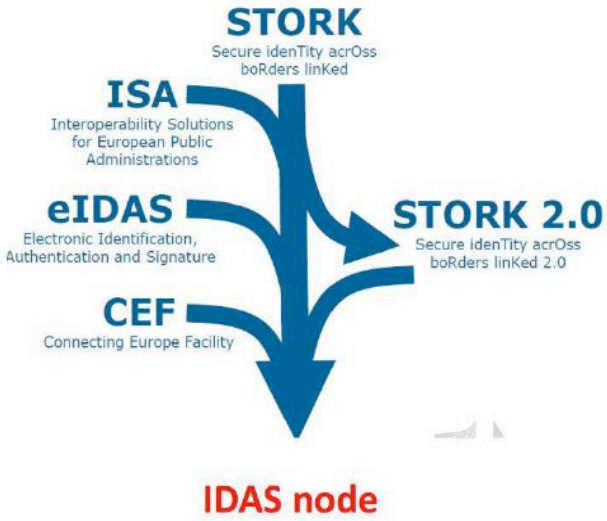


**Fig. 1.** IDAS node. Source: https://www.eid-stork2.eu

The multi-layered architecture of eGovernment systems, which is shown below, is enriched and reinforced by new building blocks provided by the innovative developments of Big Data, Cloud Computing and the Internet of Things.

A central piece of procedure and architecture of the systems represented above, is STORK 2.0, which is grounded in recognized registered international standards (OASIS web SSO, ISO/IEC 27001, OASIS DSS) and it resides to a combination of subsequent models of identity (Pan-European Proxy Services (PEPS) & Middleware Model (MW) (Leitold, 2009). Moreover, each one delivers eID verification for various service providers, combined with techniques of next-generation such as CC. This prominent architecture is entitled to STORK VIDP, and can be shown below in Figure 2.

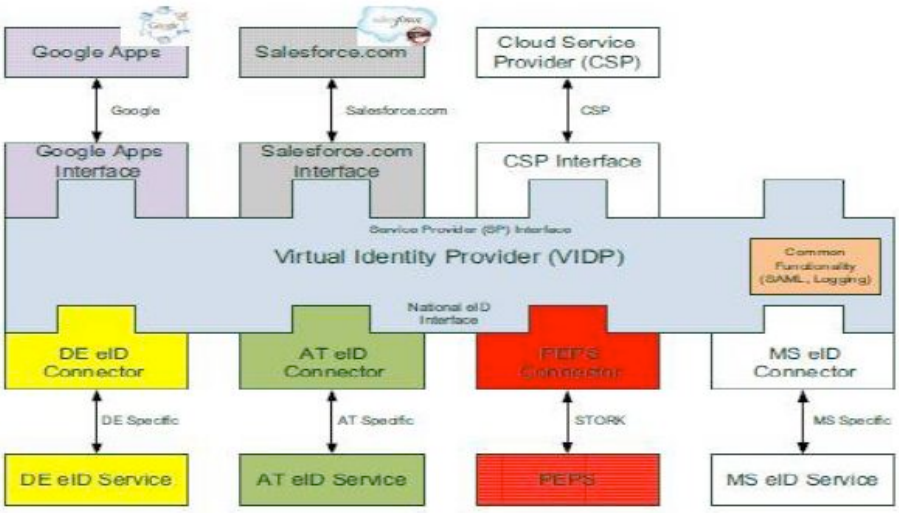


**Fig. 2.** Extended VIDP architecture supporting eID based cloud authentication

## 3 Applications in Agriculture

The applications of Smart Cross Boarder e-Government (SCBeG) systems, which are proposed to be developed on the basis of the architecture and standards which are mentioned in the previous two sections, attract already a lot of interest to various organizations, and agricultural cooperatives since they have been promising fast, not time-consuming and bureaucratic procedures, automated and safe services in agricultural products in national and cross-border environments (Sideridis et al., 2015), (Sideridis, 2017). Particularly, the import / export trade of sensitive agricultural products, will be benefited for the speedy response, efficiency, authentication and security of the data exchanged in various documents, which

guarantee the direct supply of goods from their place of production to the country of the consumer, regardless of the national borders and any long distances.

The services supported by the SCBeG systems, in addition to speeding and, as a consequence, reducing the cost of migrating goods, enlarge the role of the European Union's Small and Medium-Sized Agricultural and Manufacturing Operators, as the European citizen becomes automatically a consumer of agricultural products of any kind country of production (COP) within the EU (Ntaliani et al, 2010). In this sense, the welfare of wider populations is upgraded, high standards of production are standardized and ensured, agricultural demand is increasing and farmed isolated areas are economically supported.

Furthermore, the agricultural economy in broad effects of SCBeG Systems and other sectors of Agriculture and the environment are favored by providing them with all the necessary information and valid data in a timely manner at their local farm level. For example, the hitherto predictability of weather phenomena refers to broad spatial and temporal data. The new SCBeG systems are equipped with building blocks of Big Data (McAfee and Brynjolfsson, 2012), Cloud Computing and the Internet of Things will "personalize" the information provided, so that farmers can cope with the phenomenon of appropriate preparation and measures to prevent or even suppress any disastrous consequences (Bandyopadhyay and Sen, 2011).


**Fig. 3.** Applications in Smart Agriculture. Source: http://invoke.pt/en/strategy-solutions/agriculture

Generally, farmers and businesses in the sector will be able to take advantage of their land and other available resources (water, soil, atmosphere, etc.) in a more convenient and economical way, having quantitative and qualitative elements (e.g. transnational agreement on the exploitation of water flows and stocks).

SCBeG systems and their supported services will contribute to the qualitative upgrade of agricultural products by providing advisory information that will deliver more economical, more efficient and safer use of agricultural fertilizers and pesticides. The services offered are ergonomic and understandable, as they have

excellent interfaces through which the user - farmer optimizes her/his production (see Figures 3 and 4). Below are mentioned indicative partial applications of SCBeG systems in Agriculture and the Environment (Sideridis, 2013), (Sideridis, 2017).

• Prediction of accurate harvest time, health monitoring and treatment of diseases.
• Prediction of possible catastrophic weather events for agricultural crops (Sideridis and Stamelos, 1988).
• Personalized protection and maintenance applications, in proper temperature, humidity and ventilation conditions, for agricultural warehouses.
• Mobile applications, installed on the tractor, inform the farmer regarding soil quality and accurate local data, using Internet of Things (IoT) technology (Li et al, 2011).
• Applications for determining the level of ripe and harvesting of production. Nowadays, similar systems are operating and they can not only determine the stage of maturation but also the intervention, through the IoT systems, to accelerate the maturing time.
• Applications for maturing time monitoring by measuring sugars and other indicative data for vintage grapes harvesting on farms.
• Applications for monitoring and control of atmospheric pollutants, especially CO2, produced by factories, industries, cars and agricultural holdings.
• Applications for measurement and control of soil moisture.
• Applications for the detection of hazardous pollutants in drinking water sources, reservoirs, rivers and irrigation water in agricultural holdings, water-exporting industries and agricultural holdings.
• Applications for microclimate control and appropriate storage conditions for the excellent preservation of agricultural products.
• Applications for control of the most suitable conditions in irrigation of cultivated land.

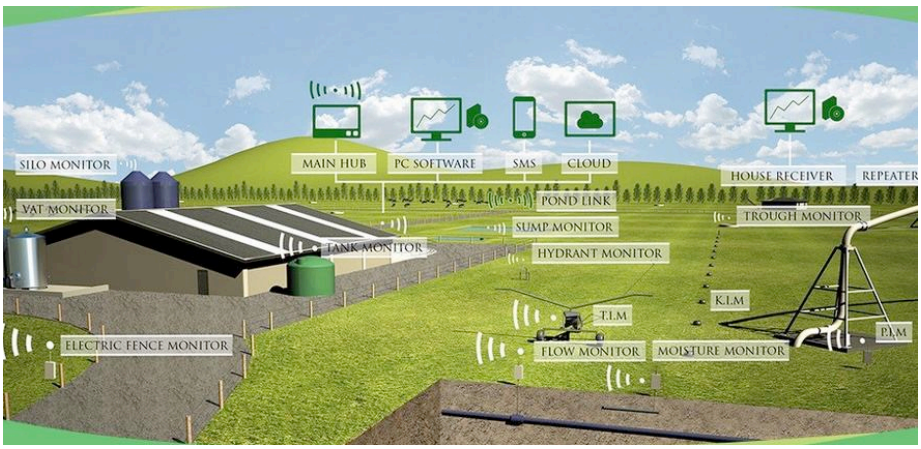


**Fig. 4.** The role of the IoT in precision farming. Source: https://www.linkit.nl/ knowledge-base/209/Agriculture_the_Internet_of_Things

• Applications for controlling livestock development and diseases data.

• Grazing monitoring applications and controlling the driving of farm animals in appropriate areas and the accurate at any time
• Monitoring and ventilation control of farm animals in closed farms.
• Mobile applications that are installed in small self-propelled robots are monitoring, managing and controlling the farmer's crops through on-line maps of his rural area (Lav et al, 2012).
• Applications for weather forecasting, rainfall, drought, windstorms, snowfalls and movements of microbiological disease organisms.
• Forest and agricultural monitoring and control applications for the detection of any gases and other hazardous materials that cause fire, with the intention of automa-tic extinguishing.

## 4 Conclusions

Cross-border eGovernment systems, enriched with innovative capabilities in the fields of Big Data, Cloud Computing and Internet of Things, as discussed in the context of G2C, G2B and B2B in this paper, offer major advances in further deploying applications to almost all Life Sciences sectors and applications. Meanwhile, the capabilities of authentication, electronic signatures and electronic identification offer essential prerequisites for the additional development in specific application areas such as those of e-Agriculture and Agricultural Economy. The trade (import and export) of fresh and sensitive agricultural products could hugely benefit from secure Cross-border transactions, the automation and the speed of carrying out all the necessary procedures digitally and the ensuing reduction of the costs of multiple handling of goods. All these enhanced services will significantly contribute to the stimulation and reinvigoration of small and medium-sized enterprises in the sector and could support opportunities for their economic survival within the contexts of globalization and the implementation of the key principle of the European Union in the creation of a Single Digital Market.

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