

## **Digital (Business) Ecosystems: expanding the Benefits of Space Technology Applications for a Sustainable Progress and a Knowledge Based Society**

### **Abstract**

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This work aims to underscore the added value that could be generated by the combination of space technology applications (earth observation, navigation, telecommunications) with the newest Information Communication Technology (ICT) concepts of the web 2.0, semantic web and open collaborative applications. The starting point is the concept of the Digital (Business) Ecosystems (DBE), a new economic paradigm based on "open & collaborative" ICT infrastructures and web architectures and applications. The DBE concept, even if it is still in its infancy, is chosen for achieving the objective of this research: *"to demonstrate the potentiality of the DBE paradigm for expanding the benefits of space technology applications, and vice versa, and contributing to a future cooperative open-knowledge society and a sustainable progress"*. Section 1 introduces to the DBE paradigm ("open & collaborative" ICT; small medium enterprises; regions) with a summary of the key chronological steps through which it has evolved. Section 2 aims to demonstrate the objective of this work through the identification of two main lines (and sub lines) of expansion of space technology applications through a DBE. The methodology applied is a GAP analysis of the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) commitment related to activities such as sustaining business development, technology transfer, environmental issues, mobility and more (end-users "space 2.0" applications). These applications are analyzed under the light of the DBE "open cooperative" knowledge-sharing model through the attribution of the lines of expansion and sub lines. The two agencies' gaps are identified, prioritized and discussed upon the different weights of the correlated lines of expansion. In conclusion, a relationship is found between the diffusion of "open & collaborative" ICT through the DBE network and the benefits of space technology applications for the society. Section 2 ends with the case of the Isle of Man, a unique space-oriented geographic and political area in which real and potential conditions for the convergence of space technology applications with a DBE have been identified. Finally, a new and unexplored paradigm is now opened to the discussion for public space policies and private commercial strategies. Research in this field can contribute to the achievement of international, national and regional policies for local development and welfare based on "open & collaborative" ICT and space applications, as well as new "space 2.0" entrepreneurial projects.

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**In partial fulfilment of the requirements of the  
MSc in Space Management '09  
International Space University**



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## Preface

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Today, a social-benefits dimension has enlarged space activities. Under this tendency, this research wants to explore the potentiality of the space sector to understand how space applications can effectively support and improve our every day life. All the fields of research have to be explored and in particular the ones that could install an imaginative bridge between space and Earth, augmenting the importance of the space on common people perception. In this direction, I found interesting analyze the convergence of the newest ICT paradigms such as “open and collaborative architectures” (SOA) and WEB 2.0 applications (wiki’s, RSS) under the light of end-user needs and of the Digital (Business) Ecosystem, a new economic and “open & collaborative” ICT based paradigm. The DBE seems to be the natural way to optimize the benefits of space technologies applications, creating networked communities where local government, space related enterprises, research and academic institutions and citizens can be simultaneously users and service providers, under the light of a collaborative and knowledge sharing-based local economy development model. New ways of approaching the knowledge and international cooperation are key factors for the challenges left to the incoming generation, called to implement the policies for a sustainable use of energy and production of carbon dioxide, while treating with increasing international relations diplomacy issues. If a change is required in the social-economic system, new approaches and paradigm, as the DBE, can fulfil the requirements set and contribute to redirect the global commitment and development. Finally, space applications can be determinant for the success of the DBE and vice versa, the DBE can maximize the benefits of space technology applications that are at the base of our modern society.

This work can be considered a new step on my personal research of the status and implementation of strategies for achieving a new international community based on knowledge and sustainability. I started two years ago with my MSc thesis on Economics and Management of Innovation: “Space sector: a prolific ground for the European and World economic and social development; the case of the European program Galileo”. Now, I am continuing with this paper that represents a personal assignment in partial fulfilment of the MSc in Space Management (MSM) at the International Space University (ISU), a unique interdisciplinary and international contest and network for postgraduate education on space activities. My supervisor is Dr. Vasilis Zervos, ISU resident faculty member; Economics and Space Policy.

Moreover, this work represents the base for a next research that will start in May '09 at the ESA-ESRIN centre under the supervision of Luigi Fusco, Earth Observation Senior Advisor and Project manager of the Frascati Living Lab (FLL)<sup>1</sup>. A three-month research on the case of the FLL and its points of convergence with the DBE concept will constitute the final module of my MSM.

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<sup>1</sup> FLL is a digital platform for collaboration and virtual incubation implemented in partnership with ESA aiming to enhance space technology applications transfer with a new bottom-up approach involving directly the end-users. It is part of the European Network of Living Labs: <http://www.openlivinglabs.eu/>

## Acronyms

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<b>CESG</b>	communications–electronics security group
<b>COKS</b>	cooperative open knowledge society
<b>DBE</b>	digital business ecosystem
<b>DD</b>	digital divide
<b>DE</b>	digital ecosystem
<b>EO</b>	earth observation
<b>ERP</b>	enterprise resource planning
<b>EO</b>	Earth observation
<b>ES</b>	environmental sustainability
<b>ESA</b>	European space agency
<b>FLL</b>	Frascati living lab
<b>IC</b>	international cooperation
<b>IoM</b>	Isle of Man
<b>ISU</b>	international space university
<b>KP</b>	knowledge progress
<b>MSM</b>	master in space management
<b>MPLS</b>	multi protocol label switching
<b>NASA</b>	national aeronautics space administration
<b>NATO</b>	north Atlantic treaty organization
<b>NSEP</b>	new social-economic paradigm
<b>POKS</b>	prospective open knowledge society
<b>PSA</b>	public space awareness
<b>RBE</b>	resource based economy
<b>RKS</b>	restricted knowledge society
<b>RTA</b>	research technology agency
<b>SMEs</b>	small medium enterprises
<b>SOA</b>	service oriented architecture
<b>SSA</b>	space situational awareness
<b>STM</b>	space traffic management

<b>WAN</b>	wide area network
<b>WHO</b>	world health organization
<b>8C</b>	8 <sup>th</sup> continent project

## **Acknowledgment**

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ESA-ESRIN – Luigi Fusco, EO Senior Advisor

ISU – Vasilis Zervos, faculty member and PA supervisor

ISU – Timie Aganaba, TA assistant

ISU – Tryfon Farmakakis, MSM '09 colleague

MEDES – Audrey Berthier, project manager SAFE

RTA-NATO – Giovanni Sembenini, agency coordinator

## Introduction

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A general definition of the concept of Digital Ecosystems as intended by the European Commission DG INFSO is the following:

*“For Digital Business Ecosystems is intended the mix of enabling technologies and paradigms for fostering endogenous local development, local capacity building and knowledge sharing processes providing tailored and personalized ICT services to citizens and business networks based on the open source philosophy”.*

However Digital Ecosystems emerged worldwide as an innovative approach to support the adoption and development of ICT and their integration for a higher level of knowledge-based society.

Although digital platforms, network and communities have been arisen from the late '90s, the *Digital (Business) Ecosystem* concept has been coined in the 2002 in Europe as a starting point for contributing to the achievement of the ambitious objectives launched by the European Union Lisbon Council (2000). The main objectives of the Lisbon agenda, renovated in the 2005 are: higher growth, more and better jobs and greater social inclusion.

The strategic message coming out from this new policy is that SMEs are key resources and actors for the development of a European knowledge-based society. They represent the natural items of the European geo-economy. In this direction, the DBE provides a new paradigm for boosting local innovation and growth through the use of “on the needs” focused “open-source applications aimed to involve the following elements:

- a) *Public research centres focused on “open & collaborative” innovation;*
- b) *SMEs clusters and local governments;*
- c) *Academic institutions;*

d) *Citizens (different categories).*

The main objective at the base of the DBE project scheme, financed by the European Commission, is the creation of an open source based software infrastructure interoperable highly likely to promote the networking and digitalization of SMEs and their services, contributing equally to the development of the market for small local producers of software.

With the development of a middleware peer-to-peer open source, the possibility of obtaining interoperability in complex systems and the opportunity to create software on a platform of open communication can lead to a reduction of opportunity cost of the potential integration of applications and the cost of production and development of software. These advantages as well some intrinsic limits related to the interoperability will be explored in the Section 1 of this work.

A driver question leads this work:

*“Is there achievable a new welfare dimension through a global “locally based” DBE network based on the integration of open source software applications and space-derived services, allowing e-government policies, social services, bottom-up and collaborative enterprise innovation?”*

By far, the DBE scheme seems to be the one through which the change can be reached. The so-called *Digital Revolution* has started already and it could, now, find a driver and catalyst in the DBE concept.

This research aims to find elements to answer the previous question. Under this light, is explored the potentiality and the limit of the DBE on leading the future economic prosperity, contributing to improving human life conditions, solving issues like the *Digital Divide* and the *Sustainability*. The following objective has been chosen as target of this work:

*“ To demonstrate the potentiality of the DBE paradigm for expanding the benefits of space technology applications, and vice versa, and contributing to a future cooperative open knowledge society and a sustainable progress”.*

The framework of this work consists of two main sections. Section 1 is dedicated to introduce the reader to the understanding of the DBE concept. Issues and roles of its elements ("open & collaborative" ICT; small medium enterprises; regions) are briefly analyzed underscoring key points and issues. Moreover, key chronological steps of the DBE EU DG-INFISO program are summarized through a schematic table constituting a key information tool summarizing actions and results related to the development of this paradigm.

Section 2, instead, is structured through logical steps to achieve the objective of the analysis. It starts with the last trends on the space sector reporting and discussing two main topics:

- a) *The end-user orientation as driver of a new space era (space “2.0”);*
- b) *Benefits from space technology transfer.*

A second step is the correlation of the benefits of space technology applications with the DBE elements and potentiality. This comparison leads to the creation of a model of social growing showing how the diffusion of “open and collaborative” ICT through a DBE network can be useful for achieving higher benefits and an upper stage of the *Knowledge Society*.

After that, is explored how DBE could really contribute to the progress of the space sector boosting the last trends. Two main lines of expansion for the space sector are identified:

- a) *International cooperation;*
- b) *Knowledge progress.*

Some sub lines are also identified for the b). Newest ICT tools are identified and correlated to each line of expansion and

some real examples involving different dimensions of the space activities (private not for profits; international organizations; etc..) are attributed too as inspiring source of the correlation.

The further step of the analysis is the identification of the end-users “space 2.0” applications. Five main categories are chosen and listed here:

- a) *Earth Observation;*
- b) *Positioning/Navigation;*
- c) *Telecommunication;*
- d) *Business Developing;*
- e) *Space Situational Awareness.*

Each sub line of each of those categories is analyzed under the "open cooperative" knowledge-sharing model of the DBE and one or more DBE line of expansion is attributed.

Finally, the ESA and NASA commitment to those applications is assessed through a GAP analysis that takes in consideration agencies' programs, policies and achievements. A certain established scale is used for this purpose and the two agencies' gaps are identified, prioritized and discussed upon the different weights of the correlated lines of expansion. Some recommendations comes from this analysis.

Section 2 ends with the case of the Isle of Man, a unique space-oriented geographic and political area in which real and potential conditions for the convergence of space technology applications with a DBE have been identified, as well some gaps.

## Section 1

### Digital (Business) Ecosystems, an overview

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#### 1.1 Introduction to the DBE concept

This section will contribute to one important target: a summary of the key chronological steps through which the Digital Ecosystem (DE) concept has evolved, since the late 2002 inside the EU DG INFSO, until when the Digital Business Ecosystem (DBE) project was funded (2003). For this target, the Table 1 in the Appendix has been created to provide to a synthetic, schematic and complete information tool about the DE and the DBE project evolution and main actors.

A definition of a DBE is proposed to facilitate the understanding of the summary itself and most widely of the research topic. The main source of this definition is the DE EU official web site<sup>2</sup>; it will be the key through which look upon the next paragraphs and Section 2:

*“For Digital Business Ecosystems is intended the mix of enabling technologies and paradigms for fostering endogenous local development, local capacity building and knowledge sharing processes providing tailored and personalized ICT services to citizens and business networks based on the open source philosophy”.*

The main actors are listed here:

- a) Local governments as catalyst of a DE;
- b) Public research centres focused on “open & collaborative” innovation; SMEs clusters (IT developers and customer of the DE);
- c) Academic institutions;
- d) Citizens (different categories).

The best way to visualize contemporary all the connections inside a DBE is to look at a

graphic flow chart. Figure 1 reports a system map from the main publication of the DG INFSO (European Commission, 2007), which summarized graphically the entire scheme of a DBE.

The dimension of a DBE paradigm includes the concept of the regional economic cluster and all its layers related to the globalisation, the delocalisation and the sector diversity. From this perspective, a DBE could be seen as an extension of this concept; for sure, there is a common starting point: the goal of boosting the local development. However, a more innovative feature makes a DBE a totally new and potential driver for the next economic revolution: the development and exploitation of “open source” based applications and new IT standards for achieve innovative services for a virtual assisted knowledge, global and locally based community.

After the DBE, the research continued within the cluster of EC FP6 projects until the end of 2008 (see Table 1). This cluster of project cooperates in order to continue the scientific and technical development, to make evolving the concept and the framework. Within the European Commission DG Information Society and Media, the Digital Business Ecosystem research cluster was followed until December 2008, when it become mature and moved to the innovation and regional deployment phase.

A DBE community is grown; its activities are wide spreading and the research results have been transferred to the market. The research is continuing within the cluster of running EC-FP6 projects. The network of digital ecosystems region is attracting more regions, through the "Regional Digital Ecosystem Networks", supported by the IST PEARDROP project and by the CIP DEN4DEK project.

Moreover, the local ecosystems implement policies of technological transfer and of innovation and contribute to build the European research Area. A growing number

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<sup>2</sup> Follow this link [www.digital-ecosystems.org](http://www.digital-ecosystems.org).

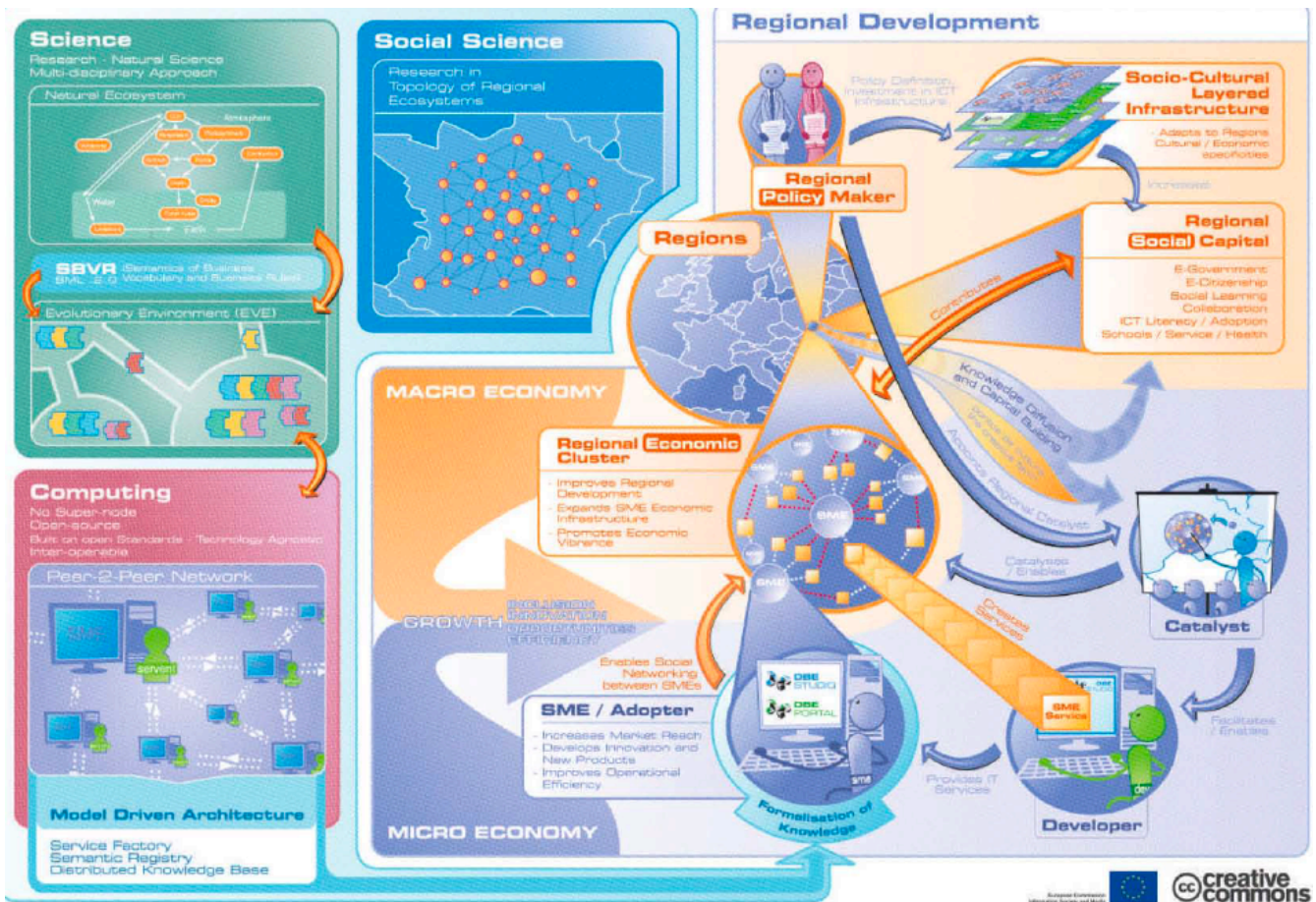


Fig.1. The Digital Business Ecosystem Scheme (source European Commission, 2007)

of innovative regions and areas are joining the initiative. The regional networks: REDEN, the "Regional Digital Ecosystem Network" and eris@ network are deploying the Digital Ecosystems at regional level.

The further development is currently done by open source communities, Trans-European, National and regional projects and by regional networks. The digital ecosystems, while sharing some common protocols and enabling technologies, are developed and grow independently at local level.

## 1.2 Open and collaborative ICT, the lymph for the ecosystem.

The main objective at the base of the DBE scheme is to create an open source based software infrastructure interoperable highly likely to promote the networking and digitalization of SMEs and their services, contributing equally to the development of the market for small local producers of software.

With the development of a middleware peer-to-peer open source, the possibility of obtaining interoperability in complex systems and the opportunity to create software on a platform of open communication can lead to a reduction of opportunity cost of the potential integration of applications and the cost of production and development of software.

All this would help local businesses in several ways. First the barriers of cost of entry would be demolished due to the availability of an open medium, at no cost to use for publication of network services and able to support cooperative efforts (division of the overall integration between different actors and non-duplication cost for each link in the chain, as with proprietary software). Secondly, the possibility of obtaining an interoperable middleware for building applications capable of meeting the needs of local business groups, digital districts, public administration and interest groups in general, would allow the posting by multinational software (which helps to the cost of development of local small and medium enterprises), the increase in profit margins for themselves and opening new markets, thanks to a channel for the dissemination of services and software.

In addition, this opportunity could open new ways of cooperation and business worldwide that are currently possible only to multinational companies for their ability to overcome the costs of entry into a particular market through the creation of sales networks and / or acquisitions.

Today there are several implementations of the Digital Ecosystem infrastructure, made by EU projects or by private companies. In order to avoid a fragmentation of initiatives, and to guarantee the sustainability of the infrastructure, based on an on going debate among the users, it is foreseen to transform the infrastructure from reference.

## Section 2

### Digital (Business) Ecosystems, expanding the benefits of space technology applications?

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#### 2.1 Introduction to the last trends in the space sector (“space 2.0”).

Today, we are looking at an incredible transformation of the utility of space for everyday life. It is enough to think at disaster management as an example of the enormous benefits we can achieve from the economic and social point of view if the potentiality of the earth observation is maximized. For this purpose some key elements have to be reached such as:

- a) *Standardization of tools;*
- b) *Harmonization of policies and procedures;*
- c) *Integration of technologies.*

Looking towards the achievement of these high estimable drivers through national policies and dialogue between states in appropriate international contests, as usual, the private sector is taking an important role in the a scene under changing. From almost 20 years, there is a strong and concrete contribute to evolving the way in which the space sector is shaped.

Starting at looking at the space as a touristic environment, many entrepreneurs started to develop a new business, called space tourism, that, shows the potentiality to become step by step a considerable new aspect of the space sector; more precisely, not only of the space sector industry, but also of the space sector services.

Services, indeed, are becoming the main feature of a new space era where space is at the centre of our daily life. This vision is at the base of the mission of projects such as the “8th Continent Project” (8C) that is a comprehensive effort to integrate space

technology and resources into the global economy<sup>3</sup>. In order to understand the benefits and the potentiality of such a kind of projects and which fundamental inputs could be taken for the objective of this work, in the following box is summarized the nature and the structure of this project.

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#### **Box 1** “ The 8<sup>th</sup> Continent Project ”

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8C wants to be the point of connection and delivering of tools and knowledge needed for organizing the emerging generation of entrepreneurial space-related business ventures, appositely called “space 2.0”. The project is based on a virtual platform<sup>4</sup> and the partnerships between the following items:

- a) *Chamber of commerce;*
- b) *Business incubator;*
- c) *Funding network;*
- d) *Research center.*

The 8C Chamber of Commerce accelerates the materialization of “space 2.0” businesses. It provides the environment to promote business. The 8C Business Incubator helps bring the wide-ranging new technologies to commercialization by connecting start-up companies to talent, resources and capital. There are space related and space derived types of technologies and the applications go from energy to aerospace, and from software to location-based services. The 8C Funding Network is a source connecting promising start-ups seeking early-stage equity funding. Finally, the research branch of 8th Continent Project is the CSM Center for Space Resources at the Colorado School of Mines. This center is extending the expertise of the school to the “8th Continent” of space by pioneering the human and robotic exploration and utilization of space resources and technology. The Center pursues these objectives through education, research and technology development projects on campus as well as with other academic institutions, government agencies, international partners and private sector companies.

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<sup>3</sup> Initial 8th Continent Founders include: DigitalGlobe, Keiretsu Forum/Denver angel network, Townsend & Townsend & Crew IP law firm, Metzger Associates Public Relations, MicroSat Systems, Broad Reach Engineering, Colorado Governor's Office of Economic Development and International Trade, and the Deming Center for Entrepreneurship at the University of Colorado.

<sup>4</sup> For more information look @ <http://www.8cproject.com>.

The project demonstrates the way to look at space under a new perspective and that time is ready for pave the way to innovations and historical changes regarding space. In this direction is significant to focus better which are the lines of changing. For this purpose there is an interesting classification resulted by the activities of another project led by Space Foundation and the National Aeronautics Space Administration (NASA). The project is the “Space Technology Hall of Fame”<sup>5</sup> and the following box will summarize its mission and achievements.

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**Box 2**  
“ The Space Technology Hall of Fame ”

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Since 1988, the Space Foundation, in cooperation with NASA, has conducted the Space Technology Hall of Fame, inducting dozens of technologies and honoring hundreds of organizations and individuals who quietly transform technology originally developed for space exploration into products that help improve the quality of life here on Earth. It also serves to increase public awareness of the benefits of space technology and encourage further innovation.

An expert panel judges the inventions on five different weighted factors; each element constitutes a part of a complementary scale of 50 points:

- a) *Economic Benefit (10 points);*
- b) *Public/Private/Partnership Investment (5 points);*
- c) *Public Awareness Factor (15 points);*
- d) *Societal Benefit Factor (15 points);*
- e) *Longevity (5 points).*

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Coming back to the aim of this paragraph, through those examples key initiatives aiming to emphasized last trends of the space sector and the real value of space applications have been underscored.

The core part of this work takes advantage from the “trends” and “real value” of space using them as starting points of the analysis.

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<sup>5</sup> For more information look @ <http://www.spacetechnologyoffame.org/>

## 2.2 DBE, ICT and lines of expansions of space technology applications.

The topic of Digital Ecosystem (DE) has been recognized critical worldwide due to the universal nature and implications of this concept.

Many common aspects are involved in this concept; the convergence of information technologies and telecommunications, users' evolution from mere consumers to active participants, governments commitment to major policy and regulatory challenges.

A two-year project run by the “World Economic Forum’s joint Industry Partners from IT, Telecoms and Media & Entertainment Industries” has started in the 2007 with the aim to gain a better understanding of the possible outcomes of the Digital Ecosystem. The Digital Ecosystem scenarios were developed around two critical questions:

- a) *Will social and economic value creation be industry controlled and led, or organic and community-led?*
- b) *Will the digital business environment evolve toward a more open or closed system?*

Guided by these key questions, three scenarios<sup>6</sup> of the Digital Ecosystem emerged as drivers of discussions inside the World Economic Forum (WEF). Definitions from the WEF project report (WEF, 2007) are shown here in the following table.

These scenarios were launched at the Annual Meeting in Davos in 2007 and formed the basis for the World Economic Forum’s second-year engagement on the Digital Ecosystem that aims to transform

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<sup>6</sup> A series of scenarios to 2015’ were developed over a period of one year through discussions and workshops in Boston, Davos, Geneva, London, New York, Paris, San Francisco, Seoul, and Tokyo. They synthesize the perspectives of many leaders in business, society, government and academia from Asia, Europe, and North America.

Table.2. World Economic Forum Digital Ecosystem Scenarios.

Safe Havens	Middle Kingdoms	Youniverse
<p>Describes a digital world in which online security concerns create a clamour from consumers, businesses and governments for virtual safe havens. Industry responds by vertically integrating to create secure walled environments that provide all digital services. Because they operate on closed standards, growing numbers of users start to feel constrained by the walls of their safe havens.</p>	<p>Describes a digital world in which consumers, governments and forward-looking businesses push for interoperability, enabling a bewilderingly wide array of niche offerings to become viable propositions – and a Digital Ecosystem dominated by intermediaries that effectively connect users to like-minded individuals and to the highly specialized suppliers that can best meet their needs. In the middle of the space between consumers and suppliers lie the kingdoms where the power lies.</p>	<p>Describes a digital world in which the rise of organic grassroots communities as powerhouses of economic value creation turns traditional business thinking on its head. This leads to the rise of new organizational structures and to digital experiences that are highly personalized. Some companies find ways to capitalize on this distributed innovation – they survive the period of uncertainty and change to see a new day dawn in the digital world; on others the sun sets for good.</p>

the key outcomes into cross-industry collaboration. Moreover a blog<sup>7</sup> has been created with the support of the WEF for create a “digital ecosystem community”, a place where the scenarios and new topics can be approached and discussed and introduced. This demonstrates the need of exploring new dimensions of the DE paradigm.

In the case of this work, indeed, the dimension explored is the one close to the EU DG INFSO policy that is exploded in the cluster project of the Digital Business Ecosystem based on “open source” applications. The driver of this research is how to maximize the benefits for the society and achieve sustainability and progress in the same time through the DBE paradigm. This work explores the potentiality of the new space technology trends and applications for answering this question. It tries to demonstrate the important role of the new “space 2.0” applications in the technologies convergence process through

<sup>7</sup> For more information, <http://www.decommunity.net/>. The Digital Ecosystem (DE) Community's website was created as a “neutral collaborative platform” intended to encourage discussion and to provide a better understanding of the future of the Digital Ecosystem emerging from the convergence between the Information Technology, Telecommunications, and Media & Entertainment Industries.

A first attempt regards the correlation between the benefits from space applications and the diffusion of the open collaborative platforms as intended by the EU DBE concept. An illustrative exercise shown in the next figure, uses the following variables:

- a) *Axis x, Hall of Fame benefits from space technology applications. The scale appositely goes from 0 to 50. As explained in the previous paragraph, there are 5 categories of benefits and they have complementary a value of 50.*
- b) *Axis y, Diffusion of “open collaborative ICT” through DBE networks worldwide. The diffusion is expressed through a simulation in the citizens number (from a local dimension – up to 200.000, to a national dimension – up to 50.000.000, to a global dimension – 2.000.000.000).*

While these are the variables, the output of their relation is a different stage of the society knowledge-sharing status. The following three stages have been identified:

- a) *Restricted Knowledge Society (RKS);*
- b) *Prospective Open Knowledge Society (POKS);*
- c) *Cooperative Open Knowledge Society (COKS).*

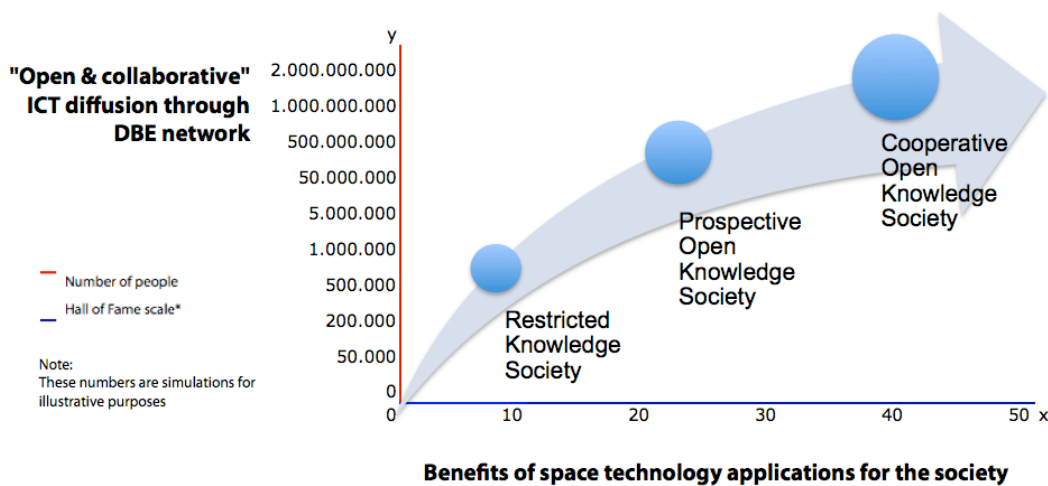


Fig.2. Benefits of space technology applications & DBE for a Cooperative Open Knowledge Society.

Even if this is just an attempt, not supported by empirical evidence, it has to be considered a simulation based on the intrinsic objective and potentiality of the DBE concept, once all the limits of the interoperability and standardization are taken over. The core is that DBE aims to stimulating and fostering local development for improving end-user benefits from two perspectives. First, the benefits deriving from the open source web architectures and applications; secondly the ones deriving from the implementation of a new model of creation of value focused on cooperation and knowledge sharing.

Keeping this light over the analysis, a further step can be done related to the identification of the lines of expansion of the space technology applications through the DBE paradigm (Table 3).

Two main lines of expansions are identified:

- a) *International Cooperation (IC)*;
- b) *Knowledge Progress (KP)*;
- b1) *New Social-Economic Paradigm (NSEP)*<sup>8</sup>;

- b2) *Environmental sustainability (ES)*;
- b3) *Public Space Awareness (PSA)*.

Moreover, a new attempt is done to relate:

- a) *DBE lines of expansion for space technology applications*;
- b) *Newest ICT tools and related elements used in a DBE*.

Some examples are attributed to each line of expansion for showing how real cases are already looking at similar expansions and related key tools. They could be the first to benefit from a DBE.

The case of the SAFE project is reported here due to the active collaboration of the project Manager to this work. A structured questionnaire (Table 4,5,6 in the Appendix) has been sent to SAFE responsible and compiled by her for contributing to the purposes of this research. The main results of this interview-questionnaire are:

- a) *The open source platform is a key feature of the the project*;
- b) *Financing sources are a fundamental need*;

abundant with plentiful resource; our practice of rationing resources through monetary methods is irrelevant and counter productive to our survival". Definition taken from the official website of the Venus project.

For more information look @

[http://www.thevenusproject.com/resource\\_eco.htm](http://www.thevenusproject.com/resource_eco.htm).

<sup>8</sup> "A Resource-Based Economy is a system in which all goods and services are available without the use of money, credits, barter or any other system of debt or servitude. All resources become the common heritage of all of the inhabitants, not just a select few. The premise upon which this system is based is that the Earth is

Table.3. Lines of expansion of space technology applications through the DBE.

DBE LINES of EXPANSION	NEW ICT TOOLS	EXAMPLES
<b>INTERNATIONAL COOPERATION (IC)</b>		
Standard communication tools	Open collaborative architectures; IP laws & data policy harmonization;	RTA (NATO Research Technology Agency); GEO (Group Earth Observation);
Cooperative data sharing models		
Eliminating digital divide		
<b>KNOWLEDGE PROGRESS (KP)</b>		
Society e-progress	User oriented, open & collaborative web applications; Semantic web;	Isle of Man; Regione Lazio;
Enterprise e-progress		
Scientific discoveries		
<b>NEW SOCIAL-ECONOMIC PARADIGM (NSEP)</b>		
Resource based economy	Open collaborative architectures; IP laws & data policy harmonization; User oriented, open & collaborative web applications; Semantic web;	SAFE project (Epidemiology - MEDES); SEVESEO project (Industry Environmental Impact - ESA/VITO);
Service industry focus		
Safety of the territorial value chain		
Human rights and health protection		
Collaborative enterprises I (bottom-up)		
Collaborative enterprises II (integration)		
<b>ENVIRONMENTAL SUSTAINABILITY (ES)</b>		
Modelling climate change	Open collaborative architectures; IP laws & data policy harmonization; Integration with GIS system and other ICT;	ESA Technology Transfer and Data User Element (GLOBCARBON); NASA Technology Transfer;
Monitoring & informing on change progress		
Modelling environmental disasters		
Monitoring & informing on disasters status		
<b>PUBLIC SPACE AWARENESS (PSA)</b>		
Educational tools, data & information	User oriented, open & collaborative web applications; Semantic web;	NASA and ESA Educational / Promotion initiatives;
General public information		
Humanistic studies and art		

The SAFE project is based on an open source platform dedicated to countries to support them to implement the International Health Regulation 2005 of World Health Organization (WHO) through a support for electronic reporting and analysis of epidemiological data. The objective would be to make this platform available for free, as open source, to any country willing to use it, especially developing countries. From a financial point of view, the needs are:

- 1) *How to get funding to set up an open source project and animate this project to have the most powerful platform able to easily evolve thanks to the community of open source developer;*
- 2) *How to get funding to support the developing countries to use this tool and deploy it in their country (training, transfer of knowledge, deployment and funding for equipment);*
- 3) *Once networks are in place, how to support the developing countries to get funding for covering the operational costs (for instance communication costs, including satellite communication costs).*

### 2.3 ESA and NASA, a GAP analysis through the DBE paradigm.

The further step of the analysis is the identification of the end-users "space 2.0" applications. The five main categories chosen are:

- a) *Earth Observation;*
- b) *Positioning/Navigation;*
- c) *Telecommunication;*
- d) *Business Developing;*
- e) *Space Situational Awareness.*

Each sub line of each of those categories is analyzed under the "open cooperative" knowledge-sharing model of the DBE and one or more DBE line of expansion is attributed.

Finally, the ESA and NASA commitment to those applications is assessed through a GAP analysis that takes in consideration agencies' programs, policies and achievements. A certain established scale is used for this purpose and the two agencies' gaps are identified and assessed through the different weights of the correlated

Table.7. ESA’s and NASA’s gaps compared with space 2.0 applications and DBE lines of expansion.

End-Users "Space 2.0" Applications	ESA commitment	ESA gaps	NASA commitment	NASA gaps	DBE lines of expansion	DBE lines of expansion value
<b>EARTH OBSERVATION</b>						
Environmental Disaster Management	++	B	++	B	IC, KP (NSEP, ES, PSA)	2
Climate change Management	++	B	++	B	IC, KP (NSEP, ES, PSA)	2
Urban mapping	+++	not	+++	not	KP (NSEP, ES, PSA)	1
Security and defense	++	B	+++	not	IC	1
Human rights and epidemiology	+	A	+	A	IC, KP (NSEP, PSA)	2
<b>POSITIONING / NAVIGATION</b>						
Public transportation	++	B	++	B	KP (NSEP, ES, PSA)	1
Private and customized services (P/N)	+++	not	+++	not	KP (NSEP)	1
Safety of life	+++	not	+++	not	IC	1
Search & Rescue	+++	not	+++	not	IC	1
<b>TELECOMMUNICATION</b>						
Public TV broadcasting	++	B	++	B	KP (PSA)	1
Public broadcasting services	+	A	++	B	IC, KP (PSA)	2
Private and customized services (T)	++	B	+++	not	KP (NSEP)	1
<b>BUSINESS DEVELOPING</b>						
Technology transfer (bottom up approach)	+	A	+	A	IC, KP (NSEP, PSA)	2
Virtual incubation	+	A	+	A	KP (NSEP)	1
Collaborative enterprises approach	++	B	+	A	IC, KP (NSEP)	2
Resources and partners network	++	B	+++	not	KP (NSEP, ES)	1
<b>SPACE SITUATIONAL AWARENESS</b>						
Near Earth's objects monitoring	++	B	++	B	IC, KP (ES, PSA)	2
Space weather monitoring	++	B	++	B	IC, KP (ES, PSA)	2

+++	HIGH commitment
++	MEDIUM commitment
+	LOW commitment
A	VITAL GAP (LOW comm)
B	CONSISTENT GAP (MEDIUM comm)
not	NO GAP (HIGH comm)
IC, KP (NSEP, ES, PSA)	DBE lines of expansion
2	HIGH importance of the application - It contributes to both lines of expansion
1	MEDIUM importance of the application - It contributes to both lines of expansion

1. IC - International Cooperation;  
2. KP - Knowledge Progress.  
2a. NSEP - New Social-Economic Paradigm;  
2b. ES - Environmental Sustainability;  
2c. PSA - Public Space Awareness.

lines of expansion. The two different types of agencies (NASA – National dimension; ESA – International organization) show similar gap level in the same areas. For example:

- a) EO – Human rights and Epidemiology (remembering the SAFE project before);
- b) Telecommunications – Public broadcasting (new format for increase PSA);
- c) Business development (virtual incubation and technology transfer bottom up approach);
- d) Space Situational Awareness (a new incoming topic for both the agencies).

## 2.4 The Isle of Man, a potential “space-enabling” DBE.

Recently, the Isle of Man (IoM) government set up an e-government project (*Connect Mann*) that demonstrates the importance of the information technologies as a government tool for the expansion of business. This case has been chosen because some real and potential conditions for the development of a Digital Business Ecosystem have been found. IoM represents, perfectly, the base for analyzing the application of the DBE concept in a space-oriented community. The following questions have to be posed for this analysis:

*Are there all the main elements of the DBE? Is there a catalyst government? Is there a space industry cluster? Are there potential end-users (local citizens and international community)? Are there research and academic institutions (locally based and partners: IISC and ISU)? Are there digital infrastructures?*

Recently, the Isle of Man has become one of the most attracting place where space industry, especially oriented in the area of space commercialization, can take the advantage of top financial and business consultancy, low taxes, friendly legislation and dedication to space commerce development. The steps of the achievement of a singular elevated commitment of the Isle of Man government is shown by the IoM Space policy of the 2007 that communicates the terms of the pro-space orientation of this government committed to helping the international space industry flourish.

Alex Downie, Isle of Man Minister for Space, describes as follow the IoM space commitment, during the opening ceremony for the IISC (last October 2008):

*“Welcoming the IISC to the Isle of Man is part of our overall strategy to encourage space innovation. We have attracted some of the space industry’s most successful companies along with several niche players to our island over the past*

*few years. Here, they find a perfect combination of a pro-space government, an established professional infrastructure, access to orbital slots and zero per cent tax on space and satellite business.”*

This gives the idea of what potentialities the Isle of Man has got in term of attracting new “space 2.0” entrepreneurs and helping the space sector to achieve a new shape.

The catalyst government, one of the DBE elements, is a reality in the IoM.

Looking at the SMEs, this feature is not found in the IoM. However, the DBE concept in this case could help the peculiar “space 2.0” services-oriented cluster that is now set up in the IoM. It includes *SES, Inmarsat, Telesat, ManSat, Sea Launch* and the just born *International Institute of Space Commerce*<sup>9</sup>.

To understand if and how a DBE could be implemented in the Isle of Man it is needed to understand which network infrastructure is developed in the environment under analysis, which are the users needs in term of services and information technologies know-how. This is why the starting point is to identify information on the status of IT services in the local environment.

The research culminated in a pilot case that has to be taken in consideration as a driving experience showing the status of Isle of Man networking status: the *Connect Mann* project. This e-government project involves the Isle of Man special partner *Manx Telecom*<sup>10</sup> that is the main provider of telecommunications services for the local government and the in-situ attracted space industry.

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<sup>9</sup> The International Institute of Space Commerce (IISC) has been set up by the International Space University (ISU), who has chosen the International Business School of Douglas, Isle of Man, UK, as the Hq to open IISC.

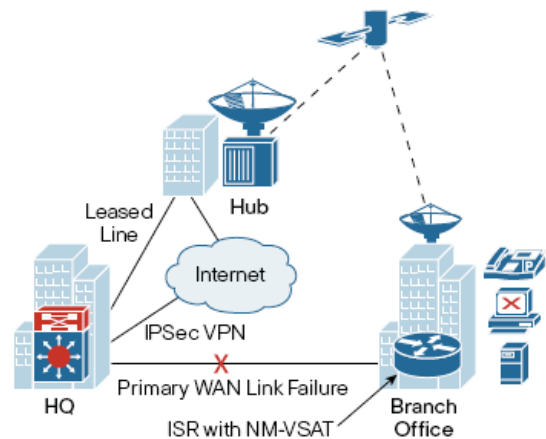
<sup>10</sup> Manx Telecom was formed in 1987 and is now a subsidiary of O2, the mobile phone operator that split off from BT in 2001. O2, in turn, is now part of the international Telefonica group.

At the end of the 2005, the Isle of Man government won a premier international telecommunications award for its *Connect Mann* project. Manx Telecom, together with Dimension Data, were chosen as principal partners by the Isle of Man Treasury's Information Systems Division to deliver the Connect Mann project and consequently designed and deployed a wide area network that connects 165 of the island's government offices and to achieve the replacement and upgrade of local area network components across multiple sites. At the core of the new network is a MPLS (multi-protocol label switching) network, the first of its kind used in a public sector organisation. Moreover, Connect Mann is based on Cisco products and adopts an integrated voice, data and video solution that enables over 5,000 government employees across 9 departments and 3 statutory boards to migrate to Cisco IP telephony. Through these Cisco systems, the Isle of Man government can take advantage of advanced video conferencing and voice recording solutions.

Even if not open source focused, and even if not strongly developed, another element of a DE has been identified: the digital infrastructure.

Having a look at this experience, it is easy to understand that the Isle of Man has got a great potential for becoming the first Digital Business Ecosystem focused on the space sector. Due to the e-government attitude and the excellent network, a base exists for the implementation of a more complete network based not only on IP "closed" applications but also on the "open" source paradigm introducing the benefits of "free access" to a technology, original and customized software, flexibility and collaborative platforms. Moreover, another fundamental element to take in consideration is the use of complementary technologies such as satellite telecommunications based applications for assuring and back up DBE infrastructures.

Due to the critical role assumed, today, by the WAN connectivity for the functioning of businesses, any downtime means not just loss of productivity but lost opportunities and damaged reputation as well (Cisco systems, 2004). Many applications, from real-time e-commerce traffic to corporate e-mail messages, to enterprise resource-planning (ERP) and videoconferencing applications, show the need for businesses of broadband connectivity and move towards data-centred consolidation with the consequence to bring the WAN connectivity to a focal stage.



*Fig.3. Need for Independent Non-terrestrial WAN Backup Solution (source Cisco systems, 2004)*

Cisco has identified several major causes of WAN failures (Cisco Systems, 2004):

- 1) *Accidental cable or optic fiber cut during construction and damage during moves or maintenance;*
- 2) *Human errors at the time of installation or configuration;*
- 3) *Man made emergencies like Terrorist Attacks and Security Breaches;*
- 4) *Natural disasters such as earthquakes, floods, and hurricanes;*
- 5) *Planned network overhaul or upgrades;*
- 6) *Power outage at the service provider;*
- 7) *Service provider network equipment failure;*

Under the light of these potential sources of network failure, the implementation of a DBE should look at obtain more reliability. The solution is provided by satellite connectivity in terms of:

- 1) *Asymmetric use for multicast content distribution;*
- 2) *Centralized management and unified grade of service;*
- 3) *Extensive coverage, available everywhere;*
- 4) *Quick installation and instant activation;*
- 5) *Single service provider for all branch offices;*
- 6) *Shared bandwidth between branch offices and pay-as-you use mean low monthly cost;*
- 7) *WAN diversity, independent of the terrestrial infrastructure.*

In the theory of the DBE, many different activities and business sectors can converge, contribute and take advantage from the Ecosystems. In the specific potential case of the Isle of Man, the following categories can be found:

- 1) *Business consultancy;*
- 2) *Business incubation;*
- 3) *Education;*
- 4) *Finance;*
- 5) *Information technologies;*
- 6) *Research and Development;*
- 7) *Services;*
- 8) *Telecommunication;*
- 9) *Tourism;*

Some of these categories are, then, strictly related to the space sector such as:

- 1) *Space business consultancy and finance;*
- 2) *Space commerce (from tourism to added value services and satellite telecommunications);*
- 3) *Space promotion (business incubators and networks);*
- 4) *Space research and education institutions.*

Finally, the IoM represents a peculiar case of a unique space-oriented geographic and political area in which real and potential conditions for the convergence of space

technology applications with a DBE have been identified, such as:

- a) *A strong government commitment to IT and digital investment, as well as space commercialization;*
- b) *A digital environment that can be developed through "open source" and state of the art WEB 2.0 technology;*
- c) *A singular cluster of space services oriented enterprises.*

## Conclusions

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Let's start this conclusive paragraph reminding the driving question of this work:

*“Is there achievable a new welfare dimension through a global “locally based” DBE network based on the integration of open source software applications and space-derived services, allowing e-government policies, social services, bottom-up and collaborative enterprise innovation?”*

The *space sector* seems to be a natural constituent that can contribute to the benefits achievable through a Digital Ecosystem. The space sector can find new lines of expansion and beneficial synergies with the newest “open & collaborative” ICT helping agencies on pursuing new strategies and governments and enterprises on providing better services to the final users. The following two perspectives have been identified for the role of the space sector in a DBE:

- a) *Space technology applications for backup the DBE (satellite telecommunications);*
- b) *Space-enabled services offered, under the leading role of the local government and through “open and collaborative” ICT to:*
  - *SMEs, (f.i. transports tracking);*
  - *Citizens (f.i., education, polluted areas);*
  - *Research and academic institutions (f.i., EO based applications).*

The implementation of a Digital Business Ecosystem based on “open source” applications and newest IT solutions (f.i., SOA, WEB 2.0) could be an efficient way for maximize the enormous benefits of space-enabled and space industry-dedicated services. The space sector, that today is approaching a new phase oriented towards the “end-users” needs (“space 2.0”), can be driven to a change by a new open-sharing model leading.

So, space technologies should be considered as a complementary and necessary item of

the DBE. In particular, a great importance should be attributed to the satellite telecommunications services for the strategic role on enhancing a high level of reliability of the DBE as shown by the case of the Isle of Man. Moreover, the IoM represents a peculiar case of a unique space-oriented geographic and political area in which real and potential conditions for the convergence of space technology applications with a DBE have been identified such as:

- c) *A strong government commitment to IT and digital investment, as well as space commercialization;*
- d) *A digital environment that can be developed through “open source” and state of the art WEB 2.0 technology;*
- c) *A singular cluster of space services oriented enterprises.*

Starting from the “space 2.0” oriented initiative of the 8C and the Hall of Fame scale of benefits of space technology transfer, an attempt has been done for correlate the diffusion of “open & collaborative” ICT through the DBE network and the benefits of space technology applications for the society. The output of the correlation is a different stage of the society knowledge-sharing status (the diffusion mentioned is expressed on simulated growing number of citizens). The following three stages have been identified:

- a) *Restricted Knowledge Society (RKS);*
- b) *Prospective Open Knowledge Society (POKS);*
- c) *Cooperative Open Knowledge Society (COKS).*

Moreover, new lines of expansion of the space activities through the DBE are identified and used for the GAP analysis of the ESA and NASA commitment to new “end-users” oriented applications.

The two main lines of expansions are:

- a) *International Cooperation (IC);*

- b) *Knowledge Progress (KP)*;
  - b1) *New Social-Economic Paradigm (NSEP)*<sup>11</sup>;
  - b2) *Environmental sustainability (ES)*;
  - b3) *Public Space Awareness (PSA)*.

The five main categories chosen for the analysis are:

- a) *Earth Observation*;
- b) *Positioning/Navigation*;
- c) *Telecommunication*;
- d) *Business Developing*;
- e) *Space Situational Awareness*.

The two different types of agencies (National and International) show similar gap level in the same areas.

Although the DBE could be seen as the model to achieve a knowledge-based society, made of interconnected communities, through which space can be “brought down to earth<sup>12</sup>”, however, recently, a debate is arising on the limits of the DBE paradigm. Apart from the network reliability issue, identified here as a crucial factor for the success of a DBE, recently, another significant issue is arisen. The Ecosystems developed worldwide and based on the “open” source infrastructures, could have developed an Achill’s heel, since each one of those infrastructures has been created singularly by the IT local enterprises and customized on the local needs. This shouldn’t be an issue at the local point of

view, but it could imply critical consequences for the targets of the DBE paradigm, due to communication barriers for different DBE. The solution to the threat of creating “ghetto” DBEs is probably the standardization (De Cecco, 2007) of the DBE platform through protocols. This achievement should derive from using the newest ICT networking solutions such as SOA (software open architectures) and WEB 2.0 applications.

The interconnection of DBE could result as the real key for exploit all the potential of this paradigm and jump into the age of a knowledge-based, global and locally based society. As in past (pc, internet, etc..) there is a need of facilitating the spread of an innovative paradigm to make it become a new fashion in the society. This is why this topic needs to be researched and this is why this work and this contribute has been realized.

Research in this field can contribute to the achievement of international, national and regional policies for local development and welfare based on "open & collaborative" ICT and space applications, as well as new “space 2.0” entrepreneurial projects.

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<sup>11</sup> “A Resource-Based Economy is a system in which all goods and services are available without the use of money, credits, barter or any other system of debt or servitude. All resources become the common heritage of all of the inhabitants, not just a select few. The premise upon which this system is based is that the Earth is abundant with plentiful resource; our practice of rationing resources through monetary methods is irrelevant and counter productive to our survival”.  
Definition taken from the official website of the Venus project.

For more information look @ [http://www.thevenusproject.com/resource\\_eco.htm](http://www.thevenusproject.com/resource_eco.htm).

<sup>12</sup> This concept is the one behind today’s newest public funded and entrepreneurial initiatives like the 8thcontinent project.

## Appendix

Table 1. DBE/DE chronological steps.

<b>2002 (SEPTEMBER)</b>	Publication of the 1 <sup>st</sup> paper about DBE by the e-Business Unit -SMEs area of the European Commission (EC), DG-INFOS: "Towards a network of digital business ecosystems fostering the local development".
<b>2002 (4TH QUARTER)</b>	First cycle of workshops was organised to: - Verify the interest of the European research community in the topic of DE - Disseminate the information and - Improve and enrich the digital ecosystem concept. The DE concept was included in the FP6 R&D -IST <sup>13</sup> work programme in the Strategic Objective 3.1.9 Networked Business and Government.
<b>2003 (APRIL)</b>	The call for project proposals of The FP6-IST work programme included: "IST as driver for small business and government reorganisation through local development processes including small business ecosystems" and "multi-disciplinary researches into complex adaptive and self-organising systems".
<b>2003 (NOVEMBER)</b>	A panel of independent experts has evaluated research proposals in the DE area and only one integrated project was selected for funding: "DBE – Digital Business Ecosystem" (completing time: October 2006).
<b>2004 (APRIL)</b>	Birth of the sector "Technologies for Business Ecosystems", within the EC, as part of the Unit "ICT for Enterprise Networking" of the EC DG INFOS. A main web site is established to provide information about this sector.
<b>2004 (MAY)</b>	The R&D projects, funded under the EC FP6, performing activities in the "ICT for Enterprise Networking" area are grouped in four clusters: (1) "Business Networking", (2) "Digital Ecosystems", (3) "Ambient Intelligent Technologies for the Product Lifecycle", (4) "Enterprise Interoperability". The second cluster "Digital Ecosystems" is established to foster the synergies among the research projects in the DE area <sup>14</sup> .
<b>2005 (APRIL / MAY)</b>	Second cycle of workshops was organised to re-tuning the research needs and the priorities in the DE area, producing a position paper to define the context and set up a research agenda for this innovative paradigm: "The Digital Ecosystems Research Vision: 2010 and Beyond".

<sup>13</sup> IST stays for "Information Society Technologies". It is an activity area inside the European Framework Programme 6, the main object of which is to enhance researches and projects for a direct contribution to European policies for the knowledge society and the e-Europe Action Plan. Medium and long term RTD on the future generation of technologies integrating computers and networks into everyday environment; more information can be found @ <http://cordis.europa.eu/ist>.

<sup>14</sup> More information @ [http://www.digital-ecosystems.org/de/refs/ref\\_proj.html](http://www.digital-ecosystems.org/de/refs/ref_proj.html)

<b>2006</b>	<p>The DE paradigm starts to grow independently at local level. Two main support/networking projects start up: PEARDROP and ERIS@<sup>15</sup>. A growing number of innovative regions start to join the initiatives of these two supporting projects and starts to build up a common framework.</p> <p>The regions, which were working together to exchange experience (and solutions) about DE pilot implementation, plus new follower regions, started to collaborate with the objective to speed-up the adoption and the deployment of a network of regional Digital Business Ecosystems<sup>16</sup>.</p> <p>Two networking projects resulted: DEN4DEK (Digital Ecosystems Network of regions for Dissemination and Knowledge Deployment) and REDEN<sup>17</sup> (Regions for Digital Ecosystems Network).</p>
<b>2007</b>	<p>With the EC reorganisation related to the launch of FP7, the EC sector "Technologies for Digital Ecosystems" is closed and no new research projects are launched within the FP7-IST programme.</p> <p>However, the DE topic is still present and is well described within the FP7 (2007-2013) of the European Community for research, technological development and demonstration activities<sup>18</sup>.</p> <p>The DE objectives are in line with the ones expressed in the communication i2010 "A European Information Society for growth and employment", i.e. to define e-business policies aiming to remove technological, organisational and legal barriers to ICT adoption with a focus on SMEs.</p>

Table 4. Questionnaire on DBE lines of expansion. The case of the SAFE project.

SCALE		SURVEYING CATEGORIES		UNTIL TODAY	FROM TODAY
0	nothing	Digital dedicated platform (open systems or new IT)		0	0
1	low	Final users orientation		0	0
2	medium	SMEs' connecting and economic growing purpose		0	0
3	high	Local government services (e-government)		0	0
<b>TARGET QUESTIONS</b>					
<b>FINANCIAL ISSUES</b>					
<b>NEEDS -</b>					
please fill here					
<b>OBSTACLES -</b>					
please fill here A					
<b>EXPECTATIONS -</b>					
please fill here A					
<b>TECHNOLOGICAL ISSUES</b>					
<b>NEEDS -</b>					
please fill here A					
<b>OBSTACLES -</b>					
please fill here A					
<b>EXPECTATIONS -</b>					
please fill here A					
<b>MANAGEMENT ISSUES</b>					
<b>NEEDS -</b>					
please fill here A					
<b>OBSTACLES -</b>					
please fill here A					
<b>EXPECTATIONS -</b>					
please fill here A					

**Emanuele Barreca:**  
Here, please attribute a mark from the scale (0-3). The scope is to identify the actual commonalities of your project with the DBE main elements.

**Emanuele Barreca:**  
Here, please attribute a mark from the scale (0-3). The scope is to let you express the potential need for your project of a Digital Business Ecosystem.

<sup>15</sup> More information @ [http://www.peardrop.eu/about/activities/Pages/Aims\\_ Objectives.aspx](http://www.peardrop.eu/about/activities/Pages/Aims_ Objectives.aspx).

<sup>16</sup> More information @ [http://www.digital-ecosystems.org/de/refs/ref\\_people.html#era](http://www.digital-ecosystems.org/de/refs/ref_people.html#era).

<sup>17</sup> More information @ <http://www.den4dek.org/> and <http://reden.den4dek.org>.

<sup>18</sup> More information @ <http://www.digital-ecosystems.org/fp7/fp7-overview.html>.

Table 5. Questionnaire on DBE lines of expansion. The case of the SAFE project 1 (MEDES).

SCALE		SURVEYING CATEGORIES	UNTIL TODAY	FROM TODAY
0	nothing	Digital dedicated platform (open systems or new IT)	3	3
1	low	Final users orientation	3	3
2	medium	SMEs' connecting and economic growing purpose	2	2
3	high	Local government services (e-government)	0	0
<b>TARGET QUESTIONS</b>				

## FINANCIAL ISSUES

### NEEDS -

The concept is based on an open source platform dedicated to countries to support them to implement the International Health Regulation 2005 of WHO through a support for electronic reporting and analysis of epidemiological data. The objective would be to make this platform available for free, as open source, to any country willing to use it, especially developing countries. From a financial point of view, the needs are:

1. How to get funding to set up an open source project and animate this project to have the most powerful platform able to easily evolve thanks to the community of open source developer.
2. How to get funding to support the developing countries to use this tool and deploy it in their country (training, transfer of knowledge, deployment and funding for equipment).
3. Once networks are in place, how to support the developing countries to get funding for covering the operational costs (for instance communication costs, including satellite communication costs).

### OBSTACLES -

Concerning point 1, the main objective is to convince foundations (on-going activities), no specific obstacle other than trying to get them convinced of the high added value of this open source approach.

For point 2. This is approximately the same comment than for point 1. This type of product is mainly targetting epidemiological institutes, at national or regional level and of course health professionals. For developed countries, the money can come from national funding. For developing countries, however, countries where this type of technology is the most needed, there is a need to find co-funding both for investment cost and operational costs. Possible sources of funding include foundations, special funds (for instance Global Funds...). An additional possible source of funding is to define research projects using these tools and technology, the costs being therefore possibly partly covered by the research funding.

For point 3. Same comment as for point 2. + specific comment for satellite communications : in developed countries more and more low cost DLS connection via satellite are available.

In developing countries, however, where this type of offer could really make the difference for instance to coordinate health efforts in epidemiological crises, there is still very few offers of this type.

There is need to support the installation of operator able to provide low cost DSL by satellite in these countries.

### EXPECTATIONS -

Interest of foundations for such initiatives. Support from space agencies to deploy affordable communication costs or imaging product (remote sensing) supporting epidemiological monitoring.

Table 6. Questionnaire on DBE lines of expansion. The case of the SAFE project 2 (MEDES).

**TECHNOLOGICAL ISSUES**

<p><b>NEEDS -</b></p> <p>No specific technological issue. The main issue is usually for such system to be complementary to existing health systems, even basic, and not to replace them. Interfacing with any type of health information system and other information system supporting epidemiological surveillance in the area of interest is crucial, but this has been strongly taken into account in the design of the platform. Another issue for epidemiological data collection is the need for highly flexible systems to enable easy eUpdate of the applications, this has also been taken into account. Finally the main needs is to give access to the applications to the maximum number of users: the tool has therefore to be multi-platform and usable and possibly available in all kinds of terminals i.e. applications have to work as web applications, as desktop applications and applications for PDA or mobile phones. The main need would be flexibility, easy of use, interoperability and a strong capability to easily evolve. The capacity to evolve can be solved in part thanks to the open source approach. The other points have been strongly considered in the specifications of the system right from the beginning.</p>
<p><b>OBSTACLES -</b></p> <p>No major obstacle.</p>
<p><b>EXPECTATIONS -</b></p> <p>To find funding to really launch the project as open source both to make the tools available to the maximum number of users and to complement the core tools thanks to the contribution of the open source community of developers.</p>

**MANAGEMENT ISSUES**

<p><b>NEEDS -</b></p> <p>No specific management issue envisaged. The key aspect of these projects is to make the link between health professionals and epidemiologists and ICT developers or service providers, but this can be solved thanks to multi-disciplinary teams. For such project, there is also a need to be closely linked with international health organisations.</p>
<p><b>OBSTACLES -</b></p> <p>The difficulty of working with big international organisations with numerous possibilities of interfaces + the difficulty to find in the developing countries the bodies that will really manage the initiative locally and ensure the sustainability of the project.</p>
<p><b>EXPECTATIONS -</b></p> <p>Support at least at European level for such open source initiatives with a high potential benefit for the populations in terms of health.</p>

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