Economic Development, Technological Change, and Growth

E-Government – A Demand-Side Innovation Policy in Romania

Sabina-Cristiana Necula[1]

Abstract: The present paper presents with example the actual status of E-Government in Romania. We start with an introduction which presents the importance of government implications in public procurement for innovation with concrete data of government's investments and policies for innovation. In this section we include objectives and prior work. We approach our research by presenting web 2. 0 technologies for E-government services with examples from other countries. The article focuses on the actual status of E-government in Romania. The main conclusions of the paper are presented in the end of the article. Our results are summarized in a discussion section. The value and implications of our research is in the area of governmental public sector innovation.

Keywords: E-Government; public procurements for innovation; web 2.0; e-tax; innovation policy

JEL Classification: O32; O33; O38

1 Introduction

We present in this paper the actual status of Romanian's government implications in public procurement for innovation with an accent on e-government services.

At present, Romania does not have a National Innovation Strategy to define clear innovation policies and priorities (the project aiming to define this Strategy has only started in 2011). Therefore, innovation policies are addressed in some of the programmes of the 2007-2013 National RDI Plan (e.g. the "Innovation" and "Partnership in priority domains"), some operations under the Sectoral Operational Programmes "Increasing Economic Competitiveness" and "Regional Development").

Specific categories of innovation policies, like non-technological, social, public sector innovation, design, creativity and services innovation are poorly represented in the current RDI policy mix. Some demand-side innovation policies are more

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developed and broadly used (e.g. regulations for stimulating innovation), while others are either in an incipient stage (e.g. tax incentives for RDI) or absent (e.g. public procurement for innovation, pre-commercial public procurement or catalytic procurement).

In 2010, further to the launch of the Europe 2020 Strategy, the 2011-2013 National Reform Programme (NRP) was released. The Programme continues the reforms started in the 2007-2010 National Reform Plan and proposes new reforms in response to the EC's Europe 2020 Strategy, first Annual Growth Survey and Euro Plus Pact that marked the start of a new cycle of economic governance in the EU and the first European semester of ex-ante and integrated policy coordination.

2. Problem Statement

E-Government means Internet + online public services. Knowledge management in government services online is dedicated to knowledge management of local communities and groups of people involved in the various actions.

In developing good e-Government policies there is a need to take into consideration the following aspects: the regional development, the demographic distribution, the ICT citizens 'use, the culture of good public governance.

The use of information technologies in public administration means primarily improved services to citizens and organizations. E-Government development was possible due to the emergence of Internet and its use spread rapidly. The first use in public administration has meant presenting information on a site, followed by allowing downloading necessary forms in relationship with the public. Later were possible filling online forms and make electronic payment transactions.

ICT is already widely used by government bodies, as well as in enterprises, but e-Government involves much more than tools. Effective E-government also involves rethinking organizations and processes, and change behavior so that public services are delivered more efficiently to those who need to use them.

People can move freely and therefore should have access to public services outside their home country.

Successes and potential of e-Government are already clearly visible in several EU countries (Europe's official documents, 2012). Electronic invoicing in Denmark saves 150 million Euros of taxpayers' money and 50 million year business money. If electronic billing would be introduced across the EU, annual savings could add up to over € 50 billion. Disabled people in Belgium can now access their dedicated resources in seconds, whereas previously it was 3 or 4 weeks.

E-Government has reached a critical juncture. Further progress requires success factors. Among them, electronic authentication (IDM - interoperable electronic identification management) for access to public services, electronic document authentication and electronic archiving are considered key factors.

The spread e-Government applications include: information / portals, administrative use, using legislative, answers questions of general interest, area guide, receiving applications and petitions, the presentation of various online forms and surveys, stock e-jobs, attracting activity of the disabled or elderly, C2A, vote via the Internet.

Also providing service oriented citizens groups such as youth, students, minorities, the elderly.

Another trend is the development of complex applications: B2a, guides online purchases, auctions, C2A, register online portals.

In this context we enunciate the following research problem: **what are the main problems that modern e-Government services can address and how can we measure the benefits**?

We enunciate the following research hypothesis: modern e-Government services determine good public governance.

3. The Research Model

In order to prove the research hypothesis and to address the research problem we propose the following research model (Figure. 1).

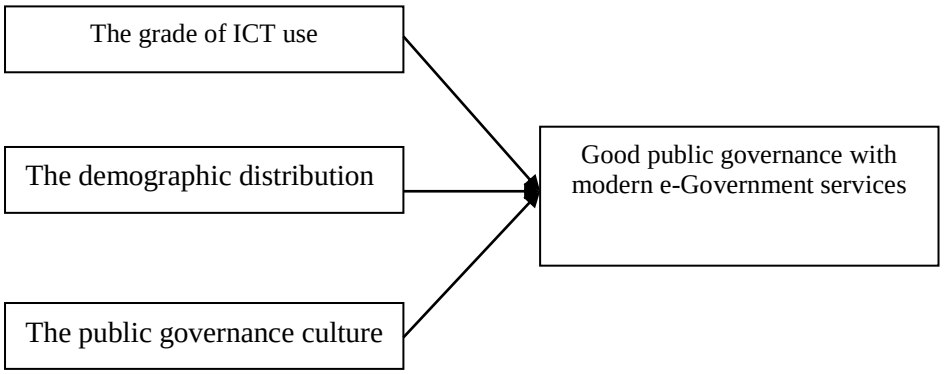

Figure 1. The Research Model

Our research methodology consists in describing facts by taking into consideration the three variables from the research model: (1) the grade of ICT use; (2) the demographic distribution, and (3) the public governance culture.

Considering the facts that we observed for Romania's case we must say that:

- Romania doesn't have a good spread of ICT use in rural areas;
- Romania has a lot of public administration agencies which means a lot of bureaucracy, a low interest in developing e-Government services in rural areas and not even in urban areas;
- Romania doesn't have a culture for public governance: very often citizen perceive public administration as a place where they have to pay taxes and receive nothing in exchange. This is the result of corruption, bad management and loss of civic and ethical responsibility.

When we discuss USA's case study for USA governmental agencies wikis we discuss the following already implemented projects:

- Intellipedia - 16 intelligence agencies content; Intellipedia case study at http://www.collaborationproject. org/display/case/ODNI+Intellipedia;
- Diplopedia - available to business external agencies through Intranet; Diplopedia case study at http://www.collaborationproject. org/display/case/Diplopedia;
- Environmental Protection Agency and the Puget Sound Information Access Challenge—wiki; case study; http://www.collaborationproject.org/display/case/Environmental+Protection+Agency%27s+Puget+Sound+Information+Challenge;
- OMB MAX Federal Community – Management and Budget Office wiki;
- OMB USAspendingGov Requirements Community – wiki open to public for addressing comments to federal financing;
- GSA's USA Services Intergovernmental Collaborative Work Environment – collaborative space for 20 intergovernmental communities;
- U. S. Court of Appeals for the 7th Circuit, Practitioner's Handbook – wiki open to public;
- NASA Wiki for Object Oriented Data Terminology wiki for object oriented technology detained by NASA California Institute of Technology.

Considering Romania's case we observe that governmental agencies or public sector agencies don't have any wiki page.

Norway is one of the countries with the most effective payment and e-government solutions in the world. This is a result of continuing policy efforts over the last two decades and considerable amounts of financial resources have been invested in a large number of e-government and other infrastructural projects. The policy attention on e-governance and simplification is expected to remain unabated in the next years expecting to yield high socioeconomic returns in form of time and money saved by private and small business users of public services.

A new and improved version of the e-government service for businesses "Altinn", Norway's citizen- centric online portal was implemented in 2010. The initiative called Altinn II is part of the Norwegian government's ambitions to maintain world leadership in e-government. In 2009 more than 440.000 businesses chose to do their statutory reporting through Altinn, and at that time over 700 different public forms were available in the web portal.

Altinn can be viewed from different perspectives:

- The user perspective: The public web portal www.altinn.no, where the business sector is given access to electronic forms and services, and can find information about rules. Very often professional users will relate to Altinn as a web service solution (ws. altinn. no) where they can submit the data directly from their own computer system (see list in Norwegian over computer systems with integration towards Altinn).

- The organisational perspective (interactional perspective): Interdepartmental cooperation to reduce the form burdens the businesses have towards the government.

- The IT perspective (interactional perspective): A "tool box" public authorities and agencies can use to produce and operate their electronic forms and services both towards the public and towards the businesses.

Considering the Romania's case we observe the current state:

- www.admiterea2001.ro

- www.e-licitatie.ro (European Commission said in the country report on ICT, published on August 4th 2009 the actual development for Romania. Commission stated eProcurement systems development, more and more frequently used in a continuous progression in Romania pointing out that the number of auctions in electronic public procurement (SEAP - www.e-licitatie.ro) increased from under 2% to over 12%)

- www.e-guvernare.ro (Services available through the Unique Form Service, to the "filing statements" by taxpayers filing returns CAS, CASS, unemployment and tax returns 100, 101, 102, 103, 300, 390)

- Virtual Payment counter offers the possibility of online payments for certain categories of duty. Thus, individuals can pay online, the state budget through credit cards, income tax represents tax obligations, tax prepayments title, adjustments for income taxes and tax duties related to the following categories of income:

a) income from commercial activities;
b) income from liberal professions;
c) income from intellectual property rights;
d) income from the transfer of use of property;
e) income from transfer of securities;
f) income from operations for the sale of foreign currency forward contract basis;
g) income from agricultural activities;
h) transfer income from the personal property;
i) income from salaries for the employees are required to establish, declare and pay income tax
j) traffic fines applied in Bucharest Romanian citizens residing or foreign nationals residing in Bucharest

Local taxes payment through the Internet by legislation (Ordinance no. 24/2002, Act no. 291/2002) established the obligation of all municipalities and cities to develop electronic payment systems for local taxes.

eTax is an integrated electronic payment of local taxes, to relieve the obligations of tax payer SoftNet developed for the electronic payment and use of Banc Post SA.

From the diffused "infokiosks" which often provides information and ticket purchase in various public places to interactive portals, citizen relationship with government is often based on digital services. Spread but, as with cultural digital information, has led to other unintended effects, of which perhaps the most important is "lost" citizens in the very large volume of digital information, together with "information noise".

In Romania, in recent years, public administration, libraries, museums, tourist offices, church, etc. have developed their own sites, which contain significant volumes of digital information.

Effects of "loss and information noise" began to appear frequently and users in Romania, when looking for information in Romanian. Thus, defining a single access portal for is a long time ago initiative in Romania.

Concept called "eRomania" released on June 16, 2009 the Ministry of Communications and Information, is mandatory and necessary for early development eRomania single portal. Creating effective portal eRomania is labor intensive, requiring resources and expertise for at least two levels: Portal development skills and expertise in digital content.

E-Romania portal, as was shown in concept will provide two types of information, corresponding to the two levels of achievement: the national level that includes general information, wide enough to admit to another level of detail and territorial level - associated portals include detailed information of interest to the regional (county, city).

Portal structure is hierarchical, from the territorial and national level to both open, so that, depending on content development, to insert new items of interest.

If, at first, E-Government meant a lot of websites which contains documents available for citizens in order to be downloaded, today E-Government means a lot more: paying online budget taxes, having available public services by making use of Internet. But, in Romania we have a lot to come. We are still in the phase where the citizens only download some files, print it, fill in and go locally at the public service to dispose it.

We are not in the phase where e-government services mean fees for citizens.

4. Results

Modern e-Government services refers to communities of people. Web 2.0 technologies are to be used in:

- social networks like MySpace, Facebook, LinkedIn and Second Life. These online spaces allow users to achieve interaction with others forming an online community. Governance involves creating dedicated groups such as crime networks, groups dedicated to recover from potential disasters and local legislative districts, www.citizencalling.com;

- Blogs belonging to public figures and through which they interact with those who voted for them. This type of communication can help the official public meetings.

- Pictures and Movies: The government can use YouTube to encourage such residents and those visiting a place to post videos with images of places they liked best events you liked or about places considered dangerous. (Intersections, sidewalks and areas with extensive vegetation) service payment of taxes in the U.S. has launched a youtube channel www.youtube.com/irsvideos;

- Polls interactive online survey conducted by Zoomerang and SurveyMonkey are common and used to collect opinions about the inhabitants of a city community problems.

- Internal processes Wikis: wikis or products such as Microsoft SharePoint can be used to standardize processes, functions or departments of common terms or entities participating in government. Simple processes such as how to process a

request for public information as a bill payable are inclined to documentation via wikis. Certainly such information may be posted directly on a website, but the advantage is precisely wiki content enrichment by those participating in the process, so that everything can happen quickly.
http://www.usa.gov/webcontent/technology/wikis.shtml;

- Wikis external processes: processes that use the interaction with the government. How to recycle a computer? What to do if they find a fridge in the street? How citizens can apply to use food labels? Interactivity they offer wikis gives a new dimension different ideas about solving a problem;

- Wikis "outs" external: most of those working in the business of government have no idea what it means designing a budget, but many constituents are expressed too bombastic. A wiki allows for a budget involved explain the elements of a budget. http://transparentfederalbudget.com/;

- Next generation will probably mean 911 cameras built into mobile phones that can send just about anyone reporting risk;

- Blogs and wikis for Customer Services and Feedback.

5. Conclusion

Romania doesn't have modern e-Government services probably because of no interest from politics governmental body. Innovation is required in every industry, economic activities and even in public administration. To not take into consideration innovation for citizens means poor administration and bad management policies.

E-government not only facilitates innovation. It can also "force" innovation on government, for two key reasons. Some kind of data needs this kind of management. There is a lot f public data which must be available to citizens and to administrative bodies, to research and innovation sector and to any other public use.

Modern e-Government services is a request for bad e-practices because bad e-practices require a public governmental response.

6. Acknowledgment

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E-Wallet. A New Technical Approach

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Abstract: The goal of this article is to propose a new technical approach regarding the "e-wallet" concept. Although the "e-wallet" concept has many implementations, we consider that we can improve the present level of knowledge by joining the Near Field Communication technology and the "classic" concepts about money. In order to develop a new architecture, we studied the present level of knowledge in the scientific literature and in the industry and we proposed new elements for e-transfers. Also, we made an experiment and the result consists in a prototype based on the Android platform emulators using the Near Field Communication technology. Our electronic prototype will be able to act as a wallet by using only a mobile smart phone because the proposed architecture embeds concepts like money, cards, payments and receipts in a single secured mobile application.

Keywords: E-payments architectures; e-money; e-transfers; mobile payments

JEL Classification: O33; O31; E42; L15

1. Introduction

Any modern economy develops based on the trade exchanges that involve the making of money payments. In fact, the payment represents a money transfer from a beneficiary to an assets or services seller. The origins of the payments can be found in the antique barter system, which represented a payment in kind, through direct interchange of goods. Due to the reduced flexibility of this modality, there have been developed payments systems based on the fiduciary currency and more and more advanced systems.

During the contemporary period, a payment system represents a set of procedures and computer networks used to make the financial transactions on the value certificates market, on the money market and that of the derived instruments, as well as for the transfer of funds among different institutions. Another issue that is to be taken into account is that of the payments made by the retail clients for the individual acquisitions of goods and services. Certain authors from the specialty literature (Patel, 2010) consider that in the contemporary world the payment systems represent in fact a very important element of the modern money systems.

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In the modern world the frequent forms of manifestation of the payments involve the money, the checks, and the bank transfers and in case of the business processes such payments are usually preceded by an invoice or followed by a form of the receipt.

At this moment, the industry of e-payments is focused on e-transfers based on card emulation and there are many successful implementations described in (Hun, 2008; Izhar, 2011; Tang, 2009). All of these systems are focused on card or bank account emulations and that means that the user has to connect with the bank to generate a money transfer (ISIS, 2012).

Our goal in this paper is to create a new architecture in which the users are able to instantaneous transfer their money from one to another by using a simple and secured e-wallet from their smart-phones. The research methodology consists in studying the literature and in developing a new prototype for a practical e-wallet whose goal is to allow the instant money transfers between two users.

In fact, we propose a new vision for managing money in an e-wallet, by using the Near Field Communication (NFC) technology and the network communications. NFC is a short distance wireless technology that normally requires a distance of 4-10 cm to initialize a connection between two mobile devices. It is a standard that extends RFID (Radio Frequency Identification) combining the interface between a smartcard and a reader in one device. We used NFC on the Android mobile platform and we developed a prototype for a practical e-wallet.

2. Characteristics, Risks and Needs for Electronic Payments

The electronic payment systems have to meet several minimal characteristics in order to be efficient (Lee, 2011):

- Atomicity: this characteristic takes into account the fact that during the transfer no existing money is lost and no new money is created;
- The impossibility of the non-repudiation: none of the actors involved in the transaction can decline his responsibility conferred by the electronic signature.

Also, the solutions of the electronic payments represent the central point of different requests, more or less economical (Tan, 2004):

- Security: the systems must restrain the possibility of the frauds within the electronic environment;
- Fiability: the systems must be accessible and available at any moment in time;

- Cost efficiency: the transaction cost must be reasonable even in case of the micro-payments;
- Integration and scalability: the systems must be inter-operable with all the other existing systems; also, they must be able to integrate themselves with the new payment methods from the on-line environment;
- The easiness of using: any system of electronic payments must be accessible through different types of hardware terminals and from different software platforms;
- Confidentiality: the data regarding the parties involved into the transactions must be available for the others only up to the confidentiality level established by the collaboration protocol.

According to the requests imposed to the solutions of electronic payments, the digital currency has to observe several defining restraints; thus, it has to be (Lee, 2011):

- Universally accepted;
- Electronically transferable;
- Divisible;
- Impossible to falsify or remove without authorization;
- Private (nobody, except those involved into the transaction, knows the value of the transaction);
- Anonymous (nobody can identify the payer);
- Able to also be operated off-line, without needing a previous on-line verification.

Up to this moment we appreciate that none of the known systems satisfies all these requests simultaneously. Nevertheless, there are several advantages of the digital currency in association with the electronic payment systems (Silver, 2012): potential for an increased flexibility, reduced costs for the transactions made within the digital environment, great rapidity regarding the speed of the transactions. At the same time, one may remark several dangers: in certain conditions, there is a possibility to realize a perfect copy of the electronic transaction, which leads to the appearance of the vulnerability in front of the informatics attacks. Also, "the tracking" of the transactions may determine the access to certain private data of the parties involved in the operations of the electronic payments.

Starting from 2007 there took place several notable initiatives in Europe regarding the payments from the mobile environments.

Table 1. Important initiatives of the payments from the mobile environments

Country	Initiatives
Belgium	• The operators launch the payment made via the SMS;
Great Britain	• Vodafone and Citigroup announce a collaboration protocol for the payments from the mobile environment; • Contactless type combined cards between Barclays and Oyster;
France	• NFC (Near Field Communication) type pilot systems in Caen, Strasbourg, Grenoble, Paris;
Italy	• The CartaSi cards processor launches the payment service for the ski paths;
Norway	• Telenor and several banks launch the BankID system;
Holland	• NFC type pilot systems that use credit and debit cards;
Germany	• NFC implementations within the transport public system from the Frankfurt area;
Austria	• The Paybox operator attains 300, 000 users;
Croatia	• 50% of the parking fees are paid via mobile phones.

Source: Adaptation after (Jong, 2007)

As we can notice, the European area tends to adopt the systems based on NFC technologies on a major scale.

From a technical point of view a transaction of electronic payment takes place under the basis of the participation of several actors to the transfer process of the digital money. The on-line payment systems based on the use of a bank card, possessing as security elements a PIN password or a specialized chip, are often used. The main entities involved into such a transaction are:

- The seller: he offers assets and services to the buyer and he sends to the brokers the payment solicitation on the account of his labour conscription to the client. At the end of the transaction, the seller receives the payment confirmation by the client.
- The buyer: he buys assets and services from the seller and he confirms to the brokers the payment request from the seller. At the end of the transaction, the buyer's account is discharged based on the request received from the brokers.
- The brokers: usually, they are the cards issuers, the digital certificates generators or the electronic wallets treasurers. They play a key-role in the

processing of the transaction as they assure the transparent connection between the seller, the buyer, the seller's bank and the client's bank. The brokers manage the flow of payment and confirmation requests, finalizing a transaction that observes the criteria of the atomicity. The brokers represent in fact the guarantee that the payment transaction is made correctly and that no "new money" is lost or generated during the process.

- The bank of the client and the bank of the seller play the role of depositories and they confirm the data requested by the brokers.

Because there are involved so many actors in a simple transaction, the payments are sometimes made with delays from one day to five days (especially during the international payments). In terms of electronic transfers of funds from one user to another by using smart phones, currently there are not specialized applications. In the following chapter we propose a new architecture which allows users to transfer e-money with no delays, using two smart phones devices that have NFC capabilities.

3. A New Architecture for E-Wallet

We intend to facilitate the e-money transfer between the users who have smart devices with Near Field Communication technology and we propose a new architecture in the following figure. In the literature we didn't find the feature we implemented in the prototype. All the sources and all the applications developed in practice implements the transfers based on debit/credit cards or on bank accounts. Our vision is based on secure transfers of the e-money that is stored just on the smart devices.

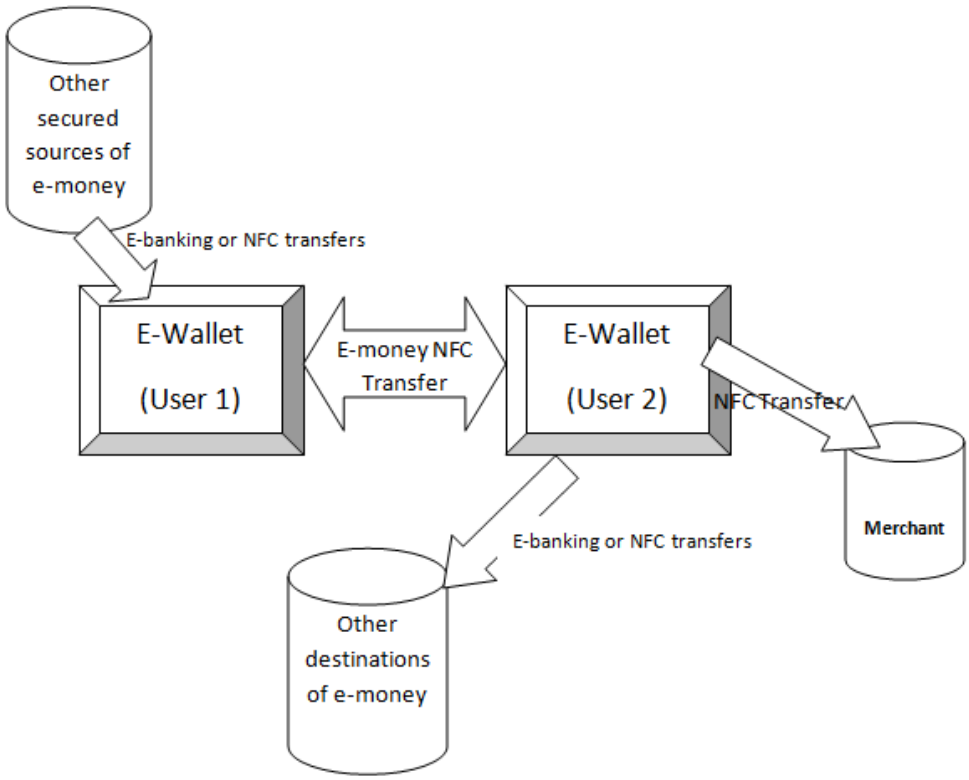

Figure 1. A proposed architecture for transferring e-money between two e-wallets

As it can be seen in the figure no. 1, we implement the e-money transfer between User1 and User2, supposing that both users have smart devices with NFC capabilities included. The money is stored in our secured application and it is transferred through the NFC tags. The application is developed on Android platform and uses NDF Data Exchange Format (NDEF) in order to transfer the messages between devices. Every message includes secured information about:

- The amount of transferred money;
- The security certificate of every monetary unit (because in our model, every monetary unit has its own security certificate);
- The payer;
- The receiver;
- The date of the transfer.

The application can run on Android 2.3.3 (API level 10) because it is necessary to be able to pass the NDEF message from one device to another (this is called *the beaming process*). The Android Beam allows passing messages between two devices only by touching them and it is not necessary a previous searching process

(like in the case of Bluetooth technology). At the implementation level, it is necessary to declare the specific permissions in AndroidManifest.xml.

```
<uses-permission android:name="android.permission.NFC"/>
<uses-sdk android:minSdkVersion="10"/>
<uses-feature android:name="android.hardware.nfc" android:required="true"/>
```

Also, our application uses some specific intent-filters.

```
<intent-filter>
<action android:name="android.intent.action.MAIN" />
<category android:name="android.intent.category.LAUNCHER" />
<
<intent-filter>
<action android:name="android.nfc.action.NDEF_DISCOVERED" />
<category android:name="android.intent.category. DEFAULT" />
<data android:mimeType="text/plain" />
</intent-filter>/intent-filter>
```

In order to implement the e-wallet features, we create a special record based on NDEF.

```
private NdefRecord newTextRecord(String text) {
        byte[] langBytes = Locale.ENGLISH.getLanguage().getBytes(Charset.
forName("US-ASCII"));
        byte[] textBytes = text. getBytes(Charset.forName("UTF-8"));
        char status = (char) (langBytes.length);
        byte[] data = new byte[1 + langBytes.length + textBytes.length];
        data[0] = (byte) status;
        System. arraycopy(langBytes, 0, data, 1, langBytes.length);
        System. arraycopy(textBytes, 0, data, 1 + langBytes.length, textBytes.length);
        return new NdefRecord(NdefRecord. TNF_WELL_KNOWN, NdefRecord.
RTD_TEXT, new byte[0],
data);
}
```

Every tag is transferred between the smart devices and it is intercepted by the "destination" e-wallet.

```
IntentFilter ndefDetected = new IntentFilter(NfcAdapter.ACTION_NDEF_DISCOVERED);
try {
ndefDetected. addDataType("text/plain");
} catch (MalformedMimeTypeException e) { }
mNdefExchangeFilters = new IntentFilter[] { ndefDetected };
// Intent filters for writing a new tag.
IntentFilter tagDetected = new IntentFilter(NfcAdapter.ACTION_TAG_DISCOVERED);
mWriteTagFilters = new IntentFilter[] { tagDetected };
```

Our application has been tested on an Android emulator and we obtained a rate of 100% successfully NDEF transfers between emulated e-wallets.

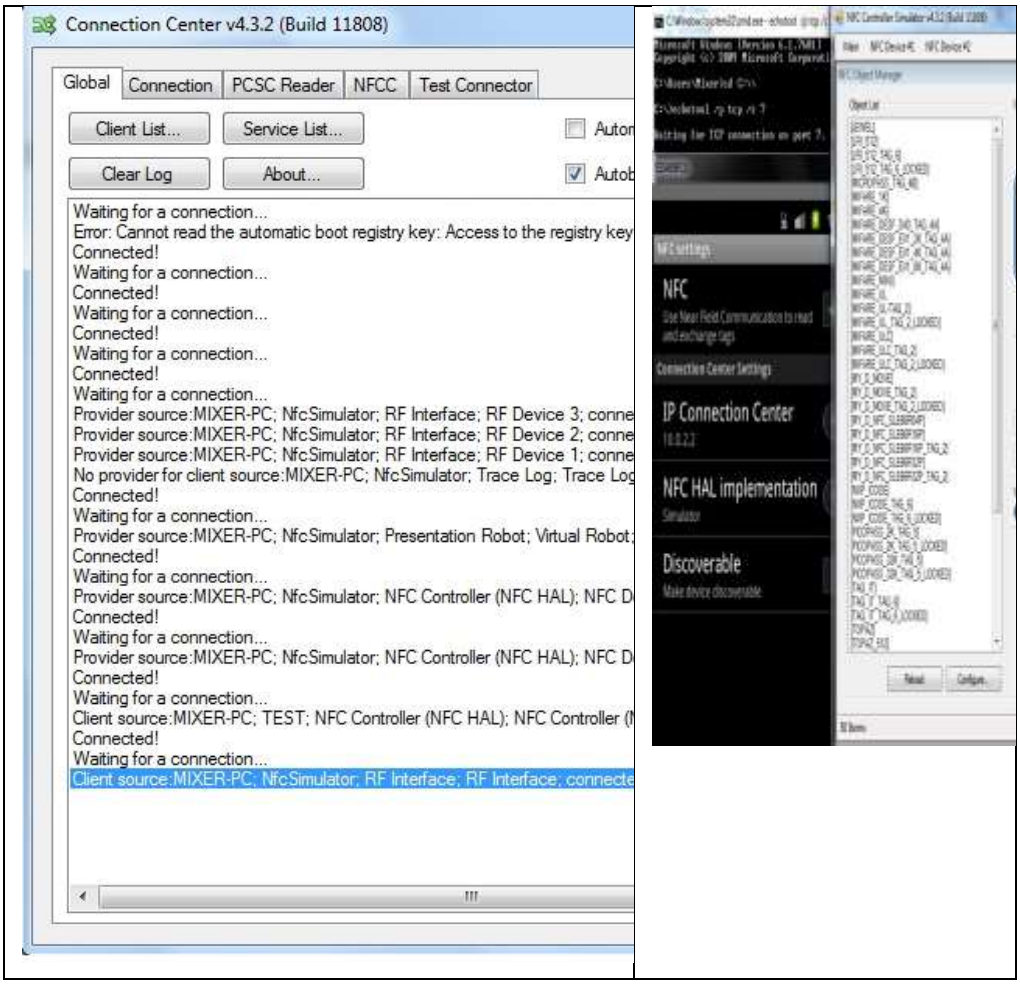

Figure 2. Transfers between emulated e-wallets

We identified some advantages for our proposed architecture:

- if the architecture is adopted on a large scale, the users will not have to use money, cards and the phone, but only the phone because the wallet is included in the device;
- the proposed e-wallet allows users to transfer e-money from one to another without any delay, because the transfer is made immediately;
- every monetary unit is marked with a security certification and the e-money cannot be multiplied.

Also, the architecture has some disadvantages:

- in case the user loses or destroy the phone, he will also lose the e-wallet and the money disappeared;
- by using the proposed application, the receiver of the e-money has to connect to internet in order to check the electronic certificate.

4. Conclusions

Taking into account the technological evolutions at a world-wide level and analyzing the investment intentions (PcWorld, 2012) of the companies, we may anticipate that the future of the electronic payments will have the mobile environments as a main infrastructure. The estimates (King, 2011) show that up to 2014, more than 50% of the "smart phone" type devices will contain interfaces that are able to communicate financial data without any physical contact with the payment terminal. The harsh competition (Paul, 2011) from the area of the contactless payments will probably determine the imposing of several strong standards meant to assure flexibility and security for the users in a global world.

Once with the proliferation of the "smart phone" type devices one may expect a reviving of the concept of electronic wallet that did not have any commercial success in the recent past because of the using difficulties.

Taking into account the foreseen technological evolutions, the strategies announced by the banks and by the great card issuer companies, as well as the increased needs of the buyers and merchandisers regarding the security and flexibility of the transactions, we consider that the future of the electronic payments systems will be based on the following defining elements: the mobile environments and devices, the electronic wallet and standards meant to increase the flexibility of the transactions.

5. Acknowledgment

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Technological Innovation Management and its Role in Performance of Organizations

Laura-Diana Radu[1]

Abstract: This paper aims at identifing the main benefits of technological innovation in organizations and how it should be managed to ensure economic efficiency. The current level of social and economic evolution was possible only through active involvement of individuals and organizations in the innovative process. Adoption of appropriate policies and strategies at institutional, national and international level has significant impact on both the innovation process and innovation results. At company level, involvement in an innovative process depends on the financial and human resources and on the availability and interest of management and employees. The main motivating factor in adoption of technological innovation is, most often, obtaining financial benefits. This reflects itself either as a direct increase in profits, or by obtaining competitive advantage which leads, in the long run, to profits increase and achieving a favorable position on the market. Should not be neglected other motivating factors of innovation, such as compliance with environmental standards, ensuring a secure position on the market with opportunities for further expansion, reducing the cost of raw materials and / or production process, improving company image, attitude and achievements of partners in the field (competitors, suppliers, customers) etc. Managers need to carefully analyze these factors and decide the manner and degree of involvement in an innovative process.

Keywords: technological innovation; innovative process; economic performance; innovation management

JEL Classification: O32; Q55

1 Introduction

Technological innovation represents, directly or indirectly, an important component of the human existence influencing evolution and economic growth by different means. One of the arguments in this sense is represented by the results obtained even from the first studies on economic growth and technological innovation undertaken by Robert Solow in 1957. Using a Cobb-Douglas function with the production and labor factors, where technology was a „residual" and exogenous element of the pattern, he discovered that half of the growth in USA registered in the first half of the 20th century was due to technological change.

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(Sánchez & Rodríguez, 2009, p. 385) The Organization for Economic Co-operation and Development (OECD) published in the Oslo Manual the following conceptual definition of innovation: innovation is implementing a new or significantly improved product (good or service), a process, and a new marketing method, a new organization method in the business practice on labor distribution or in the external relations. (Toner, 2011, p. 16) From the same perspective of OECD, innovation is considered to be an iterative process, initiated as a consequence of the identification of a new sales market and/or the opportunity to insert a new service or product based on a technological invention, leading to development, production and marketing with the view of ensuring the commercial success of the invention. This definition underlines two important different concepts: (1) the innovation process includes the technological development of an invention together with its insertion on the market and its distribution to the end user and (2) the innovation process, is, by nature, iterative, automatically including the insertion and later development of the innovation. (Garcia & Calantone, 2002, p. 112) In *Green Paper of Innovation*, innovation is described by the following activities (European Commission, 1995, p. 1):

- the renewal and enlargement of the range of products and services and the associated markets;
- the establishment of new methods of production, supply and distribution;
- the introduction of changes in management, work organization, and the working conditions and skills of the workforce.

Another definition describes innovation as *the conversion of new knowledge in economic and social benefits as a result of complex interaction between numerous factors within a system including an environment (local, national, regional) with companies, research institutes, financers and their contact networks*. (Iancu, 2010, p. 9)

It seems clear, of all the approaches presented, that innovation is not confined to results obtained in laboratories and research centers. It supposes the projection and the production of products and services, their distribution to consumers and maintenance and, if necessary, the personalization and update throughout the entire lifecycle.

The importance of innovation is also pointed out when considering 2009 as "*The European Year of Creativity and Innovation*", by the European Parliament and Council in Decision no. 1350/16.12.2008. The objectives of this decision were to create a favorable environment for innovation, attract the audience and innovation organizations with the view of involving them in innovation as well as to promote the necessary abilities for innovation through education and creative thinking in all the fields etc. If we consider the definition of innovation according to its features, the studies showing the importance of the technological evolution for the economic

growth have led to the identification of the following aspects (Sánchez & Rodríguez, 2009, pp. 385-386):

- The technological innovation represents the "knowledge" for which the reproduction is often difficult and expensive;
- The specific feature of technology generates high transfer costs;
- The innovation activity is cumulative, with a growth yield in time;
- The empirical research demonstrates that the majority of innovations belong to products;
- Approximately half of the innovations are created by the product, machine or process users.

In organizations, the technological innovation has both a *qualitative* value, increasing the comfort offered to consumers and/or employees and a *quantitative* value since it conquers new markets, attracts clients and increases profits. It is carried out at the national level and may lead to the growth of exports and of the GDP and consequently to micro and macro-economic growth. Therefore, favorable attitudes and encouraging innovations are essential not only to the organizations involved directly or indirectly in the innovation process but also for the national economy of the country where the organization resides. A very important role in supporting and encouraging the innovation is played by public and international bodies which might raise the interest of companies for innovation through non-refundable or partly refundable money, elaboration and application of favorable policies such as fiscal facilities.

2. Types of Technological Innovations

The technological innovation can be classified according to at least two criteria: *"the object" of innovation* (of product and process) and *the novelty through innovation* (radical and incremental or sustaining and disruptive). The first criterion is also mentioned in the OECD approach, according to which (OECD, 2005, pp. 48-49):

- *Product innovation* is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics;
- *Process innovation* is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

According to the level where innovation is found, namely either product or process, it can be classified as: *finding new solutions to older problems, insert new*

products/processes and using old products-processes in a new manner (Table 3). In most of the cases, process innovations are connected to product innovations and consequently the change of production processes lead to smaller or bigger changes of the final product, whereas the change of the product requires changes of processes. If we take into account the second criteria, the level of novelty acquired by the product or process, the innovation falls most often within two categories: *radical* and *incremental*. *The radical innovation* isdefined as the accomplishment of a new business line, respectively of a new process or product with unique performance features which are new or already existing but offering a performance improvement at least 5-10 times higher or a cost reduction with at least 30-50%. (O'Connor & McDermott, 2004, p. 13) *The incremental innovation* is represented by the changes of products and/or services in order to bring substantial benefits on price or functionality. (Banbury & Mitchell, 1995, p. 161)

Table 1. Types of innovations

Use/Problem		**Process/Product**	
		New	Old
		Category 1	Category 2
Old		**New solutions to older problems** Products: new medicine Processes: Just-in-Time	**No innovations**
		Category 3	Category 4
New		Mostly innovative: **new products/processes leading to new opportunities** Products: PCs, in 1980 Processes: bar codes for product inventory	**Old products/processes used in a new manner** Products: other uses of the paper clips, DVDs Processes: satellite images soil testing

(White & Bruton, 2007, p. 22)

The implication of the organizations in innovation processes is very important, especially in our days, in the context of globalization and spectacular technological development. According to Clayton Christensen companies should have the following attitude on innovation: "*All companies should be engaged in sustaining innovation, insert such products as to be sold to their best clients with higher profits. The continuous innovation process is predictable and carefully planned. By contrast, when new businesses are created through a radical innovation process, it is impossible to know from the beginning which is the best strategy. The manager can launch the product and, by trial and error, takes the best action.*" (Christensen, 2005)

The involvement of companies in the innovation process, whichever class it may belong to, must be supported by rational criteria and preceded by market studies

capable to estimate the right success and to objectively correlate the necessary investments with the expected financial results. Moreover, it is necessary to analyze the necessary actions for developing the innovative idea and implementing it in the organization as well as disseminating it to consumers due to the fact that innovation often implies a series of successive changes difficult to estimate from the beginning.

3. The Efficient Management of the Technological Innovation in Organizations

The efficient management of the technological innovation must be accomplished and distributed in a profitable manner for the company involved in its development, implementation and use. Its ability to improve the results and performance of a company does not depend only on the novelty of the process or product, but also on its interaction with other technologies and its influence on the competitive position of the company. According to specialists, *to a greater or lesser degree, innovations either enhance or destroy competencies that a company already possesses.* (Utterback, 1995, p. 141) The efficient management of innovation requires the involvement of top managers in the innovation process and the awareness of the following realities (Tushman, 1997, p. 23):

1. The innovation management requires an environment where innovative thinking and work are encouraged;
2. The innovation management requires better and more valuable products and services;
3. The innovation management is proactive and encourages creativity and risk taking.

All successful innovators should understand the importance of fast income and take the necessary measures to control costs and simplify the project planning, improve usage of raw materials and increase the production efficiency. Another possibility that should be considered, if possible and profitable, is to externalize certain secondary activities. This could determine important savings of human resources and technologies and also gathering innovation ideas, from outside the company, to improve the product and/or the production process.

The efficient management of innovation processes is based on clear policies, a budget planning which will improve and put into effect creative ideas, stimulate the creative thinking in human resources and its dissimulation between members inside and outside the company. Moreover, the following features are favorable to an innovation attitude (Delbecq & Mills, 1985, p. 23):

1. A periodical revision of informal proposals from groups within the organization;

2. Clear directions on studies which must be undertaken as well as on the expected results;

3. Learning activities from others, understanding the work of others;

4. Sets of realistic expectations;

5. A supportive environment for „troubleshooting" and trials, adequate resources for maintenance and service.

The factors influencing the performance of innovation and of the innovation process, inside a company, are in a large number and they are generated both by the internal environment, such as employees, technologies, management, approached strategy, etc. as well as by the external environment such as suppliers, markets, legislation, economic environment, competition etc.

4. The Influence of Technological Innovations on the Activity and Economic Performance of Organizations

In the current business environment, the capacity of a company to make new products and adopt new production methods is highly important taking into account the conditions imposed by a competitive global market. Consequently, the assets of a company prove a competitive advantage if it is valuable, rare, difficult to imitate and hard to replace. (Barney, 1991, pp. 105-106)

The innovation capacity of the company It might be reflected in many activities such as improving new products, using new technologies to obtain the products, responses to innovations from competitors, use 'accidents' as actions generating new technologies/products, design new products/technologies to satisfy he future needs of consumers. The corresponding approach of these activities, the encouragement and efficient management of the innovation process can bring strategic advantages to the company involved (Table 2).

Table 2. Strategic advantages through innovation

Mechanism	Strategic advantage	Examples
Novelty in product or service offering	Offering something no one else can.	The first…Walkman, mobile phone, fountain pen.
Novelty in process	Offering in ways others cannot match – faster, lower cost, more customized.	Pilkington's float glass process, Internet banking, online bookselling.
Complexity	Offering something which others find it difficult to master.	Rolls-Royce and aircraft engines – only handful competitors can master the complex machining and

Mechanism	Strategic advantage	Examples
		metallurgy involved.
Legal protection of intellectual property	Offering something others cannot do unless they pay license or other fee.	Blockbuster drugs like Zantac, Prozac, Viagra
Add/extend range of competitive factors	Move basis of competition, e.g. from price of product to price and quality, or price, quality, choice.	Japanese car manufacturing, which systematically moved the competitive agenda from price to quality.
Timing	First-mover advantage or fast-follower advantage.	Amazon. com and Yahoo! – other can follow, but the advantage „sticks" to early movers.
Robust platform design	Offering something which provides the platform on which other variations and generations can be building.	Walkman architecture – through minidisk, CD, DVD, MP3 Intel and AMD with different variants of their microprocessor family.
Rewriting the rules	Offering something which represents a completely new product or process concept.	Typewriters vs. computer word processing, ice vs. refrigerators etc.
Reconfiguring the parts of the process	Rethinking the way in which bits of the system work together.	Zara, Benetton in clothing, Dell in computers.
Transferring across different application contexts	Recombining established elements for different markets.	Polycarbonate wheels transferred from application market like rolling luggage into children's toys.

(Tidd & Bessant, 2009, pp. 8-10)

Any advantage obtained by the company from technological innovation is essential, as it can be observed from the examples above, both internally and externally, offering a competitive position on the market. Consequently, the innovation process must be approached from a rational manner, according to the possibilities of every organization.

5. Conclusions

The technological innovation is an instrumental factor in creating new forms of value in such a competitive environment as the current economic, social and politic world is. It favors the creation of new products which are accepted and sold worldwide, with a competitive price and quality. The technological innovation should be supported both by the public and the business enterprise expenditure.

The main reason in adopting technological innovations is, obviously, the desire of financial benefits. They aim, as a rule, directly or indirectly, to obtain higher returns which depend often on the development and use of the latest technologies. Favorable attitude toward innovation is the answer to many factors which have explicit or implicit connections and their analysis creates the involvement premises in such a process. In order to ensure the success of innovation the companies must have, create or buy the necessary financial, material and human resources, approach the innovation process in all its complexity and be ready to assume the risk of a possible failure.

Results of the innovative process depend not only on product or process obtained, but also of its efficient management. Also, companies should cultivate a pro-innovation attitude inside also in their relations with the outside world and to stimulate employees and collaborators by offering various incentives and create a favorable environment for shaping innovative ideas which on longer or shorter term could bring financial and / or competition benefits. Information and communication technologies now offer a favorable environment for accumulation of information and dissemination of creative ideas and innovation globally.

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Overview of the Practical and Theoretical Approaches to the Estimation of Mineral Resources. A Financial Perspective

Leontina Păvăloaia[1]

Abstract: Mineral resources represent an important natural resource whose exploitation, unless it is rational, can lead to their exhaustion and the collapse of sustainable development. Given the importance of mineral resources and the uncertainty concerning the estimation of extant reserves, they have been analyzed by several national and international institutions. In this article we shall present a few aspects concerning the ways to approach the reserves of mineral resources at national and international level, by considering both economic aspects and those aspects concerned with the definition, classification and aggregation of the reserves of mineral resources by various specialized institutions. At present there are attempts to homogenize practices concerning these aspects for the purpose of presenting correct and comparable information.

Keywords: mineral resources; proven reserves; probable reserves; possible reserves

JEL Classification: Q32; O13

1. Introduction

In certain states, in the absence of specific norms, the reporting of reserves and resources is done in compliance with the practice of the mining industry in that area. Because estimated reserves have a special importance for the entities in the mining industry there have been numerous preoccupations to define and classify reserves. The Association of Petroleum Engineers has drawn a guide to estimate Petroleum reserves, and it has recommended taking into account the following information in the estimation of reserves (Mitchell, 2004, p. 4):

- *economic* (information on current costs, prices and taxes for the proven reserves, the prevision of costs, prices and future charges for the other categories of resources);
- *feasibility* (feasible development schemes, depending on the available technologies and the restrictions on environmental protection);
- *geological* (initial evaluation of crude oil reserves and the establishment of the characteristic features of reserves).

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Proven identified reserves could not be mined due to technical difficulties or very high costs. But, an oil field which is declared non-mineable for the moment could be mined in the future due to technological progress.

In establishing reserves, one must consider that:

- reserves cannot be measured directly;
- they are estimated on the basis of available data (geological, technical, economic), and they are analyzed depending on the extant methods and professional reasoning;
- the precision of estimations depends on the quantity and quality of available data and the evaluators' experience.

In order to better understand these aspects, we shall first present a few aspects concerning the definition and classification of mineral reserves drawn by various national and international bodies.

2. Points of View in Defining and Classifying Mineral Resource Reserves

In order to define and determine reserves and resources, various institutions have adopted different practices, such as (Frost, 2005, p. 26):

- ***security norms***:
  - USA SEC guide 7 - *Industries Description of property by issuers engaged or to be engaged in significant mining operations*, (Securities and Exchange Commission – SEC 1978);
  - Canada *National Instrument 43-101 Standards of Disclosure for Mineral Projects* and *National Instrument 51-101 Standards of Disclosure for Oil and Gas Activities*;
  - United Kingdom *Statements of Recommended Practices* (SORP 2001) etc.
- ***stock exchanges***:
  - Australia - *Australian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves – JORC Code*;
  - Johannesburg bourse from South Africa - *South African Code for Reporting of Mineral Resources and Mineral Reserves - SAMREC Code* etc.
- ***national norms***:
  - Russia – Ministry of Natural Resources (RF- 2005);
  - China - Department of Petroleum Reserves (PRO- 2005);

- Norway – Petroleum Department (NPD -2001);
- USA - Geological Department (USGS - 1980) etc.

- ***technical standards***:
  - SPE/WPC/AAPG - Oil and Gas Reserves Committee of the Society of Petroleum Engineers - SPE; World Petroleum Council - WPC, American Association of Petroleum Geologists - AAPG;
  - United Nations Framework Classification - UNFC - 2004;
  - Committee for Mineral Reserves International Reporting Standards - CRIRSCO;
  - Organization of the Petroleum Exporting Countries - OPEC.

The efforts towards standardization were initiated by the Society of Petroleum Engineers (SPE) during the World Petroleum Congress (WPC) where around 50 states participated. In the **WPC-SPE** documents, reserves are divided into two large groups depending on the probability of estimating the quantity and the possibility of commercial mining (IASC, 2001, p. 45): *proven reserves* (developed and little developed) and *little known reserves* (probable and potential). The estimation of reserves is permanently re-evaluated depending on the new discoveries and the improvement of extractions.

Proven reserves represent that quantity of petroleum that, in the case of known reserves and on the basis of geological and technical analyses, of current data and extant *economic conditions, operating methods and government rules,* can be estimated at *a reasonable certainty level* to be mineable commercially.

Probable reserves represent the minable economic part of indicated mineral resources and, in certain cases, of measured mineral resources, demonstrated via a preliminary feasibility study. This study can comprise appropriate information concerning the mining method, the adopted treatment, and other economic aspects can be proved when drawing the report to justify economic extraction.

Possible reserves are represented by those reserves that at present are not exploitable economically. The evaluation of economic viability of potential reserves includes the economic evaluation of the long-term production plan for each area or project. The production period is established depending on the variable limits of the model used during the evaluation before optimizing the profitableness of resources, the mine's capacity and the profit generated by the inflow of capital. This viability is grounded on preliminary feasibility studies.

According to the **4-10** norm **in the SEC's S-X regulation,** ***proven reserves*** are estimated on the basis of geological and technical data that make it possible to determine at a reasonable certainty level the quantity of petroleum or natural gas

extant in reserves known to be exploited under extant economic and operational conditions. This process implies subjective judgments that make the evaluation of an exercise's reserves to be revised. The estimation of proven reserves is done every year by experimented engineers and geologists, and it is subject to an expertise before being validated by the management (Frost, 2005, p. 24).

The **SORP** British norm (paragraph 12) classifies reserves as:

- ***proven and probable reserves*** of petroleum and gas, which include the estimated quantity of crude oil, natural gas or natural liquid gas based on geological, geophysical and technical data demonstrated at a certainty degree that can be exploited in the following years based on known reserves and which are considered mineable commercially;
- ***developed and little developed reserves*** represent the estimated quantity of crude oil, natural gas or natural liquid gas based on geological and technical data demonstrated with a reasonable certainty, that can be mined over the following years based on reserves that are known from an economic point of view and from the point of view of operating conditions, i.e. prices and costs at the data when the estimation is done.

The norm stipulates that reserves can be considered minable commercially if there is the intention to extract hydrocarbons, and this intention is based on:

- the reasonable evaluation of future economic knowledge for this activity;
- the reasonable estimation of the existence of a distribution market for all or almost all foreseen hydrocarbon production;
- proof of ownership or of the possibility to own the equipment necessary for production, transportation etc.

Eurostat acknowledges the following three categories of reserves for the petroleum and gas sector (Eurostat, 2005):

- ***proven reserves*** - those reserves of a high degree of certainty (90% or more) that can be technically and economically mined depending on current technologies and prices;
- ***probable reserves*** - those reserves that are not yet proven, but in whose estimation there are more than 50 % chances that they can be mined technically and economically;
- ***possible reserves*** - those reserves which at present cannot be seen as probable, but which have a significant chance, yet lower than 50%, that they will be mined.

OPEC carries out a classification similar to Eurostat, by dividing resources into:

- ***proven reserves*** – the estimation of the total quantity of hydrocarbons on the basis of geological and technical data demonstrated at a reasonable

certainty level to be minable in the following years and under certain economic conditions and operating methods;

- ***probable reserves*** are those reserves which, following the analysis of geological and technical data, are suggested to be probable to be recovered. In this context, when probabilistic methods of determination are used, there is a probability higher than 50% to be recovered;
- ***possible reserves*** are those reserves that, following the analysis of geological and technical data, suggest that it is more likely that they will not be recovered. In this context, when probabilistic methods are used, there is a probability higher than 10% for that resource to be mined.

In order to ensure the convergence of the definitions used, Eurostat and the London Group have inventoried national practices concerning mineral resources accounts, and in 2002, Eurostat published information on practices in certain states from Europe (Eurostat, 2002, p. 15) that are presented in Table no. 1.

Table 1. The way to define reserves and the source of data

Country	Source of data to estimate reserves	Definition of reserves		The stock in physical units that will be evaluated	Applies SEEA or SCN
		Known reserves	Little known reserves		
Denmark	The Danish Agency for Energy	The evaluated sum of proven, probable and possible reserves	No available data	Discovered reserves	SEEA
Germany	Niedersächsisches Landesamt für Bodenforschung	The sum of proven and probable reserves	No available data	No available information	No information
France	Secretariat for the Conservation of Hydrocarbons Deposits in the Ministry of Industry	Include only certain reserves	No available data	Certain reserves	SCN
The Netherlands	Ministry of Economy and Business	Probable estimated reserves	Future adding of reserves determined following exploitation	Basis of estimation is established by the government and is close to the rent of rent	Not clear
Austria	Austrian Organization of Geology and	Sum of proven reserves developed (1),	No available data	Discovered reserves	More SEEA

Country	Source of data to estimate reserves	Definition of reserves		The stock in physical units that will be evaluated	Applies SEEA or SCN
		Known reserves	Little known reserves		
	extraction companies	proven non-developed (0,9), probable (0,5) and possible (0, 1)			
Great Britain	The Ministry of Trade and Industry	The sum of certain and probable reserves	The higher and lower limit of estimated non-discovered reserves	Discovered reserves and the lower limit of non-discovered resources	More SCN than SEEA
Norway	Norwegian Petroleum Direction (NPD)	Foreseen level of discovered reserves estimated by NPD	Foreseen level of non-discovered reserves estimated by NPD	Discovered reserves and the foreseen level of non-discovered ones	SEEA

Source: (Eurostat, 2002, p. 15)

Given the multitude of definitions and classifications, attempts have been made to uniformize them, with a view to carrying out comparable reports.

3. Tendencies towards Uniformization

The SEEA 2003 model does not define clearly the terms "resources" and "reserves" used in classifying assets:

- *reserves* refer to a subset of *resources* on the basis of certain criteria (for instance, the economic recovery of resources given by the current conditions);
- *resources* include discovered *reserves* (according to UNFC) or anything that lies under ground (SPE/AAPG/WPC) based on geological data.

SCN 93 considers only the assets of monetary values and only certain reserves, which include *estimated quantities based on specific, geological and technical data which allow one to determine at a reasonable certainty level if the quantity of petroleum or natural gas in the known reserves can be mined under the current economic and operating circumstances* (Commission of the European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, World Bank, 1993, par. 21. 152). SEEA 2003 considers reserves to be proven, probable and possible in physical accounts (certain states also include hypothetical estimated reserves), while monetary accounts include proven and probable reserves.

In the SEEA 2003 manual, chapters 7 and 8 present general principles concerning mineral resource accounts in physical and monetary units, and the foreseen treatment for the classification of mineral resources in physical units is not harmonized with various classifications adopted by each state. However, it comprises, in fact, a framework for the interpretation of the way of classifying reserves, which applies to problems connected to the type of reserves that will be included or excluded from the monetary accounts of mineral assets. The SEEA 2003 Manual refers mainly to the McKelvey diagramme, which classifies reserves according to economic feasibility and the degree of uncertainty (Figure no. 1) (United Nations, et al., 2003, pp. 324-340).

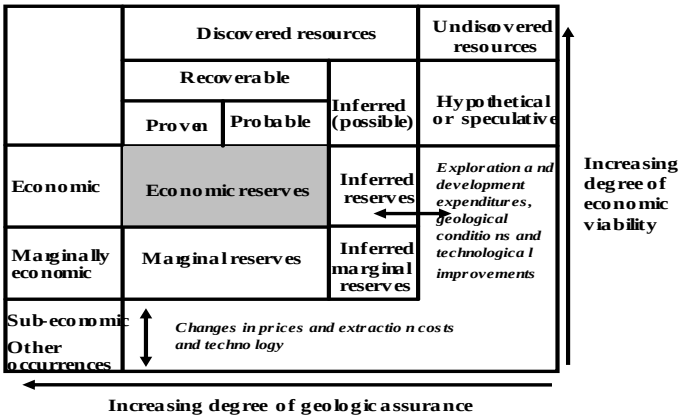

Figure 1. McKelvey Scheme

(Edens & DiMatteo, 2007, p. 10)

Certainly, this system of classification is not used in all countries. In order to converge national systems with McKelvey's system, certain retreatment are made, but they are not always carried out coherently, in order to obtain comparable results.

After the publication of SEEA 2003, the London Group has continued to analyze these aspects and it has been trying to harmonize the extant practices by collaborating in this sense with specialized institutions, such as the group of UNECE experts for the harmonisation of the definition of non-renewable energy and of mineral resources (Group of Experts the Harmonization of Fossil Energy and Mineral Resources United Nations Economic Commission for Europe).

UNFC (United Nations Framework Classification) (Hass & Kolshus, 2006) elaborated a new framework for the classification of resources, for convergence in defining and classifying reserves. This classification (Figure no. 2) considers three criteria: *economic and commercial viability* (E), *feasibility* (F) and *characteristic geological features* (G).

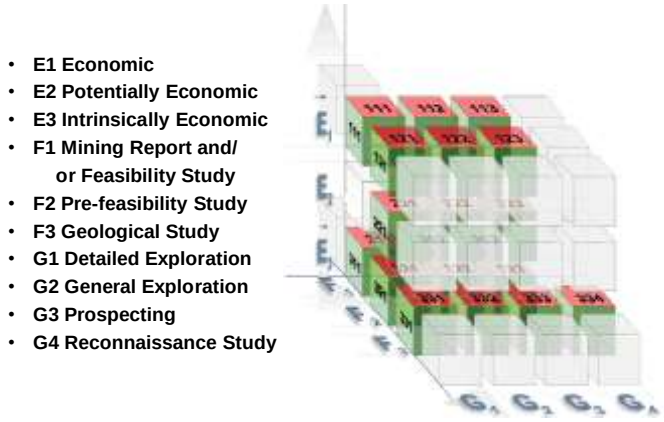

Figure 2. Classification of resources according to UNFC

(McDonald, 2007, p. 18)

The classification done by UNFC uses the numeric codification, made of 3 figures, depending on the three criteria of classification. For instance, box 111 shows that those quantities are recoverable from an economic and commercial point of view (first figure), are justified via feasibility studies which show that they can be exploited with current technologies (the second figure) and the estimations were done on the basis of reasonable geological data (the third figure). UNFC recommends the use of the terms "low"/"the best"/"the highest" to express estimation and not of the terms "proven"/"probable"/"possible". In the UNFC classification the G1 category corresponds to proven reserves, G2 to probable reserves and G3 to possible reserves.

UNFC has been trying to harmonize various classifications concerning mineral resources by establishing correspondences with the other classifications. In 2006, Blystad and his collaborators carried out a study which established the correspondence between several national and international classifications, by comparing the UNFC system with the Norwegian one, with the SPE/WPC/AAPG system and the Russian one (Blystad, Griffiths & Heiberg, 2006).

The classification system in **Norway** comprises 3 categories, *prospective resources* (in yellow), *contingent resources* (in green, 4A-7F) and *reserves* (in red, 1-3F). In the **UNFC** system potential reserves correspond to boxes 111 and 112 (red), contingent resources in green and potential ones in box 334 (yellow). Figure no. 3 features this conversion for accounts from 31.12.2003.

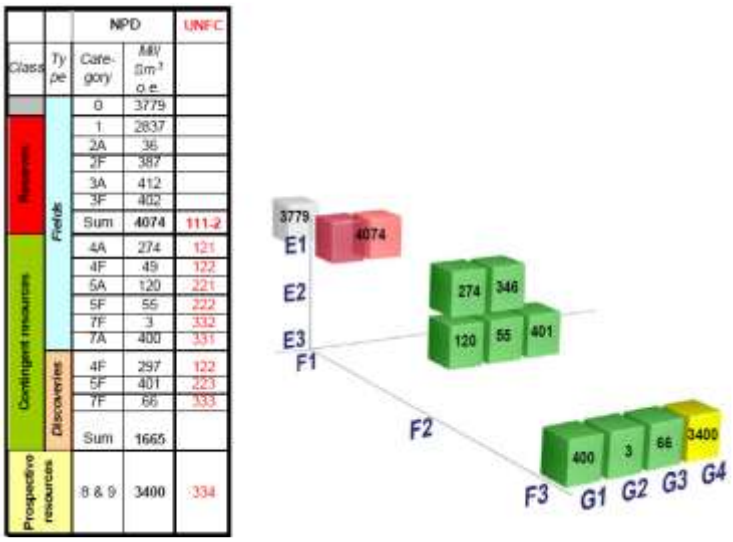

Figure 3. Correspondence between the classification of resources in Norway and UNFC classification

where:

0 –petroleum deliveries
1 – reserves in production
2 F/A – reserves for which the operational plan and development plan have been approved
3 F/A - reserves for which the extension of the license has been approved
4 F/A – resources in the planning phase
5 F/A – resources for which recovery is possible but not clear
6 – resources for which exploitation is not profitable
7 F/A – resources which are not yet well evaluated
8 – resources during the prospecting stage
9 –non-localized resources

Source: (Blystad; Griffiths & Heiberg, 2006, p. 15)

The **SPE/WPC/AAPG** classification is similar to the one in **UNFC** (Frost, 2005, p. 26), and the correspondence between the two classifications is presented in Figure no. 4. In general, several expressions are used to estimate reserves. For potential resources the terms used are "low"/ "the highest"/ "high" estimation, noted with 1C/2C/3C, and for *proven/probable /possible* reserves, the notations used are 1P/2P/3P. In fact, 1P means proven reserves, 2P proven and probable reserves, and 3P proven, probable and possible reserves.

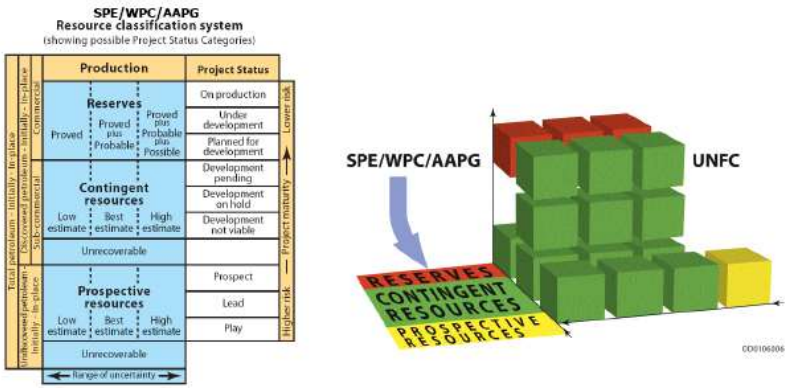

Figure 4. Correspondence between the SPE/WPC/AAPG classification and the UNFC classification

(Frost, 2005, p. 26)

In establishing the correspondence between the classifications carried out by **Russia and UNFC,** the authors considered only geological reserves. This correspondence is presented in Figure no. 5.

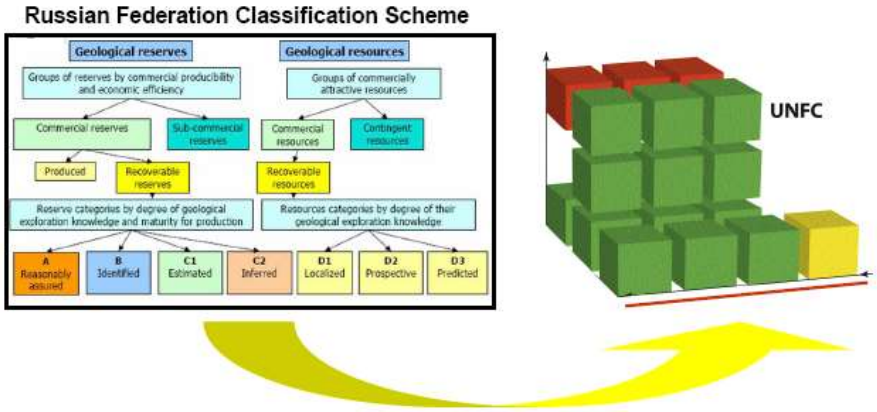

Figure 5. Correspondence between the classification carried out by Russia and the UNFC classification

(Blystad, Griffiths & Heiberg, 2006, p. 16)

In order to ensure the unitary treatment of mineral resources we must also consider the methods to approach them: deterministic or probabilistic.

4. The probabilistic and deterministic approach in the evaluation of mineral resources

In defining reserves, two approaches are adopted:

- ***the deterministic approach*** which defines categories of reserves in qualitative terms "with a reasonable certainty";
- ***the probabilistic approach*** which defines categories of reserves by quantifying probable evaluations.

If *deterministic methods* are used, then the term "reasonable certainty" is the expression of a high degree of conviction that those quantities can be exploited. In the case of *probabilistic methods* there is a higher than 90% probability that the estimated quantity would be exploited (Figure no. 6). JORC adopts the deterministic approach for ore, while in the field of petroleum, the probabilistic method: 90% for proven reserves, 50%-90% probable reserves, 10%-50% possible reserves.

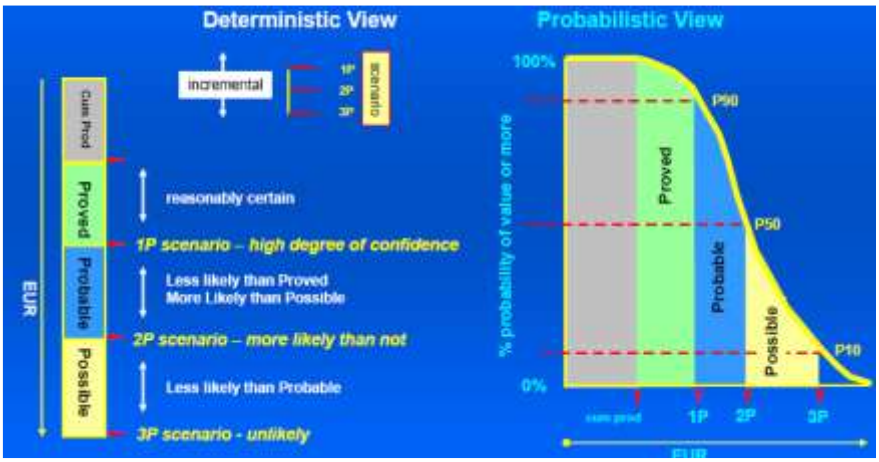

Figure 6. Deterministic vs probabilistic approach

(Ritter & Etherington 2007, p. 18)

Apart from the way to approach reserves, there also arises the issue of summing up the various categories of reserves: which of them are *considered* and how they are *aggregated*. SEEA 2003 recommends to consider the monetary accounts of proven and probable reserves, while Eurostat recommends all three categories: proven, probable and possible (Figure no. 7).

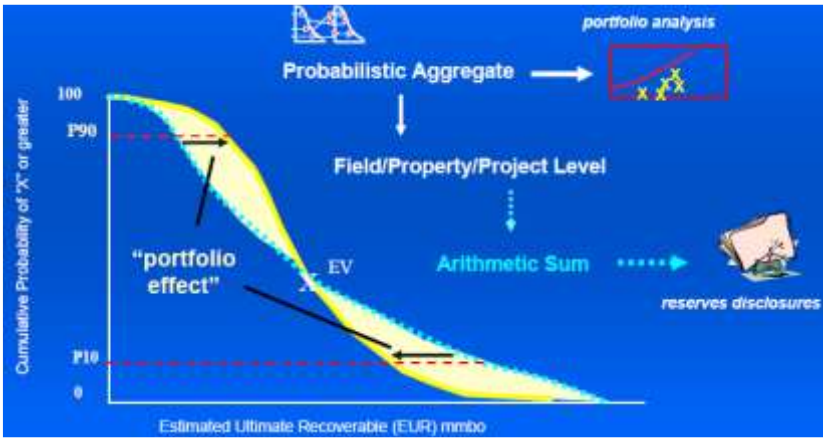

Figure 7. Aggregation of reserves

(Hass & Kolshus, 2006)

In yearly reports most companies that exploit mineral resources present information concerning methods to estimate reserves and what types of reserves were considered (proven, probable, possible...). For instance, the Russian company Lukoil (www.lukoil.com) stipulates that in 2006, proven reserves increased by 4, 1%. Thus, over the last seven years, the company has managed to compensate completely the production of hydrocarbons by discovering new reserves. The evaluation of reserves was carried out in compliance with the SPE/WPC requirements, while the situation of petroleum and gas reserves for the period 2008-2010 is presented in Table 2.

Table 2. Lukoil petroleum and gas reserves in 2008-2009

	2010			2009			2008		
	Oil, million barrels	**Gas, billion cubic feet**	**Oil+gas*, million boe**	**Oil, million barrels**	**Gas, billion cubic feet**	**Oil+gas*, million boe**	**Oil, million barrels**	**Gas, billion cubic feet**	**Oil+gas*, million boe**
Proved	13319	23615	17255	13696	22850	17504	14458	29253	19334
Probable	6474	11888	8455	7293	15163	9820	8083	22103	11767
Possible	2780	2318	3167	3683	8226	5054	3333	11694	5282

** The ratio used for recalculation of cubic feet as barrels of oil equivalent (boe) is: 1 boe = 6, 000 cubic feet.*

With a view to harmonizing the reflection of reserves of mineral resources in yearly reports, numberless studies and projects were carried out, at both international and national level, but so far, as we have shown above, no common

viewpoint has been reached, which leads to the provision of various information, and most often comparisons are difficult to make.

5. Conclusion

The different definitions of resources show that there is no common point of view for the estimation of reserves. This is why, in the presentation of information connected to these reserves, entities must apply the regulations of the state on the territory whose exploitation is made, and groups transacted on the stock exchange use this information depending on the regulations of the respective stock exchange.

Changes in the classification of reserves can have a significant impact on the value of resources. For instance, Shell, at the moment when it was admitted to be transacted on the New York stock exchange, had to apply the SEC stipulations, and following the application of these norms, 4,47 billion barrels of equivalent petroleum had to be reclassified, which determined the diminishing by approximately 23%, of proven reserves that had been previously reported (www.shell.com).

Also, certain companies publish information on resources in yearly reports. This information differs depending on the stock exchange where the company is quoted or on the adopted norms reporting. Thus, SEC stipulates that only *proven reserves* be published, in Canada *proven and probable reserves*, while in Great Britain entities can choose to present *proven reserves* or *proven and probable reserves*. Other companies also present in yearly reports, so as to offer users a comprehensive image, a situation of all estimated reserves, but which are not audited (for instance, Total, Shell, BP etc.). Due to this fact, it becomes imperative to have a unitary approach, because only information thus presented can be comparable, and users could be correctly informed.

6. Acknowledgement

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