

# **Digital Agenda:**

## **Dialogue between Brazil and EU on Policies for a Digital Society**

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(Action Code: TICS0003)

**Technical Document A:**

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### **Main EU ICT Public Policies**

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## **Executive Summary:**

This document relates the „Brazilian Government Initiatives (on ICT)” (Chapter 2) to a “Characterization Matrix of EU ICT Initiatives (CM)” based on a set of questions formulated by the Brazilian MCTI. Thirteen (13) themes (technological domains) chosen by the MCTI are addressed and analysed in this document: Cybersecurity, Cloud Computing, Big Data and Analytics, IoT/M2M, Industry 4.0, Open Platforms (Smart Services), Start-ups, e-Learning + e-Skills, Social Innovation, Mobile Empowerment, Mobile / Mobility, Next Generation Internet/Future Internet and (Social) Media. This analysis refers to the document “Horizon 2020; Work Programme 2016 – 2017 [Chapters 5.i (ICT) and 17.Cross-cutting activities (Focus Areas)]; European Commission Decision C (2015) 6776; 13 October 2015”. The result of this analysis is the elaboration of “Characterization Matrix of EU ICT Initiatives (CM)” (Chapter 3). This matrix gives also a first estimation of the level of interest from the Brazilian and from the EU side on the different themes and EU Initiatives discussed in the document.

Horizon 2020 provides in its area of “Cross-cutting activities” in Focus Areas (especially Industry 2020, Internet of Things and Smart Cities) special funding for Trials, Large Scale Pilots or Demonstrators on System Architectures (supply-side) and on multiple Use-Scenarios (demand-side) in certain Application Domains to develop, test and evaluate the results and the impact of the different EU-ICT Initiatives. These activities are presented in Chapter 4 and 5 of this document and it is proposed to use them as an instrument to further develop the dialogue for a “Digital Agenda for the Brazil-EU cooperation on ICT”. Three application domains are proposed:

- ICT for the Industry 2020 (Industry 4.0 Scenario),
- Smart Farming and Food Security / Precision Agriculture (Scenario for the Internet of Things ; IoT-Scenario ) and
- Nature-based solutions for smart cities (Smart Cities Scenario)

At the end of this “Technical Document A” (Chapter 6) its content is related and put into the context of the resolutions and recommendations from the following two documents: “VIII EC-BR DIALOGUE ON INFORMATION SOCIETY; Minutes of the meeting in Brasília, 18.11.2015” and “Joint Declaration between the Brazilian Ministry of Communications and the EC DG CONNECT on a Strategic Cooperation in the area of Next Generation of Global Communications (5G); 23.02.2016”. The result is the recommendation to use the content of this “Technical Document A” to implement four actions for the further development of the action TICS0003 “Digital Agenda: Dialogue between Brazil and EU on Policies for a Digital Society”:

- Action 1: Choose areas of common interest and priority
- Action 2: Consider to prepare a 5<sup>th</sup> EC-BR Coordinate Call
- Action 3: Involve there Industry to achieve symmetry with EU
- Action 4: Do joint, Industry-driven work on specific applications.

These actions are described in more detail at the end of Chapter 6.

The Technical Document A was presented in Brasília to the Secretary of the MCTI on 05.04.2016. The outcome of that meeting is reported in Chapter 7 of the document.

The Technical Document A includes at the end two Annexes: one lists all the documents used as reference in this “Technical Document A” and a second Annex includes the copy of the Power Point slides of the lecture given by the author at the MCTI in Brasília on 14.10.2015.

## 1. Introduction

This “Technical Document A” is a deliverable for the action “Digital Agenda: Dialogue between Brazil and EU on Policies for a Digital Society” (Action Code: TICS0003). The commissioned content for this “Technical Document A” was discussed and roughly outlined in a first meeting at the MCTI from 13.10 to 15.10.15 in Brasilia, having as participants several senior officers of the MCTI, the Brazilian Local Expert, Ricardo Asse, and the European External Expert, J. L. Encarnação. These discussions also related the expected content of this document to the scope, purpose and goals of the planned trip of a Brazilian MCTI delegation to Europe, schedule tentatively to take place in April 2016. Altogether these discussions resulted into the following tasks that summarize the rational for the content expected for this document:

- Put detailed information together on how the visions and content of the EU-ICT activities within H 2020 were developed and how they are now being implemented. Describe these activities, one by one, and draft some conclusions. To achieve this purpose a set of questions was prepared by the Brazilian expert (see Figure 2).
- The Brazilian MCTI delegation will visit and meet several Institutes and top ICT experts in Europe strongly involved in EC funded projects, to learn their inside views and experiences on how H2020 is developing and being successfully implemented. The technical content of the document should help in preparing and in making choices for the visits and meetings and also in setting the corresponding agendas.

- One important goal for the visit to Europe, also expressed in the discussions, was to learn more, understand better and get detailed inside during all the visits and meetings on how European industry has contributed to the H2020 vision, concept and framework, how big is its involvement, how much is industry contributing to its implementation and what are the different models in place for funding this participation of the Industry in the EU-ICT activities. The document should propose and draft scenarios that could be used as a basis for related discussions (see Figure 5).

On 14.10.15 J. L. Encarnação gave also a lecture at the MCTI with the title:

- New structures for large enterprises as a reaction to the trends “Mobile Empowerment” and “Internet of Jobs”

(see Annex 2), which was followed by intensive discussions around those two trends. This presentation and these discussions also helped in finding in the context of this document some common understanding in some important issues related to topics like IoT, Industry 4.0 and Technology Platforms.

As a results of these meetings, the lecture and all the discussions it was decided that the Local Senior Expert with the support of the officers of the MCTI would prepare the matrix “Brazilian Government Initiatives (on ICT) by Category” (see Fig. 1a, 1b, 1c, 1d) and also a set of questions to be used as a sort of frame for the discussions at the EC (see Figure 2) and also as a reference for the content of this document. This information was prepared by the Brazilian Local



Expert (Ricardo Asse) and sent to the European External Expert (J. L. Encarnação) to be used by him at a meeting scheduled to take place in Brussels between him and senior officers from the EU DG CONNECT on 10.02.16.

The Figure 1 and Figure 2 were presented and discussed at this meeting, having these discussions as a result a new matrix, the “Characterization Matrix of the EU ICT Initiatives” (CM) (see Figure 3), to be used as the basis for the discussions with the EU DG CONNECT officers when the Brazilian MCTI delegation visits Brussels. This CM Matrix was therefore the main agenda of the meeting with the EC Director M. Campolargo and the Senior Officer Jorge Pereira, both from DG CONNECT. The matrix was discussed in depth, filled by J. Pereira after the meeting and made available to J. L. Encarnação for further use and detailing in this document.

At the meeting itself the following documents were made available to J. L. Encarnação and discussed in the context of the “Characterization Matrix of EU ICT Initiatives” (CM):

## **Horizon 2020**

### **Work Programme 2016 – 2017**

- ( 1 ) **5. i. Information and Communication Technologies**
- ( 2 ) **17. Cross-cutting activities (Focus Areas)**

## **European Commission**

### **Decision C (2015) 6776 of 13 October 2015**

The content of the CM Matrix was, after the meeting and based on how it was filled by J. Pereira, further detailed in this document, row by row, that means theme by theme (the CM matrix itself addresses the Brazilian choice of 13 themes, being each theme a technological main stream domain of the EU-ICT activities within Horizon 2020).

In this document, when describing and detailing the content of the CM matrix some of the texts, definitions and descriptions of programmes, areas and activities are partially taken literal from these two documents [(1) + (2)]. The reference to the pages used from the reference document is given explicitly in the corresponding chapters of this Technical Document A.

Several texts out of Wikipedia are also used in this Technical Document A to set the basic definitions and concepts for the themes, as well as related technologies, systems and applications needed to understand the context and the content of the document. Since these references to Wikipedia are not given explicitly in each single case, this remark should be understood as giving here an explicit, “general reference” for the use of Wikipedia throughout the all document.

After the discussion of the content of the CM matrix (the 13 themes chosen by MCTI ), some sort of classification of the EU-ICT activities is given as an abstraction and basic reference model for a better understanding of H2020 and as a support for further discussions. Based on such a model, some technical areas and application

scenarios are identified, presented and discussed, that have the potential for being the basis of an agenda for the dialogue during the visit of a Brazilian delegation to the EU in Brussels and to some R&D Institutions in Europe (a proposal for such a trip with dates, agendas, addresses and contacts will be the content of a “Technical Document B”, to be written and submitted also by the author of this document) scheduled tentatively for April 2016. These technical areas and application scenarios may also be used to set the basis, to start discussions and the preparatory work for a potential **future 5<sup>th</sup>. Brazil-EU Joint Call** (see Figure 5).

This last section of the “Technical Document A” brings its content in relation to two additional documents:

- **VIII EC-BR DIALOGUE ON INFORMATION SOCIETY; Minutes of the meeting in Brasília, 18.11.2015**
- **Joint Declaration between the Brazilian Ministry of Communications and the EC DG CONNECT on a Strategic Cooperation in the area of Next Generation of Global Communications (5G); 23.02.2016**

To bring the content of this “Technical Document A” in the context of these two documents in a consistent way a set of four actions compatible with the resolutions and recommended actions in these documents are presented at the end of this “Technical Document A”.

The document was presented and discussed at a meeting with the MCTI Secretary on 05.04.2016 in Brasília. The outcome is reported in Chapter 7.

## **2. Brazilian Government Initiatives (on ICT) by Category**

To be able to relate or to compare, but also to prepare a dialogue Brazil – EU on ICT, it was first necessary to have as a reference a synopsis of the - for this purpose relevant - ICT Initiatives on the Brazilian side. These Initiatives are listed by category in Fig. 1 a. There is a total of 32 Initiatives listed and structured in the following categories:

- Access to capital
- Manpower training / Competitiveness
- Entrepreneurship and Innovation
- Internationalization / Globalization
- Research and Development
- Access to Demand / Market

The Initiatives under these categories are further briefly described based on keywords and therefore self-explanatory in the Figures 1 a, 1 b, 1 c, 1 d and 1 e. They are not further described or discussed in this document.

Nevertheless, as far as “Technical Document A” is concerned, this information is the reference for the dialogue Brazil – EU from a Brazilian point of view. The questions to be addressed and discussed at a later visit of a Brazilian Delegation to the EU in Brussels have

therefore this set of matrices as a starting point. Does the EU has some similar Initiatives, what are the commonalities and differences and what are the strategies and tools the EU is using for the implementation? If the EU has additional Initiatives not included in this matrix, then, what are their scopes, purposes and goals and with what priorities, strategies and tools are they going to be implemented by the EU?

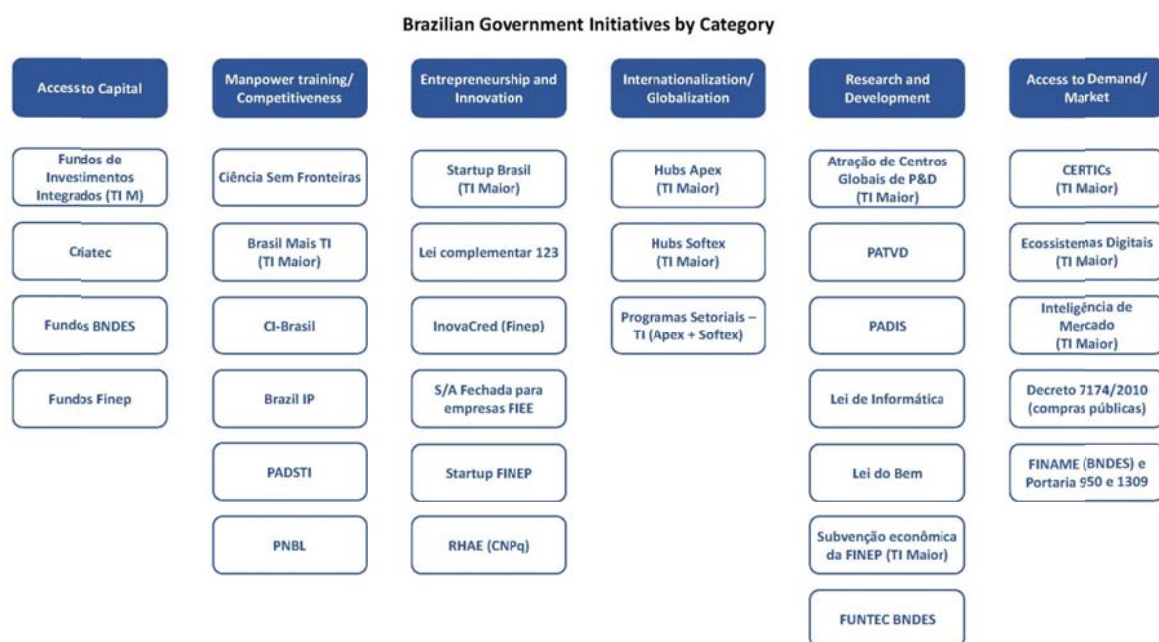


Fig. 1 a: Brazilian Government Initiatives (on ICT) by Category

Brazilian Government Initiatives by Category

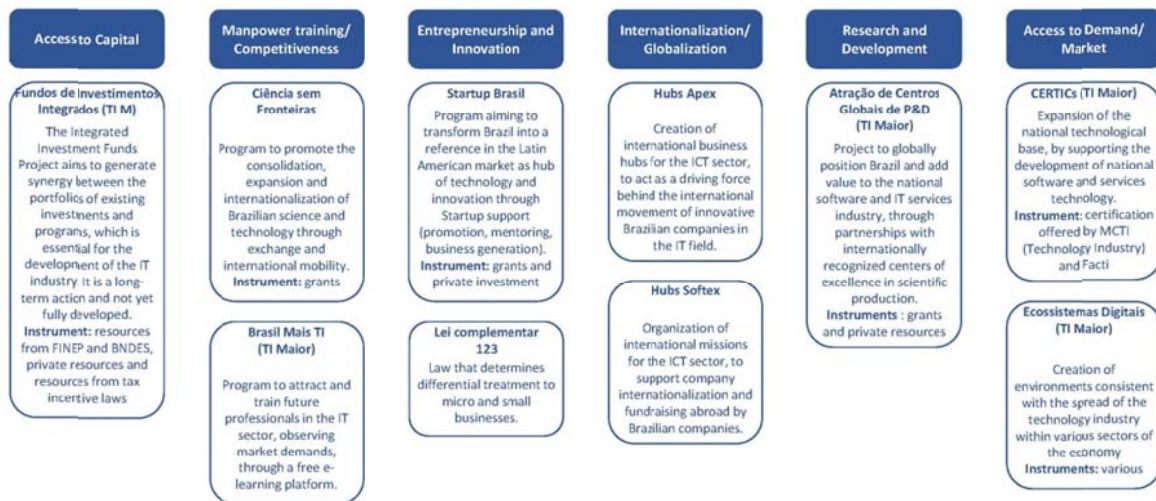


Fig. 1 b: Brazilian Government Initiatives (on ICT) by Category

Brazilian Government Initiatives by Category

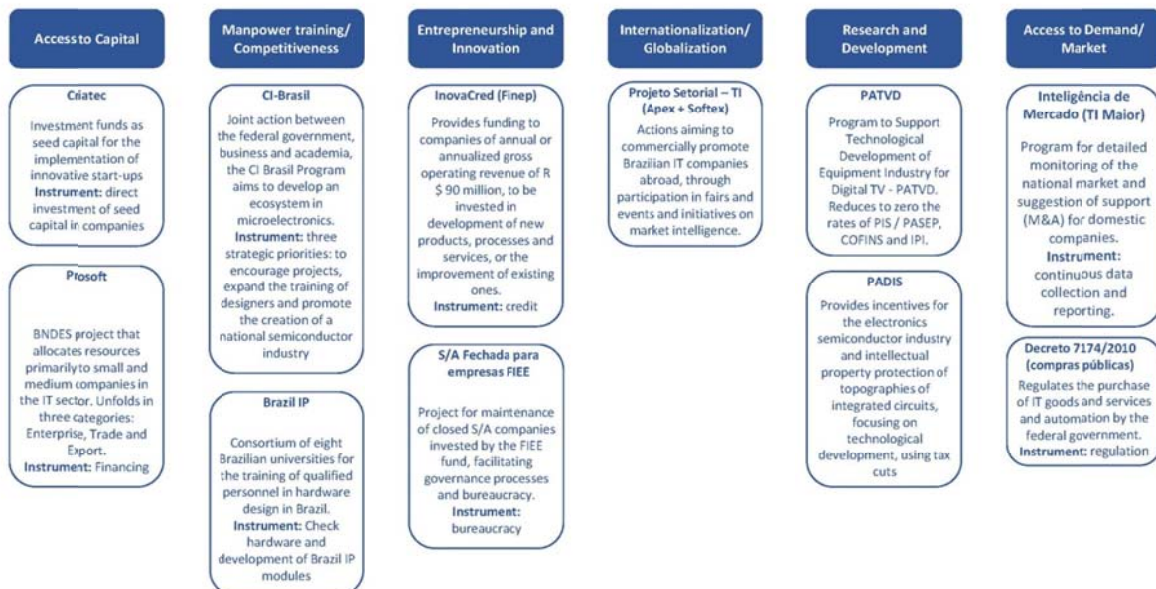


Fig. 1 c: Brazilian Government Initiatives (on ICT) by Category

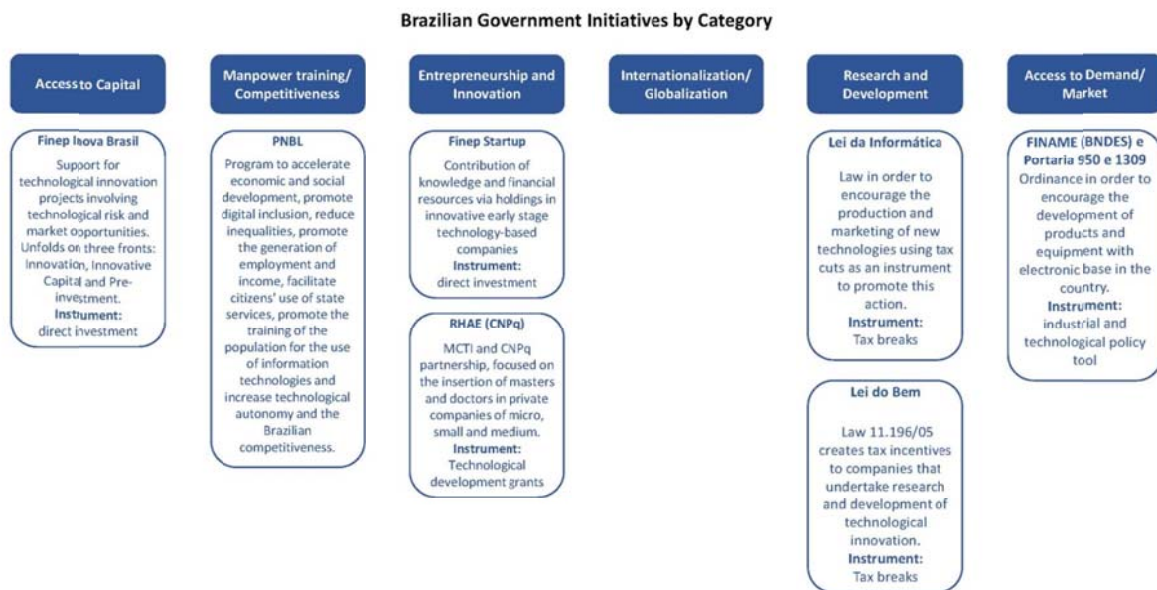


Fig. 1 d: Brazilian Government Initiatives (on ICT) by Category

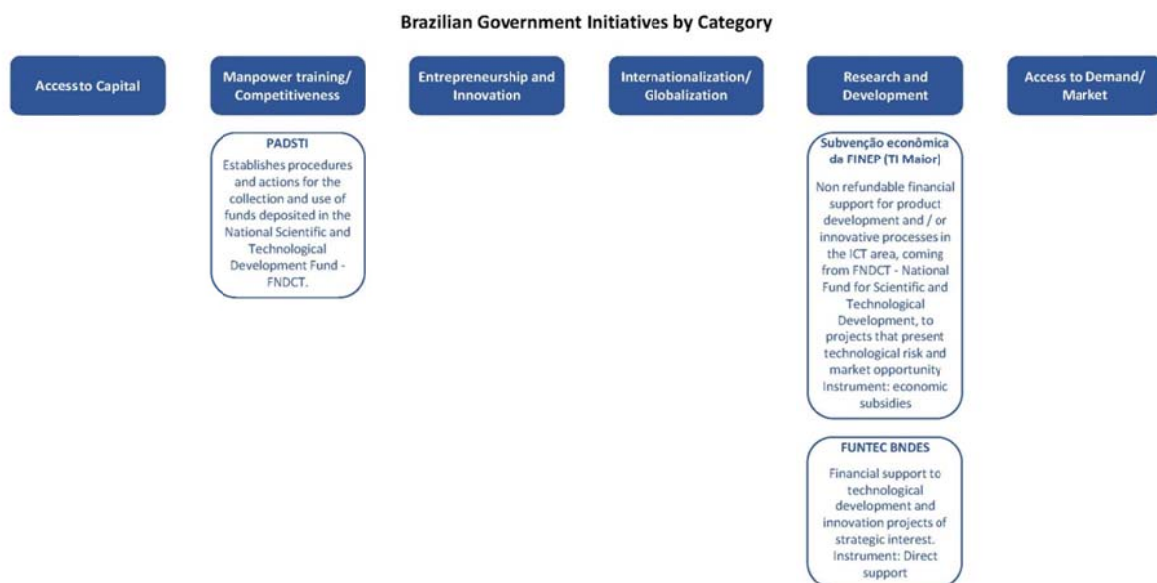


Fig. 1 e: Brazilian Government Initiatives (on ICT) by Category

### **3. Characterization Matrix of the EU ICT Initiatives (CM)**

In order to be able to structure the discussions with the EU in Brussels relating these Brazilian Initiatives to the EU Initiatives, a new matrix was developed by the Brazilian side, putting several questions to a set of technical areas (themes) considered and chosen to be important and of interest to the dialogue Brazil – EU on ICT (Fig. 2).

These questions developed by the Brazilian side are:

- What is the text used by the EU in its policies and programs? (Which are the Reference documents)
- How are the incentives structured for each theme?
- What are the criteria used to accept / reject participants?
- What are the priority industries / themes for subsidies?
- Where is the EU's Focus on manpower training among these themes?
- What are the initiatives regarding access to capital?
- What are the initiatives for internationalization and international cooperation?
- Are there initiatives to foster entrepreneurship in the identified sectors?



These questions should be addressed relating and putting them in the context of the following technical areas (13 themes):

- Cybersecurity
- Cloud Computing
- Big Data and Analytics
- IoT / M2M
- Industry 4.0
- Open Platform (Smart Services)
- Start-ups
- e-Learning + e-Skills
- Social Innovation
- Mobile Empowerment
- Mobile / Mobility (5G)
- Next Generation Internet (Future Internet)
- (Social) Media

The documents used to elaborate this in “Technical Document A” are those already indicated in the Introduction chapter (“HORIZON 2020; Work Programme 2016 – 2017”). Figure 2 shows the format used for the CM-Matrix as proposed by the Brazilian side; each column corresponds to a Technical Area, each column corresponds to a question to be addressed.

	Industry 4.0	Smart Services	Big Data and Analytics	Mobile Empowerment	IT Security	Startup Creation	Cloud	Mobile	Social	Learning	Block chain
What is the text used by the EU in its policies and programs?											
How are the incentives structured for each theme?											
What are the criteria used to accept/ reject participants?											
What are the priority industries/ themes for subsidies?											
Where is the EU's focus on manpower training among these themes?											
What are the initiatives regarding access to capital?											
What are the initiatives for internationalization and international cooperation?											
Are there initiatives to foster entrepreneurship in the identified sectors?											

Fig. 2: The Format for the “Characterization Matrix of the EU ICT Initiatives” (CM)

### 3.1 Cybersecurity

**Cybersecurity** or **IT security**, is the protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide. It includes controlling physical access to the hardware, as well as protecting against harm that may come via network access, data and code injection, and due to malpractice by operators, whether intentional, accidental, or due to them being tricked into deviating from secure procedures. The field is of growing importance due to the increasing reliance on computer systems in most societies. Computer systems now include a very wide variety of "smart" devices, including smartphones, televisions and tiny devices as part of the Internet of Things – and networks include not only the

Internet and private data networks, but also Bluetooth, Wi-Fi and other wireless networks.

In view of **privacy considerations**, businesses are often unsure about how to deal with the data collected through their operations. This data is of particularly high value to companies for offering personalised services or developing new business models. Data subjects (citizens, consumers) often feel that they have no control over the use of their personal data. This is aggravated by uncontrolled exploitation, aggregation and linking of personal data by large corporations and advertisers. The resulting lack of confidence undermines efficient and legitimate data sharing and value creation for agreed purposes. The challenge is to develop technologies that are inherently privacy-preserving and offer the basis for empowering the data subjects to understand and be informed of (and, where appropriate, control) the use of their personal data, and the entrepreneurs to develop and run their data driven business (see pp. 47 of document “Horizon 2020 – 5.i ICT”).

The EU-ICT activity on “Cybersecurity” is summarized in the following table:

	<b>Cybersecurity</b>
EU Unit (s)	H 4 (Trust and Security)
Initiatives	Cybersecurity strategy; Network and Information Security NIS Directive; ePrivacy

WP	Digital Security; Cybersecurity & Trustworthy ICT
Instruments	RIAs
Criteria	Industry driven
Sector	ICT / Banking
International Cooperation	(Yes)

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.2 Cloud Computing

**Cloud computing**, also called **on-demand computing**, is a kind of Internet-based computing that provides shared processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centres. It relies on sharing of resources to achieve coherence and economies of scale, similar to a utility (like the electricity grid) over a network. At the

foundation of cloud computing is the broader concept of converged infrastructure and shared services. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort.

Recent **trends in cloud computing** go towards the development of new paradigms (heterogeneous, federated, distributed clouds) as opposed to the current centralised model, with tight interactions between the computing and networking infrastructures. The **challenge is to address**, from the research and experimentation perspectives, the necessary evolution in cloud architectures, cloud networking, deployment practices and run-time management as well as the associated security and privacy needs. The ambition is to increase the uptake of cloud technology by providing the robustness, trustworthiness, and performance required for applications currently considered too critical to be deployed on existing clouds. From the innovation side, the challenge is in fostering the provision and adoption of competitive, innovative, secure and reliable cloud computing services by SMEs and public sector organisations. Mastering these trends in cloud computing will contribute towards a connected Digital Market (see pp. 18-20 of document “Horizon 2020 – 5.i ICT”).

The EU-ICT Activity on “Cloud Computing” is summarized in the following table:

	<b>Cloud Computing</b>
Unit (s)	E 2 (Cloud computing)
Initiatives	Cloud Computing strategy
WP	Challenges in the data economy
Instruments	RIAs / PCPs
Criteria	Industry-driven
Sector	ICT/Companies/Government
Focus on (Re-) Qualification	Yes
Access to capital	Yes
International Cooperation	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.3 Big Data and Analytics

**Big data** is a term for data sets that are so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization, querying and information privacy. The term often refers simply to the use of predictive analytics or certain other ad-

vanced methods to extract value from data, and seldom to a particular size of data set. Accuracy in big data may lead to more confident decision making, and better decisions can result in greater operational efficiency, cost reduction and reduced risk.

**Analysis** of data sets can find new correlations to "spot business trends, prevent diseases, combat crime and so on." Scientists, business executives, practitioners of medicine, advertising and governments alike regularly meet difficulties with large data sets in areas including Internet search, finance and business informatics. Scientists encounter limitations in e-Science work, including meteorology, genomics, connectomics, complex physics simulations, biology and environmental research.

**Data sets** are growing rapidly in part because they are increasingly gathered by cheap and numerous information-sensing mobile devices, aerial (remote sensing), software logs, cameras, microphones, radio-frequency identification (RFID) readers and wireless sensor networks. The world's technological per-capita capacity to store information has roughly doubled every 40 months since the 1980s; as of 2012, every day 2.5 exabytes ( $2.5 \times 10^{18}$ ) of data are created. One question for large enterprises is determining who should own big data initiatives that affect the entire organization.

A **specific challenge** is the systematic transfer of knowledge and technology across different sectors and there is an underdeveloped data sharing and linking culture. Traditionally, data has been collected and used for a certain purpose within sectorial "silos", while using data across sectors for offering new services opens new opportunities for solving business and societal challenges. The lack of agreed standards and formats, and the low rates of publishing data assets in machine discoverable formats further hold back data integration. The fact that textual data appears in many languages creates an additional challenge for sharing and linking such data. Finally, there is a lack in Europe of secure environments where researchers and SMEs can test

innovative services and product ideas based on open data and business data.

The **challenge is** to break these barriers and to foster exchange, linking and re-use, as well as **to integrate data assets** from multiple sectors and across languages and formats. A more specific challenge is to create a stimulating, encouraging and safe environment for experiments where not only data assets but also knowledge and technologies can be shared (see pp. 40 -48 of document “Horizon 2020 – 5.i ICT”).

The EU-ICT activity on “Big Data and Analytics” is summarized in the following table:

	<b>Big Data and Analytics</b>
Unit (s)	G 3 (Data Value Chain)
Initiatives	Big Data Strategy; Open Data; Reuse of Public Sector Information
WP	Big Data PPP
Instruments	PPP / Large-scale pilots
Criteria	Industry-driven
Sector	Government (Open Data) / Companies



Focus on (Re-) Qualification	Yes
Promoting Entrepreneurship (and community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.4 Internet of Things (IoT) / M2M

The **Internet of Things (IoT)** is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. The ambition is to **foster the take up of IoT** and to enable the emergence of IoT ecosystems supported by open technologies and platforms. It will be addressed through a complementary set of activities structured around Large Scale Pilots.

**IoT Pilots** will make use of the rich portfolio of technologies and tools so far developed and demonstrated in reduced and controlled environments and extend them to real-life use case scenarios with the goal of validating advanced IoT solutions across complete value chains with actual users and proving its enormous socio-economic potential.

**Support actions** provide consistency and linkages between the pilots and complement them by addressing horizontal challenges critically important for the take-up of IoT at the anticipated scale. These include ethics and privacy, trust and security, respect for the scarcity and vulnerability of human attention, validation and certification, standards and interoperability, user acceptability and control, liability and sustainability. A coordination body will ensure an efficient interplay of the various elements of the IoT-FA and liaise with relevant initiatives at EU, Member States and international levels.

Research and innovation effort in specific IoT topics will ensure the **longer-term evolution of Internet of Things**.

A novelty in Horizon 2020 is the Pilot on **Open Research Data** which aims to improve and maximize access to and re-use of research data generated by projects. Projects funded under the IoT call of the Work Programme 2016-17 will by default participate in the Pilot on Open Research Data in Horizon 2020.

A further new element in Horizon 2020 is the use of **Data Management Plans (DMPs)** detailing what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved (see pp. 90 -103 of document “Horizon 2020 – 17. Cross cutting activities (Focus Areas)”)

The EU-ICT activity on “Internet of Things (IoT) / M2M” is summarized in the following table:

	<b>IoT / M2M</b>
Unit (s)	E 1 (Future Networks) A 3 (Complex Systems)
Initiatives	IoT (AIOTI)
WP	Large Scale Pilots on IoT
Instruments	RIAs / Large Scale Pilots
Criteria	Industry-driven
Sector (s)	ICT / Manufacturing / Precision Agriculture / Connected Car / Energy/ Water / e-Health & Wellbeing
Focus on (Re-) Qualification	Yes
International Cooperation	Yes
Promoting Entrepreneurship (and Community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.5 Industry 4.0

**Industry 4.0** or the **fourth industrial revolution**, is a collective term embracing a number of contemporary automation, data exchange and manufacturing technologies. It had been defined as 'a collective term for technologies and concepts of value chain organization' which draws together Cyber-Physical Systems, the Internet of Things and the Internet of Services.

Industry 4.0 facilitates the vision and execution of a "**Smart Factory**". Within the modular structured Smart Factories of Industry 4.0, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real time, and via the Internet of Services, both internal and cross-organizational services are offered and utilized by participants of the value chain

There are **six design principles in Industry 4.0**. These principles support companies in identifying and implementing Industry 4.0 scenarios. Interoperability: the ability of cyber-physical systems (i.e. work-piece carriers, assembly stations and products), humans and Smart Factories to connect and communicate with each other via the Internet of Things and the Internet of Services:

- Virtualization: a virtual copy of the Smart Factory which is created by linking sensor data (from monitoring physical processes) with virtual plant models and simulation models
- Decentralization: the ability of cyber-physical systems within Smart Factories to make decisions on their own
- Real-Time Capability: the capability to collect and analyse data and provide the derived insights immediately
- Service Orientation: offering of services (of cyber-physical systems, humans or Smart Factories) via the Internet of Services
- Modularity: flexible adaptation of Smart Factories to changing requirements by replacing or expanding individual modules

**Characteristic for industrial production in an Industry 4.0** environment are the strong customization of products under the conditions of highly flexibilized (mass-) production. The required automation technology is improved by the introduction of methods of self-optimization, self-configuration, Self-diagnosis, cognition and intelligent support of workers in their increasingly complex work.

This **focus area** is at the heart of how Horizon 2020 contributes to sustainably boosting economic growth and renewing Europe's industrial capacities in a world of finite resources. It will demonstrate the economic and environmental feasibility of the **circular economy** approach, and at the same time give a strong impetus to the re-industrialization of the EU, by developing and deploying new approaches and technologies. This focus area will bring together complementary activities, which *as a whole* will address the overall objectives of enhancing European industrial competitiveness and moving towards a circular economy.

This call **supports systemic innovation**, which is understood as innovation that aims at responding to a societal challenge by obtaining a

systems-wide transformation through affecting the system's economic, social and environmental dimensions. This implies a transdisciplinary perspective that integrates technology, business models and economic organization, finance, governance and regulation as well as skills and social innovation. Systemic innovation therefore calls for the adoption of a challenge-driven, solutions-oriented research and innovation strategy that crosses disciplinary boundaries and involves co-creation of knowledge and co-delivery of outcomes with economic, industrial and research actors, public authorities and/or civil society.

The industrial side of this call is based on the contractual **Public-Private Partnerships (cPPPs)** on Factories of the Future (FoF) and Sustainable Process Industries (SPIRE). It will help develop and deploy the necessary key enabling technologies to support manufacturing across a broad range of sectors. It will help industry to meet the increasing global consumer demand for greener, more customized and higher quality products through the necessary transition to a demand-driven industry with less waste and a better use of resources.

To underpin the systemic approach, **circular economy models** play an important role as they boost innovation and involve all stakeholders in value chain(s) increasing resource efficiency. The circular economy is an economy in which production and consumption are organised in a way that the value of products, components, materials and resources is maintained or enhanced throughout the value chain and the life of the products. The circular economy decouples the creation of wealth and jobs from the consumption of resources (e.g. energy, water and primary raw materials), maximises resource productivity and minimises resource extraction and waste.

(See pp. 6 – 8 and 19 – 46 of document “Horizon 2020 – 17. Cross cutting activities (Focus Areas)”)

The EU-ICT activity on “Industry 4.0” is summarized in the following table:

	<b>Industry 4.0</b>
Unit (s)	A 3 (Complex Systems)
Initiatives	Industry 4.0
WP	Factories of the Future
Instruments	RIAs; Large-Scale Pilots
Criteria	Industry-driven
Sector	Manufacturing (Adaptive, JIT, small-run)
Focus on (Re-) Qualification	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.6. Open Platforms (Smart Services)

In ICT, an **open platform** describes a software system which is based on open standards, such as published and fully documented external application programming interfaces (API) that allow using the software to function in other ways than the original programmer intended, without requiring modification of the source code. Using these interfaces, a third party could integrate with the platform to add functionality.

**An open platform does not mean it is open source**, however most open platforms have multiple implementations of APIs. An open platform can consist of software components or modules that are either commercial or open source or both.

An open platform implies that the vendor allows, and perhaps supports, the ability to do this. Using an open platform a developer could add features or functionality that the platform vendor had not completed or had not conceived of. An open platform allows the developer to change existing functionality, as the specifications are publicly available open standards.

The future design of the **Internet of Things applications** will depend crucially on the development of sophisticated platform architectures for smart services, smart objects, embedded intelligence, and smart networks. Most of the today's IoT systems are however mainly focused on sensors, whereas in the future actuation and smart behaviour will be the key points. Research driven by ambitious use cases and benefiting from innovation areas in components, systems, networking and web technologies needs to be carried out to respond to the ever increasing needs of future IoT systems in terms of scalability, heterogeneity, complexity and dynamicity. IoT platforms should be open and easy-to-use to support third party innovation Architectures,



concepts, methods and tools for **open IoT platforms** integrate evolving sensing, actuating, energy harvesting, networking and interface technologies. Platforms should provide connectivity and intelligence, actuation and control features, linkage to modular and ad-hoc cloud services, Data analytics and open APIs as well as semantic interoperability across use cases and conflict resolution. The work may also address the emergence of an open Web of Things like environment with search capabilities, so that "thing events" can be published, consumed, aggregated, filtered, re-published and searched for. Platforms should be compatible with existing international developments addressing object identity management, discovery services, virtualization of objects, devices and infrastructures and trusted IoT approaches. Proposed research and innovation should take advantage of previous work and build on existing platforms, such as FIWARE, CRYSTAL or SOFIA, if appropriate.

(See pp. 100 -101 of document “Horizon 2020 – 17. *Cross cutting activities (Focus Areas)*”)

The EU-ICT activity on “Open Platforms (Smart Services)” is summarized in the following table:

	<b>Open Platforms (Smart Services)</b>
Unit (s)	E 3 (Net Innovation)
Initiatives	Entrepreneurship; FIWARE
WP	Open Service Platforms; Distributed Architectures

Instruments	Innovation Actions; RIAs
Criteria	Industry-driven
Sector	ICT / Integrators
Focus on (Re-) Qualification	Yes
International Cooperation	Yes
Promoting Entrepreneurship (and community action)	<b>Yes</b>

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.7 Start-ups

A **start-up company** or **start-up** is an entrepreneurial venture or a new business in the form of a company, a partnership or temporary organization designed to search for a repeatable and scalable business model. These companies, generally newly created, are innovative in a process of development, validation and research for target market.

**Turning research results into innovative products and services** often remains difficult and more needs to be done to foster a culture of entrepreneurship. These problems should be addressed by reinforcing the involvement of end users, supporting digital entrepreneurship, strengthening support to start-ups and SMEs, facilitating the meeting between financial investors and start-ups, increasing the skills for future entrepreneurs. Topics are furthermore leveraging the power of the public purse by bringing procurers together to use innovation in order to create better services for citizens and first customer opportunities for digitally-driven tech companies

Too many promising high tech start-ups or innovative SMEs do not manage to **grow and scale up** at national or international level. The tendency is that they either remain within a restricted national market or, if they manage to emerge, are often bought while they are still too small, thus failing to become full actors on the international scene and to create a sound ecosystem around their success. Beyond this, turning research results with high innovation potential into viable products and services, bringing them to the national market or even at a global level remains a big challenge.

Leveraging the **Start-up Europe** and **Innovation Radar** initiatives, actions should on the one hand help established start-ups and prospective tech entrepreneurs to achieve market success and, on the other, raise broader awareness of high potential. Actions should support the expansion of start-ups. They should stimulate further tech entrepreneurship and the creation of new high growth businesses and jobs, seeking maximum synergies through innovation ecosystems. Innovators targeted by the Innovation Radar include startups, SMEs, spinoffs and research teams. Innovators identified, promoted and supported by the Innovation Radar are expected to enriching and benefiting from, the Start-up Europe ecosystem.

(See pp. 83 – 87 of document “Horizon 2020 – 5.i ICT”).

The results of the discussions at the meeting in Brussels on “Start-ups” are summarized in the following table:

	<b>Start-ups</b>
Unit (s)	E 3 (Net Innovation), F 2 (Innovation)
Initiatives	Start-up Europe; Innovation Radar
Instruments	Innovation Actions; SME Instrument
Criteria	Start-ups; VC; Accelerators; Scale-ups
Sectors	All (ICT-driven)
Focus on (Re-) Qualification	Yes
Access to capital	VC Marketplace; EIB
International Cooperation	Yes
Promoting Entrepreneurship (and community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.8. e-Learning, e-Skills

**Learning** today takes place in a context of new interactions between formal and informal learning, the changing role of teachers, the impact of social media, and the students' active participation in the design of learning activities. While there is strong demand for (user-driven) innovation in digital learning, the current environment limits development to silo products, creates barriers to technological and market innovation and cross border adoption of new learning technologies. The challenge is to create an innovation ecosystem that will facilitate open, more effective and efficient co-design, co-creation, and use of digital content, tools and services for personalised learning and teaching. It requires co-creation and co-evolution of knowledge and partnerships between business actors and research players, communities of users, educational and training organisations to develop the appropriate components and services and leading edge learning technologies, which in turn will empower teachers and learners and facilitate (social) innovation in education and training.

There is a **need to develop and test open, interoperable components** for a flexible, scalable and cost-effective cloud-based digital learning infrastructure to deliver user-driven innovation in technological solutions and educational services for primary and secondary education, for personalized, collaborative or experimental learning and skills validation. The infrastructure shall enable stakeholders to create, manage and deliver more efficient processes, content, services, applications and contextual data across a wide variety of education and training systems. It should enable stakeholders to discover, mix and re-use different components and to create new learning solutions. It should be scalable to meet rapidly changing and expanding needs and software requirements while maintaining high levels of security and privacy for teachers and students (see pp. 53 – 56 of document “Horizon 2020 – 5.i ICT”).

The results of the discussions at the meeting in Brussels on “e-Learning + e-Skills” are summarized in the following table:

	<b>e-Learning + e-Skills</b>
Unit(s)	E 4 (Experimental Platforms) G 4 (Skills and Youth)
Initiative	Digital Skills
Instruments	RIAs
Sector	Students; life-long learning; re-education
Focus on (Re-) Qualification	Yes
Promoting Entrepreneurship (and community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.9 Social Innovation

**Social innovations** are new strategies, concepts, ideas and organizations that meet the social needs of different elements which can be from working conditions and education to community development and health — they extend and strengthen civil society. Social innovation includes the social *processes* of innovation, such as open source methods and techniques and also the innovations which have a social purpose — like online volunteering, microcredit, or distance learning. Social Innovation focuses on new work and new forms of cooperation (business models), especially those that work towards a sustainable society.

Social innovation can take place within government; the for-profit sector, the non-profit sector (also known as the third sector), or in the spaces between them. Research has focused on the types of platforms needed to facilitate such **cross-sector collaborative social innovation**.

**Social entrepreneurship**, like social enterprise, is typically in the non-profit sector excluding both for-profit and public organizations. Both social entrepreneurship and social enterprise are important contributions to social innovation by creating social value and introducing new ways of achieving goals. Social entrepreneurship brings “new patterns and possibilities for innovation” and is willing to do things that existing organizations are not willing to do.

The EU-ICT activity on “Social Innovation” is summarized in the following table:

	<b>Social Innovation</b>
Unit(s)	E 3 (Net Innovation)
WP	CAPS
Instruments	RIAs
Criteria	Informal organizations
Sector	Communities
Focus on (Re-) Qualification	Yes
Promote Entrepreneurship (and community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.10 Mobile Empowerment

The **Internet** does a lot of valuable things like entertain us, connect us to others, and handle business transaction, but arguably, the most



important thing it does is to **provide people with information**. In the right hands, information allows business owners and consumers to make better informed decisions when considering business issues or making purchases. Mobile devices make this feature of the internet even more important because it puts access to that information near consumers at all times. Recent studies from UPS, Deloitte, Nielsen and more have shown that the **mobile internet empowers business owners and consumers** in a way that is beneficial to both. This new ICT paradigm is called “Mobile Empowerment”.

Mobile empowerment based on mobile technologies allows the development and implementation of new business models and new business opportunities targeting **micro enterprises (ME)** and their customers. This paradigm is specially important in developing countries like the BRICS economies.

The goal is to develop new **frameworks that use cloud-based applications, innovative low-cost internet delivery mechanisms (delay tolerant networks and opportunistic communications) and affordable mobile technologies to unlock new mobile business opportunities**. In the BRICS economies this is especially important for rural areas. Adapted innovative services at affordable cost offer sustainable access to new markets on a global scale to the benefit of underserved populations, local and European service providers.

In areas where high-speed Internet access (3G and beyond) is often costly or unavailable, **“Mobile Empowerment” implements a low cost content delivery infrastructure**, that might be operated with the help of public community-based infrastructures. Essential components of the network are the mobile and fixed info stations. Using standard Internet connection, the multimedia content ordered by a ME is downloaded from the server to the fixed info station and forwarded to mobile info stations being installed in public community-based infrastructures.

Instead of relying on cellular data, a **DTN approach** may be used to provide affordable technical ways for the micro-entrepreneurs to obtain and distribute multi-media content, and to develop their business at relatively low cost. Such technology platforms can serve as opportunity for micro-entrepreneurs to establish their own businesses.

The EU-ICT activity on “Mobile Empowerment” is summarized in the following table:

	<b>Mobile Empowerment</b>
Unit (s)	E 4 (Experimental Platforms)
Instruments	RIAs
Sectors	Communities and individuals; Micro-enterprises
Focus on (Re-) Qualification	Yes
International Cooperation	Yes
Promoting Entrepreneurship (and community action)	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.11. Mobile / Mobility (5G)

Under “Mobile / Mobility” we want to understand here the area of “Next Generation of Global Communications Networks (5G)”. **5G (5<sup>th</sup> generation mobile networks or 5<sup>th</sup> generation wireless systems)** denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards. 5G has speeds beyond what the current 4G can offer. The Next Generation Mobile Networks Alliance defines the following **requirements for 5G** networks:

- Data rates of tens of megabits per second should be supported for tens of thousands of users
- 1 gigabit per second to be offered simultaneously to many workers on the same office floor
- Several hundreds of thousands of simultaneous connections to be supported for massive sensor deployments
- Spectral efficiency should be significantly enhanced compared to 4G
- Coverage should be improved
- Signalling efficiency should be enhanced
- Latency should be reduced significantly compared to LTE.

5G should be rolled out **by 2020 to meet business and consumer demands**. In addition to providing simply faster speeds, 5G networks also will meet the needs of new use cases, such as the Internet of Things (network equipment in buildings or vehicles for web access) as well as broadcast-like services and lifeline communication in times of natural disaster. Although updated standards that define capabilities beyond those defined in the current 4G standards are under consideration, those new capabilities have been grouped under the current ITU-T 4G standards.

The major difference, from a user point of view, between 4G and 5G are more than just faster speed (increased peak bit rate). For example, higher number of simultaneously connected devices, higher system spectral efficiency (data volume per area unit), lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, lower latencies, higher number of supported devices, lower infrastructure deployment costs, higher versatility and scalability, or higher reliability of communication. Those are the objectives in several of the research initiatives.

The future 5G will enable new applications and new “ecosystems” that it will make it easier to **respond to important and growing societal needs** such as intelligent mobility or e-health. In that sense, 5G will play a critical role for modern society in terms of supporting all aspects of private and economic life of citizens. In this context there is a need for a common understanding on the definition of 5G, preparing global standardization for 5G and working towards harmonization of radio spectrum policy to ensure global interoperability. There is also a need to join forces to support and facilitate the development of new applications (see “**Joint Declaration between the Ministry of Communications of Brazil and DG CONNECT on 5G**” – February 2016).

The EU-ICT activity on “Mobile / Mobility (5G)” is summarized in the following table:

	<b>Mobile / Mobility (5G)</b>
Unit (s)	E 1 (Future networks) E 4 (Experimental Platforms)
Initiative	5G
WP	5G PPP
Instruments	RIAs
Criteria	Industry-driven
Sector	Mobile / Wireless
International Cooperation	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### **3.12 Next Generation Internet / Future Internet**

While the technical development of the Internet was an extensive research topic from the beginning, an increased public awareness of several critical shortcomings in terms of performance, reliability, scalability, security and many other categories including societal,

economical and business aspects, led to **future Internet research** efforts. The time horizon of future Internet studies is typically long term, taking several years before significant deployments take place. Approaches towards a future Internet range from small, incremental evolutionary steps to complete redesigns (clean slate) and architecture principles, where the applied technologies shall not be limited by existing standards or paradigms such as client server networking, which, for example, might evolve into co-operative peer structures.

Internet has become an engine for innovation, economic growth, job creation and social progress. It is accelerating innovation, reshaping established industries, facilitating new ways of doing business, and transforming social behaviours. At the same time, this increasing diversification of usage patterns and of applications, is posing stronger requirements on the underlying networking and computing infrastructures. User privacy and data protection also emerge as technology drivers. The aim is to **provide an integrated response to the technology challenges and to the innovation needs**, in order to position Europe at the forefront of the Internet developments. The use and development of open source software will be encouraged where appropriate to further promote openness, facilitate the sharing of project results and accelerate innovation in Europe through the introduction of novel products and services.

**Next Generation Internet** refers to a number of projects intended to improve Internet performance or content quality in regions of various sizes and location.

The Future Internet challenge focuses on four interrelated areas that complement each other:

- **Networks**, where the 5G PPP industry roadmap is complemented by longer term research;
- **Software Technologies**, responding to the need of more flexible, reliable, secure and efficient software for complex and highly connected systems;

- **Experimentation** in large-scale or real-life environments, infrastructures for validating Future Internet technologies, products and services and their application to related areas;
- **Innovation**, supporting the emergence and nurturing of innovation ecosystems, supporting Web entrepreneurship, bottom-up innovation and social collaboration (see pp. 21 – 39 of document “Horizon 2020 – 5.i ICT”).

The EU-ICT activity on “Next Generation Internet / Future Internet” is summarized in the following table:

	<b>Next Generation Internet / Future Internet</b>
Unit (s)	E 1 (Future Networks) E 2 (Cloud Computing) E 3 Net Innovation) E 4 ( Experimental Platforms)
Sector	IC / IT
Focus on (Re-) Qualification	Yes
International Cooperation	Yes

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### 3.13 (Social) Media

**Social media** are computer-mediated tools that allow people or companies to create, share, or exchange information, career interests, ideas, and pictures/videos in virtual communities and networks. *Social media* is defined as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of user-generated content." Furthermore, social media depend on mobile and web-based technologies to create highly interactive platforms through which individuals and communities share, co-create, discuss, and modify user-generated content. They introduce substantial and pervasive changes to communication between businesses, organizations, communities, and individuals. These changes are the focus of the emerging field of technoself studies. Social media differ from traditional or industrial media in many ways, including quality, reach, frequency, usability, immediacy, and permanence. Social media operate in a dialogic transmission system (many sources to many receivers). This is in contrast to traditional media that operates under a monologic transmission model (one source to many receivers).

People obtain information, education, news, and other data from electronic and print media. **Social media are distinct from industrial or traditional media** such as newspapers, television, and film as they are comparatively inexpensive and accessible. They enable anyone (even private individuals) to publish or access information. Industrial media generally require significant resources to publish information as in most cases the articles go through many revisions before being



published. One characteristic shared by both social and industrial media is the capability to reach small or large audiences.

The **media and content sector** is driven more and more by the use of technology and new business models, new ways of interaction, consumption and expression are appearing in the rise of the digital era. Europe's media sector is strong in creating content. It is embracing new technologies and investing in innovation to benefit from the digital market. However, the sector has to become even more tech savvy as competition is growing from global players that are particularly strong at technological innovation. The challenge is to make the best use of technology for reaching out to new audiences, adapting to the digital era and thriving in the connected **Digital Single Market**.

High quality content is the main source of revenue for the **Creative Industries** and also instrumental for their competitiveness in a large, international market. The challenge is to maximize the potential for re-use and re-purposing of all types of digital content, for instance, by directly conceiving and creating content usable in different contexts and technical environments; improving its granularity; increasing its ability to dynamically adapt to the users; generating more realistic digital models; embedding semantic knowledge; and other approaches to make content "smarter" thanks to new and emerging technologies.

SMEs represent 85% of all actors in the **creative industry sector**. They co-exist with global players and often face difficulties in adopting state of the art ICT technologies and accessing finance. Moreover, they operate on fragmented and localized target markets and have to bear high market costs which affect their international competitiveness. In this context, ICT tools and technological innovation are fundamental for the creative industries and their competitiveness. They widen creative possibilities and improve efficiency in all sectors. The goal is to increase the competitiveness of the European creative in-

dustries by stimulating ICT innovation in SMEs, by effectively building up and expanding a vibrant EU technological ecosystem for the creative industries' needs and by fostering exchanges between the creative industries SMEs and providers of innovative ICT solutions (see pp. 48 – 52 of document “Horizon 2020 – 5.i ICT”).

The EU-ICT activity on “(Social) Media” is summarized in the following table:

	<b>(Social) Media</b>
Unit (s)	G 1 (Converging Media & Content)
Initiatives	Media Freedom and Pluralism; Audio-visual Media Services; Converging Media & Content
WP	Converging Media & Content
Instruments	RIAs
Sector	Media & Citizens
International Cooperation	Yes (?)

This information will have to be further discussed and detailed at the meetings of the Brazilian delegation during the visit to Europe.

### **3.14 Merging the 13 single matrices into one matrix, the CM-Matrix**

We have described and discussed so far the 13 main areas (themes) of actions and activities within the **HORIZON 2020 Work Programme 2016 – 2017** chosen by the Brazilian MCTI to be addressed by this document and to be the basis for agendas and discussions during the visit scheduled for April 2016 of the Brazilian delegation to Europe. They are in this chapter merged into one matrix, the general CM-Matrix of the EU-ICT Activities, and shown in Figure 4; this process was developed and proposed at the meeting at EC DG CONNECT and comes quite close to Figure 2, proposed by the Brazilian side. It refers to and accommodates the content of HORIZON 2020 and the related EU ICT activities as close as possible to the questions formulated in Figure 2. The content of Figure 4 was proposed by Jorge Pereira from EC DG CONNECT, and then further developed and detailed by the author of this “Technical Document A”.

#### **(A) HORIZON 2020 - Types of Actions**

In the CM-Matrix shown in Figure 4 several acronyms are used. To better understand their meaning and their impact on the EU-ICT Activities the different “Types of Actions” in HORIZON 2020 are now briefly presented.

- **RIA – Research and Innovation Action**

The Public-Private Partnerships take the form of contractual arrangements (cPPPs) between the European Commission and Action

primarily consisting of activities aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution. For this purpose they may include basic and applied research, technology development and integration, testing and validation on a small-scale prototype in a laboratory or simulated environment.

Projects may contain closely connected but limited demonstration or pilot activities aiming to show technical feasibility in a near to operational environment.

Funding rate: 100%

- **IA – Innovation Action**

Action primarily consisting of activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. For this purpose they may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication.

A ‘demonstration or pilot’ aims to validate the technical and economic viability of a new or improved technology, product, process, service or solution in an operational (or near to operational) environment, whether industrial or otherwise, involving where appropriate a larger scale prototype or demonstrator.

A ‘market replication’ aims to support the first application /deployment in the market of an innovation that has already been demonstrated but not yet applied/deployed in the market due to market failures/barriers to uptake. 'Market replication' does not cover multiple applications in the market of an innovation that has already been applied successfully once in the market. ‘First’ means new at least to Europe or new at least to the application sector in

question. Often such projects involve a validation of technical and economic performance at system level in real life operating conditions provided by the market.

Projects may include limited research and development activities.

Funding rate:

70% (except for non-profit legal entities, where a rate of 100% applies)

- **CSA – Coordination and Support Action**

Actions consisting primarily of accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies, including design studies for new infrastructure and may also include complementary activities of strategic planning, networking and coordination between programmes in different countries.

Funding rate: 100%

- **PPP – Public Private Partnership**

The aim of the Public Private Partnerships (PPPs) is to fund research and innovation in several key industrial sectors to boost competitiveness and support employment, while at the same time significantly contributing towards a more green and sustainable economy. The multi-annual research and innovation roadmaps for a given domain are proposed by a constituted high-level industry group and open for

stakeholder consultation, to be finally adopted by the European Commission.

This consultation is done with representative industrial associations for key sectors of Europe's economy. In this way, the EU and industry will provide vital funding for research and innovation activities in sectors which are essential to Europe's industrial leadership.

- **JU – Joint Undertaking**

A Community contribution for the establishment of long term public-private partnerships in the form of Joint Technology Initiatives (JTIs). This may be implemented through **Joint Undertakings** within the meaning of Article 171 of the EC Treaty (new Article 187 TFEU). They are set up as public-private partnerships aimed at mobilizing and pooling European, national and private efforts, for a certain period of time.

- **JPI – Joint Programming Initiative**

The overall aim of the Joint Programming process is to pool national research efforts in order to make better use of Europe's public R&D resources and to tackle common European challenges more effectively in a few key areas. It is a structured and strategic process whereby Member States agree, on a voluntary basis and in a partnership approach, on common visions and Strategic Research Agendas (SRA) to address major societal challenges. On a variable geometry basis, Member States commit to Joint Programming Initiatives (JPIs) where they implement together joint Strategic Research Agendas.

The Joint Programming process was launched by a Communication of the Commission in July 2008 and the Competitiveness Council adopt-

ed several Conclusions since to guide the development of the process. It has mandated a dedicated configuration of ERAC (the High Level Group on Joint Programming - GPC) to steer the process and identify the themes for possible JPIs.

- **PCP – Pre-Commercial Procurement**

Pre-Commercial Procurement is designed to steer the development of solutions towards concrete public sector needs. Under Horizon 2020, the EU increases support for groups of public procurers who work together on joint Pre-Commercial Procurements (PCPs).

The procurement of research and development (R&D) is an important tool to stimulate innovation. It allows public authorities to steer the development of new solutions directly towards their needs. However, the procurement of R&D remains underused in Europe. Under Horizon 2020, the EU increases support for groups of public procurers who work together on joint Pre-Commercial Procurements. Pre-Commercial Procurement (PCP) is the procurement of research and development of new innovative solutions before they are commercially available. PCP works in conjunction with Public Procurement of Innovative Solutions (PPI).

- **PPI – Public Procurement of Innovative Solutions**

The Public Procurement of Innovative solutions (PPI) can stimulate innovation by bringing innovative commercial end-solutions earlier to the market. Contracting authorities can act as a launch pad for innovative goods or services which are not yet available on large scale commercial basis and may include conformance testing.

A strong and stable demand through government procurement can create demand long before a commercial market is established. This has several advantages:

- By acting as the first buyer or lead customer, a contracting authority can boost a particular, new market.
- The public benefits directly by being offered new and innovative public services that are provided in a more cost-efficient and effective manner.
- PPI and Pre-Commercial Procurement can lead to scientific and technological breakthroughs in areas such as health and well-being, food security, sustainable agriculture or clean & efficient energy.

Under Horizon 2020, the Commission co-funds groups of procurers to undertake joint PPI procurements in order to have a single joint PPI call for tender and a single joint evaluation of offers. This can speed up the development of innovative solutions by encouraging cooperation between procurers from across Europe, either by supporting networks of procurers (to prepare joint PPIs) or by co-funding the initial call for tender, the related coordination, and the networking activities.

- **ETP – European Technology Platform**

European Technology Platforms (ETPs) are industry-led stakeholder fora recognized by the European Commission as key actors in driving innovation, knowledge transfer and European competitiveness. ETPs develop research and innovation agendas and roadmaps for action at EU and national level to be supported by both private and public funding. They mobilize stakeholders to deliver on agreed priorities and share information across the EU.



By working effectively together, they also help deliver solutions to major challenges of key concern to citizens such as the ageing society, the environment and food and energy security. ETPs are independent and self-financing entities. They conduct their activities in a transparent manner and are open to new members.

ETPs have a strategy, mobilization and dissemination function. In order to fulfil their role, their main activities encompass:

- developing industry-focused strategic research and innovation agendas including technology roadmaps and implementation plans;
- encouraging industry participation in Horizon 2020, the EU's framework programme for research and innovation, and cooperating with networks in Member States;
- fostering networking opportunities with other ETPs and other partners along the value chain to address cross-sectoral challenges and promote the move towards more open models of innovation;
- identifying opportunities for international cooperation;
- acting as one of the channels of external **advice** for the programming and implementation of Horizon 2020; notably, ETPs have been a key driving force behind the launch of high profile public-private partnerships under the programme.

Commission engagement with the ETPs takes a number of forms:

- provision of a central contact point with overall coordination responsibility in DG Research and Innovation
- a dedicated contact point for individual ETPs in the relevant Directorate-General
- participation in ETP-organized events
- consultation on implementation aspects of Horizon 2020
- organisation of cross-ETP workshops

- **EIP – European Innovation Partnership**

European Innovation Partnerships (EIPs) are a new approach to EU research and innovation. They are challenge-driven, focusing on societal benefits and a rapid modernization of the associated sectors and markets.

EIPs act across the whole research and innovation chain, bringing together all relevant actors at EU, national and regional levels in order to: (i) step up research and development efforts; (ii) coordinate investments in demonstration and pilots; (iii) anticipate and fast-track any necessary regulation and standards; and (iv) mobilize 'demand' in particular through better coordinated public procurement to ensure that any breakthroughs are quickly brought to market. Rather than taking the above steps independently, as is currently the case, the aim of the EIPs is to design and implement them in parallel to cut lead times.

EIPs streamline, simplify and better coordinate existing instruments and initiatives and complement them with new actions where necessary. This should make it easier for partners to co-operate and achieve better and faster results compared to what exists already. Therefore, they build upon relevant existing tools and actions and, where this makes sense, they integrate them into a single coherent policy framework. Flexibility is important; there is not a 'one-size-fits-all' framework.

EIPs are launched only in areas, and consist only of activities, in which government intervention is clearly justified and where combining EU, national and regional efforts in R&D and demand-side measures will achieve the target quicker and more efficiently.

## • Summary of the HORIZON 2020 – Types of Actions

Most of the acronyms used in the CM-Matrix (Figure 4) are summarized in the following tables (Figure 3):

Horizon 2020 – Types of Action						
For Researchers						
Type of Action <sup>1</sup>	Code	Minimum Conditions <sup>2</sup>	Funding Rate	Typical Duration	Average EC Contribution	Aim
Research & Innovation Action	RIA	≥ 3 legal entities from 3 MS/AC	100%	36-48 months	€ 2.0 – 5.0M	collaborative research projects
Innovation Action	IA	≥ 3 legal entities from 3 MS/AC	70% <sup>3</sup>	30-36 months	€ 2.0 – 5.0M	produce plans & arrangements or designs for new, altered or improved products, processes or services
Coordination & Support Action	CSA	1 legal entity	100%	12-30 months	€ 0.5 – 2.0M	accompanying measures (standardisation, dissemination, policy dialogues etc.) no research
MSCA* (except Cofund)	MSCA	see separate factsheet				facilitate mobility of researchers for training & career development
ERC Grants	ERC	1 legal entity in MS/AC	100%	60 months	Starting: ≤ € 2.0M Consolidator: ≤ € 2.75M Advanced: ≤ € 3.5M	support excellent investigators and their research teams to pursue ground-breaking, high-gain/ high-risk research
Prizes	PRI	1 legal entity	n/a	n/a	variable; see respective topic	<ul style="list-style-type: none"> <li>recognise past achievements</li> <li>induce future activities</li> </ul>
SME Instrument	SME	1 SME in MS/AC	3 phases: <ul style="list-style-type: none"> <li>Phase 1: lump sum of € 50K / project</li> <li>Phase 2: € 1 – 2.5M / project (1-2 years) (70% of eligible costs reimbursed)</li> <li>Phase 3: no funding</li> </ul>			combination of demonstration activities (testing, prototyping, ...), market replication
Fast Track to Innovation	FTI	≤ 5 legal entities from 5 MS/AC	70% <sup>3</sup>	tbd	≤ € 3.0M	produce plans & arrangements or designs for new, altered or improved products, processes or services

<sup>1</sup> Defined in the Work Programme.  
<sup>2</sup> Additional conditions may be listed in the respective Work Programmes.  
<sup>3</sup> 100% for non-profit organisation (= any legal entity except companies)  
 \* MSCA = Marie Skłodowska Curie Actions

### For Public Sector and other Funding Bodies, Programme Managers etc. (Cofund Actions)

Type of Action <sup>1</sup>	Funding Code	Minimum Conditions <sup>2</sup>	Funding Rate	Typical Duration	EC Contribution	Comment
MSCA Cofund <sup>3</sup>	MSCA Cofund	1 legal entity	50%	36-60 months	≤ € 10.0 M	Co-funding of regional, national & international doctoral & fellowship programmes
ERA-NETs	ERA-NET	≥ 2 legal entities in MS/AC	33%	60 months	variable, see respective topic	coordinate research efforts of participating MS/AC in the field described & implement joint transnational call for proposals with EU co-funding
Pre-Commercial Procurement	PCP	≥ 3 public procurers from MS/AC	70%	18-48 months for 2 Phases: A) Preparation B) Execution	variable, see respective topic	enable the public sector as a technologically demanding buyer to encourage research, development and validation of breakthrough solutions in areas of public interest
Public Procurement of Innovative Solutions	PPI	≥ 3 public procurers from MS/AC	20%	18-48 months for 2 Phases: A) Preparation B) Execution	variable, see respective topic	enable trans-national buyer groups of procurers to share the risks of acting as early adopters of innovative goods or services which are not yet available on a large-scale commercial basis

<sup>1</sup> Defined in the Work Programme.  
<sup>2</sup> Additional conditions may be listed in the respective Work Programmes.  
<sup>3</sup> MSCA = Marie Skłodowska Curie Actions. For further details on MSCA Cofund, see also our separate MSCA factsheet.

**Figure 3: The HORIZON 2020 – Types of Actions (Reference for the acronyms used in Figure 4 – CM Matrix)**

## **(B) CM-Matrix: The Characterization Matrix for the EU-ICT Activities**

The following CM-Matrix (Figure 4 a, b and c) is the result of merging all the matrices of the Technical Areas ( Themes ) addressed and discussed in Chapter 3 of this document. But Figure 4 is not only the merge of all tables in Ch. 3.1 to 3.13 but it also gives an estimation of what seems to be the Brazilian and EU levels of interest in these areas. A tentative visualization of this is given by the last lines of the CM-Matrix. These two lines are still very preliminary and open for discussion, but they are very important and already show a certain direction of the common interests and priorities when preparing future joint activities, as for example a possible, future 5<sup>th</sup> BR-EU Coordinate Call.

Another important point shown by this matrix is that most of the EU-ICT activities are strongly “Industry-driven”. This means that the Industry defines as a constituency for a given Technical Area (Theme) a common strategic research agenda (SRA), this SRA is then submitted to the Commission for further strategic and political consideration and the Commission decides finally based on funding available and on its own priorities what Calls to launch. When the Industry submits in competition their own proposals to these Calls, they then have to relate to the SRA which was developed and agreed by the Industry as a constituency. This way the proposal submitted are “Industry-driven” and follow the interests of the Industry for a given domain.

In case of the BR-EU cooperation the aspect “Industry-driven” should be also strongly taken into consideration to achieve a better strategic symmetry between both sides. This should specially be taken care of when preparing and developing future joint activities and Coordinate Calls in the BR-EU Co-operations on ICT.

But “Industry-driven” can not only mean that such an expect has to be covered by the “Start-Up Initiatives”, because the “Industry-driven” aspect does not include only Star-Ups, but specially also many of the existing industrial stakeholders (like large companies and SMEs) that are already active and operating in the ICT market domain. This means additionally that models and mechanisms have to be provided to match the funding needed for an involvement of these industries in the projects of future BR-EU joint activities.

	Cyber Security	Cloud	Big Data and Analytics	IoT/M2M
Unit(s)	H4 (Trust and Security)	E2 (Cloud Computing)	G3 (Data Value Chain)	E1 (Future networks), A3 (Complex Systems)
Initiatives	Cybersecurity Strategy; Network and Information Security NIS Directive; ePrivacy	cloud computing strategy	Big Data Strategy; Open Data; Reuse of Public Sector Information	IoT (AIOTI)
WP	Digital Security; Cybersecurity & Trustworthy ICT	Challenges in the Data Economy	Big Data PPP	Large Scale Pilots on IoT
Instruments (RIAs, Innov Actions, PPP, PCP/PPI)	RIAs	RIAs / PCPs	PPP / Large-scale Pilots	RIAs / Large-Scale Pilots
Criteria (LEIT or Societal Challenges)	Industry-driven	Industry-driven	Industry-driven	Industry-driven
Sector	ICT / Banking	ICT / Companies / Government	Government (Open Data) / Companies	ICT / Manufacturing / Precision Agriculture / Connected Car / Energy / Water / eHealth & Wellbeing
Focus on (re-)Qualification		Y	Y	Y
Access to Capital		Y		
International Cooperation	Y?	Y		Y
Promoting Entrepreneurship (and community action)			Y	Y
<b>EU INTEREST</b>				
<b>BR INTEREST</b>				

Fig. 4a: Completed “Characterization Matrix of the EU ICT Activities”

Industry 4.0	Open Platforms (Smart Services)	Startups	eLearning + eSkills	Social Innovation
A3 (Complex Systems)	E3 (Net Innovation)	E3 (Net Innovation), F2 (Innovation)	E4 (Experimental Platforms), G4 (Skills and Youth)	E3 (Net Innovation)
Industry 4.0	Entrepreneurship; FIWARE	Startup Europe	Digital Skills	
Factories of the Future	Open Service Platforms; Distributed Architectures			CAPS
RIAs / Large-Scale Pilots	Innovation Actions/RIAs	Innovation Actions; SME Instrument	RIAs	RIAs
Industry-driven	Industry-driven	Startups; VC; Accelerators; Scaleups		informal organisations
Manufacturing (Adaptive, JIT, small-run)	ICT / Integrators	ALL (ICT-driven)	students; life-long learning; re-qualification	communities
Y	Y	Y	Y	Y
		VC Marketplace; EIB		
	Y	Y		
	Y	Y	Y	Y




Fig. 4b: Completed “Characterization Matrix of the EU ICT Activities”

Mobile Empowerment	Mobile	ngInternet	(Social) Media
E4 (Experimental Platforms)	E1 (Future networks), E4 (Experimental Platforms)	E1 (Future networks), E2 (Cloud Computing), E3 (Net Innovation), E4 (Experimental Platforms)	G1 (Converging Media & Content)
	5G		Media Freedom and Pluralism, Audiovisual Media Services, Converging Media & Content
	5G PPP		Converging Media & Content
RIAs	RIAs		RIAs
	Industry-driven		
communities and individuals	Mobile/Wireless	ICT / IT	Media and Citizens
Y		Y	
Y	Y	Y	Y?
Y			




Fig. 4c: Completed “Characterization Matrix of the EU ICT Activities”

## 4. Classification of the EU-ICT activities

The EU-ICT activities chosen for discussion by the Brazilian MCTI were described so far one by one, theme by theme. For the further discussions there is a need for a certain level of abstraction with some structuring and classification of these 13 themes. This helps to abstract from a single theme and to put all these themes in a more generic, functional context. Here it is proposed to structure them in five main classes of activities related to the EU HORIZON Work Programme:

- **ICT- Communication Infrastructure Activities:** Next Generation Internet; 5 G
- **Computing Activities** (EU ICT Activities for Technologies, Systems and Architectures): Cloud Computing; Big Data and Analytics; Cybersecurity
- **Cross Cutting Activities:** IoT / M2M; Industry 4.0; Open Platforms (Smart Services)
- **Vertical Activities:** Social Innovation; Mobile Empowerment
- **Supporting Activities (Multipliers):** Start-ups; e-Learning & e-Skills

The different classes have different scope and purposes, they address different types of challenges, they have their own specific goals and they use in the implementations their own set of tools and instruments. But they all somehow play together as a whole in order to implement the mission and vision of the HORIZON 2020 Programme.



The class “Computing Activities” is already the core of the 4<sup>th</sup> BR-EU Coordinate Call on ICT. A potential future 5<sup>th</sup> BR-EU Coordinate Call could and most probably should build upon these already ongoing and successful activities.

In Figure 5 we visualize a reference model on how these five classes of EU ICT Activities and the corresponding Initiatives relate to each other and come together in the HORIZON 2020 Programme. This reference model may also help in structuring the discussions for developing policies and strategies and in putting priorities in the “Brazilian – EU dialogue in ICT”.

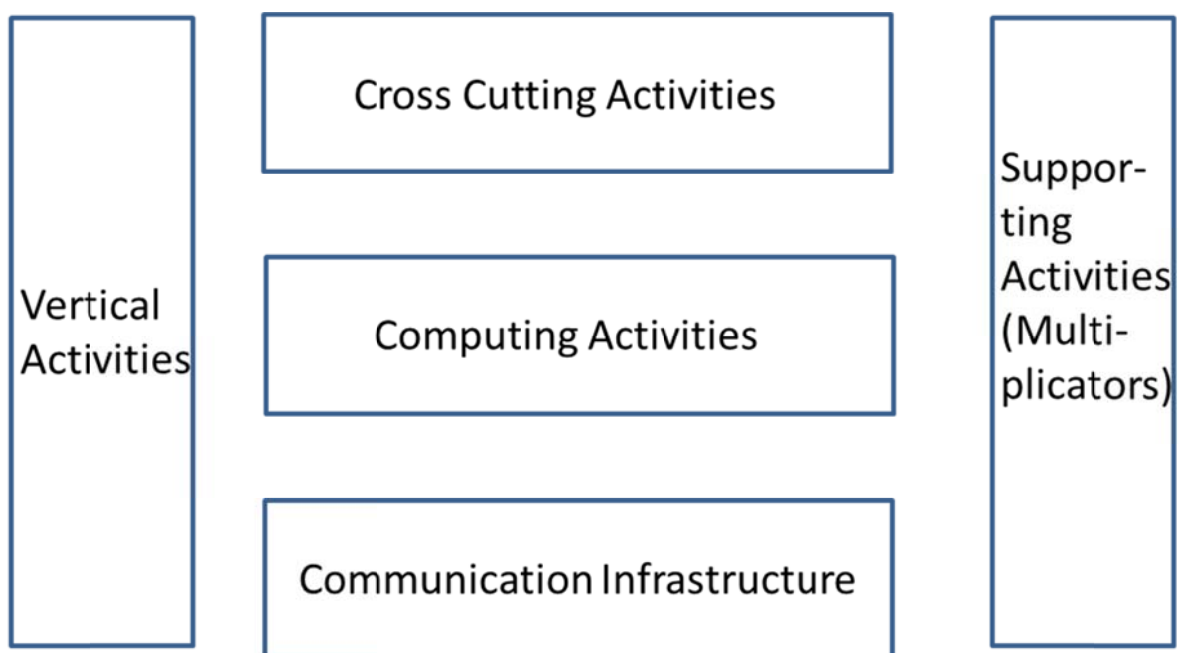


Figure 5 a: The five classes of the EU ICT- Activities in Horizon 2020

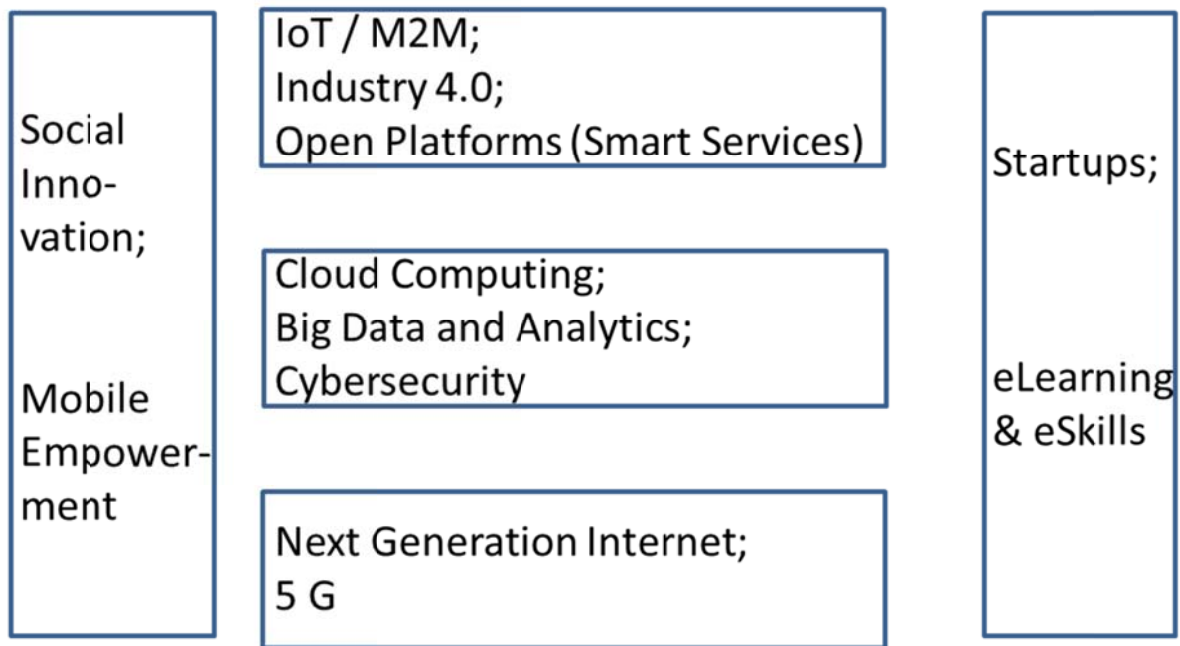


Fig. 5 b: The activities mapped into the five classes of the EU ICT-Activities in Horizon 2020

## 5. Applications in Trials, Large Scale Pilots and Demonstrators

In the context of the class “Cross Cutting Activities” the HORIZON 2020 Programme puts also a very special emphasis on the funding of Trials, Large Scale Pilots and Demonstrators, based on which System Architectures (supply-side) and/or multiple Use-Scenarios (demand-side) can be developed, tested and evaluated. The expected impact here is for a given application domain among others:

- Validation
- Exploration
- User acceptance

- Development of standards
- Opportunities for Spin Offs
- Evaluation of Security and Sustainability.

Some of the **Application Domains** considered are (see pp. 1 – 123 of document “Horizon 2020 – 17. Cross cutting activities Focus Areas”) for:

- Industry 4.0
  - ICT for the Factory of the Future (FoF)
  - Sustainable Process Industries (SPIRE)
  - Circular economy based on systemic innovation (CIRC)
- IoT (Internet of Things)
  - Smart living
  - Smart food and Food security (Precision Agriculture)
- Smart and sustainable cities
  - Sustainable cities through nature-based solutions

## 6. Conclusions and Actions recommended

In this Technical Document A one set of thirteen (13) areas of the EU ICT Initiatives within the HORIZON 2020 Work Programme, as well as some of the in the Programme listed Application Domains for Trials, Large-scale Pilots and Demonstrators were presented and briefly discussed. This is intended to be used in preparing the agenda for visits and meetings during a trip of a Brazilian MCTI delegation to Europe (most probably: Brussels – including the EU – and Germany; sched-

uled tentatively for April 2016). The details, the contacts and the agenda for this trip are the content of the **Technical Document B** that will be written also by the author of this Technical Document A.

In order to make the best possible use of the information content of Technical Document A to further develop the “Dialogue between Brazil and EU on Policies for a Digital Society”, now preferences and priorities on the 13 Themes have to be identified from the Brazilian side. This has to be done choosing a subset of the EU-ICT Activities described in this document, as well as also choosing some Application Domains for joint trials, large-scale pilots or demonstrators, which could end up being the basis for a joint Brazil-EU cooperation and therefore the core for a common Digital Agenda between Brazil and the EU” (see pp. 115 -120 of document “Horizon 2020 – 5.i ICT; Call-EU-Brazil Joint Call; H2020-EUB-2017”).

These preferences and priorities will then also result into a choice of Organizations, Institutes and Individuals (Senior Officers and Senior Experts) to be visited and contacted during the visit of the Brazilian MCTI delegation to Europe. To make sure that such an interaction is not too abstract a small set of possible cooperation scenarios should be considered and prepared to be the basis for developing the “Dialogue between Brazil and EU on Policies for a Digital Society”.

A first rough evaluation of the meetings of the author of this document so far, at the MCTI in Brasilia and at the EU in Brussels, and a first analysis of the “Characterization Matrix of EU ICT Initiatives” developed in this Technical Document A indicate that the following **three scenarios** or a choice among them may be a good and promising basis **for** such a **dialogue**:

- **ICT for the Industry 2020**
- **Smart Farming and Food Security (Precision Agriculture)**
- **Nature-based solutions for smart cities**

They would integrate activities in all five classes of EU ICT Initiatives, would relate to important Application Domains and could consider “supply-views”, as well as “demand-views”, dependent on the ICT policies to be considered and developed (Figure 6).

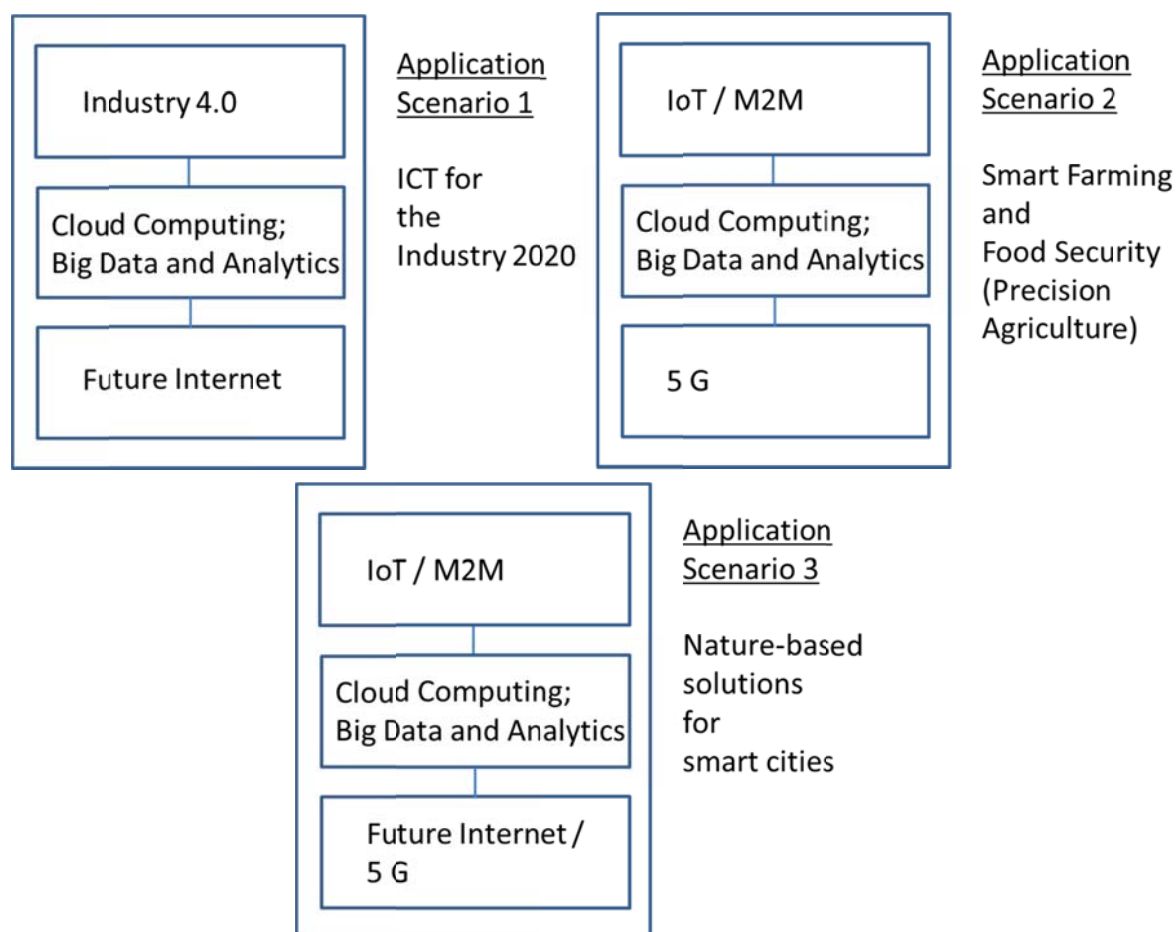


Figure 6: Scenarios: Trials, Large-scale Pilots or Demonstrators

At the end of this document a set of actions is recommended for the further process “Digital Agenda: Dialogue between Brazil and EU on Policies for a Digital Society”. These actions are in line with the results and recommendations listed in the following documents:

- **VIII EC-BR DIALOGUE ON INFORMATION SOCIETY;  
Minutes of the meeting in Brasília, 18.11.2015**
  
- **Joint Declaration between the Brazilian Ministry of Communications and the EC DG CONNECT on a Strategic Cooperation in the area of Next Generation of Global Communications ( 5G ); 23.02.2016**

The **actions recommended** here are:

- **Action 1:** Choose out of the CM Matrix (Figure 3) a subset of technical **areas of common interest and priority** and use them as common ground for further discussions;
  
- **Action 2:** Start, based on that choice, with the discussions and preparatory work for a possible future **5<sup>th</sup> EC-BR Coordinate Call**;
  
- **Action 3:** To achieve a **better symmetry** with the EU-ICT activities on this, work to guarantee a strong **involvement of industry** from both sides in such a coordinate call has to be done ;
  
- **Action 4:** To make that happen, develop and detail **Industry-driven scenarios for joint trials, large scale pilots**

**and / or demonstrators in the context of a set of specific applications** (some proposals for this are made in this document; see Figure 6) to be implemented in such a coordinate call .

## **7. Outcome of the meeting in Brasilia on 05.04.2016 with the MCTI Secretary Manuel Augusto Cardoso da Fonseca and some of his Senior Staff**

At this meeting the European External Expert, J. L. Encarnação, presented in detail his draft of “Technical Document A” (Chapter 1 to 6) . All participants of the meeting had then an intensive discussion led by the Secretary on the Conclusions and Actions recommended in the Report. The meeting came to the following outcome that was supported by the Secretary. It is here written down in the order of the actions recommended in chapter 6.

### **Action 1: Choice of the areas of interest and with priority**

The choice was:

- ICT-Communication Infrastructure: Next Generation Internet; 5G
- Computing: Cloud Computing; Big Data and Analytics; Cybersecurity;

these areas are already core of the 4<sup>th</sup> BR-EU Coordinate

Call and do not have to be part of the 5<sup>th</sup> Call

- Cross Cutting Activities: Industry 4.0; Internet of Things (IoT).
- “Security” should be taken into consideration in all activities, but should not be an activity by itself.

**Action 2: Start** during the mission to Europe with first discussions and the **preparatory work for a 5<sup>th</sup> BR-EU Coordinate Call on ICT**

**Action 3: Consider and discuss** during the mission to Europe **a strong involvement and participation of Industry** to achieve a better symmetry BR-EU in the Call

**Action 4: Consider** for the further discussions the **Industry-driven Application Scenarios :**

- ICT for Industry 2020
- Smart farming and food security  
(Precision Agriculture)
- Nature-based solutions for Smart Cities

This outcome will be the basis and the focus for the meetings and discussions during the mission of the Brazilian MCTI Delegation to Europe, led by the Secretary Manuel Augusto Cardoso da Fonseca



## **Annexes:**

### **Annex 1: Documents used as Reference in this Technical Document A**

#### **(A) Horizon 2020**

Work Programme 2016 – 2017

- ( 1 ) 5. *i.* Information and Communication Technologies
- ( 2 ) 17. Cross-cutting activities (Focus Areas)

European Commission

Decision C (2015) 6776 of 13 October 2015

(B) VIII EC-BR DIALOGUE ON INFORMATION SOCIETY; Minutes of the meeting in Brasília, 18.11.2015

(C) Joint Declaration between the Brazilian Ministry of Communications and the EC DG CONNECT on a Strategic Cooperation in the area of Next Generation of Global Communications ( 5G ); 23.02.2016

## Annex 2: J. L. Encarnação (Powerpoint Slides):


**New structures for Large Enterprises  
as a reaction to the trends  
"Mobile Empowerment" and "Internet of Jobs"**

Professor Dr.-Ing. José L. Encarnação  
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 Presentation at the SEPIn MCTI meeting for the  
"Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015


**CONTENT**

- Mega trends
- Job Market
- Visions for the future
- Evolution of the Internet
- Internet of Jobs
- Proposal for a Reaction of Large Enterprises to such an evolution (vision)
- Collaboration Platforms as Centers of Gravity
- Internet Work Kiosks
- Summary

 Presentation at the SEPIn MCTI meeting for the  
"Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015 2


**MEGA TRENDS**

- Global **shortfall of formal jobs**
- Mobile **Empowerment**
- Internet of **Jobs**

 Presentation at the SEPIn MCTI meeting for the  
"Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015 3

**GLOBAL JOB MARKET (1)**


- World population: ca. 7 billion
- Adults (aged 15 and older): ca. 5 billion
- People that work or want to work: ca. 3 billion
- Existing formal jobs ca. 1.2 billion
- Global **shortfall of formal jobs** ca. 1.8 billion  
(25 % of world population)

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**GLOBAL JOB MARKET (2)**

**"Market volume" for the creation of "new jobs"**

- World GDP in 2010: \$ 60 trillion  
(sum of countries, total goods and services for one year)
- Estimated GDP in 2040: \$ 200 trillion
- Difference is the new global mix of customers, employers, new businesses and equity: \$ 140 trillion
- This is the "market volume" for the next evolution of the economy in the world.

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**STRATEGY FOR THE CREATION OF NEW JOBS**

The "Market Volume" of \$ 140 trillion will size the next economic revolution.

Therefore there is a **strong need for a strategy** for the large-scale creation of new jobs.

Such a strategy will be based on

- Mobile **Empowerment**
- and on the
- "Internet of **Jobs**"

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## PARADIGM SHIFT

- **Fundamental Questions:**
  - ❖ The **digital revolution** – how are we living and working in the year 2030?
  - ❖ What is the **impact** of the digital revolution **in the creation of value**?
  - ❖ Will the digital revolution help to “**leapfrog**” **steps in the creation of value chain** in the socio-economic development?
- **Trends:**
  - **Mobility and Smart Technologies** (e. g. Smartphones, Smart-Tablets) are changing structures and processes in internet-based economies and industries
  - **Users have a new role** by directly participating and contributing to the economic value chain
  - **New opportunities for business, services and new jobs**
  - **New economies based on Micro-Enterprises (VSME) and Expert Pools (Internet Communities of Experts)**
  - **New opportunities for the socio-economic development**

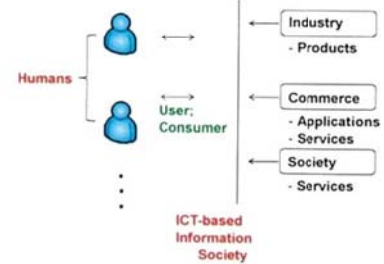


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## TODAY'S SCENARIO: ICT-BASED INFORMATION SOCIETY

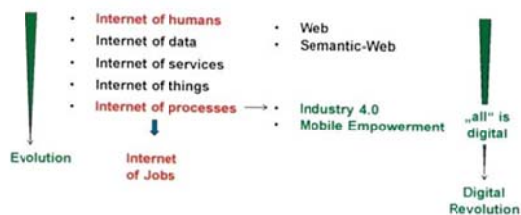


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## EVOLUTION OF THE INTERNET

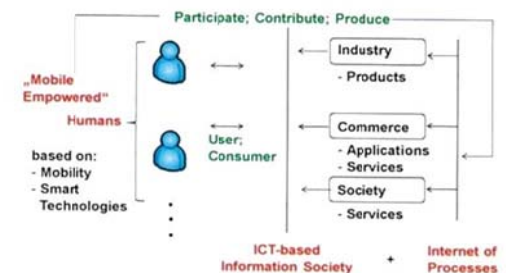


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## TOMORROW'S SCENARIO: MOBILE EMPOWERMENT

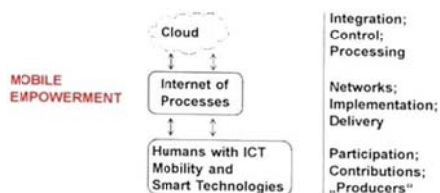


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## THE VISION FOR THE FUTURE



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## INTERNET OF PROCESSES

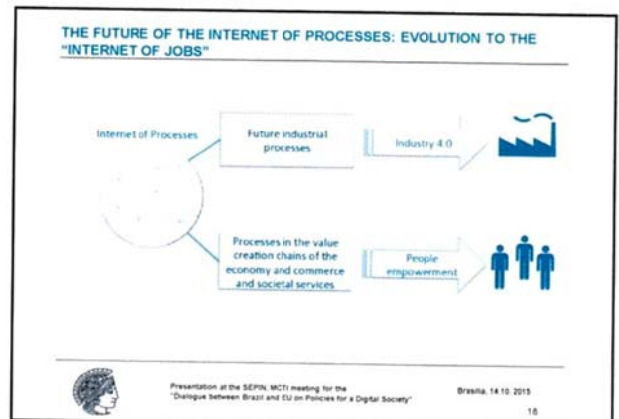
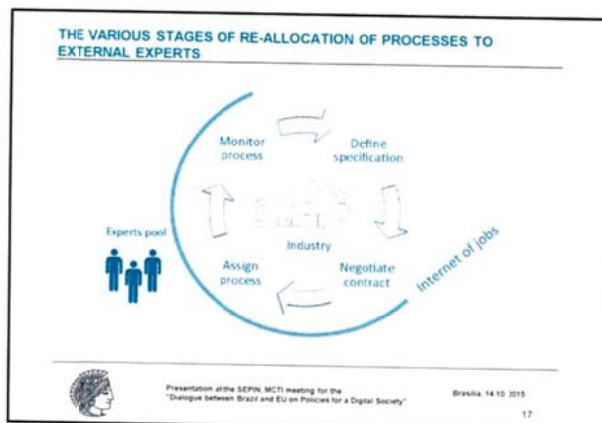
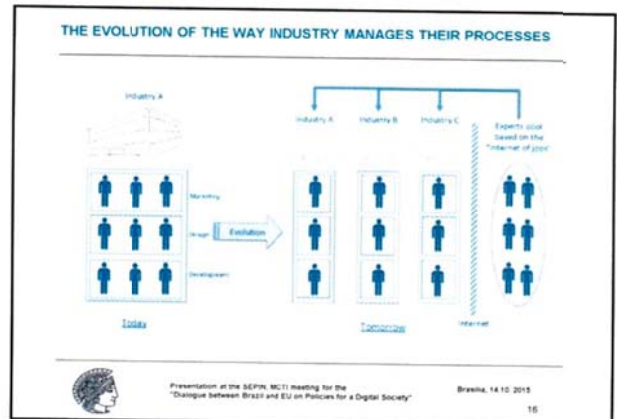
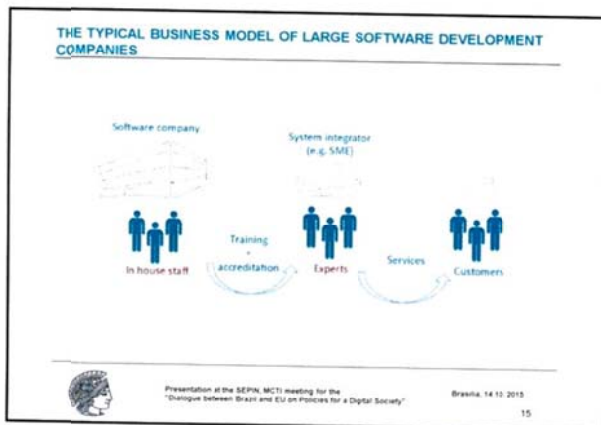
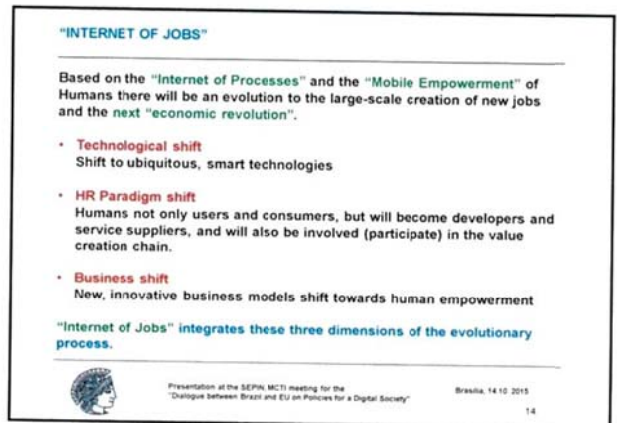
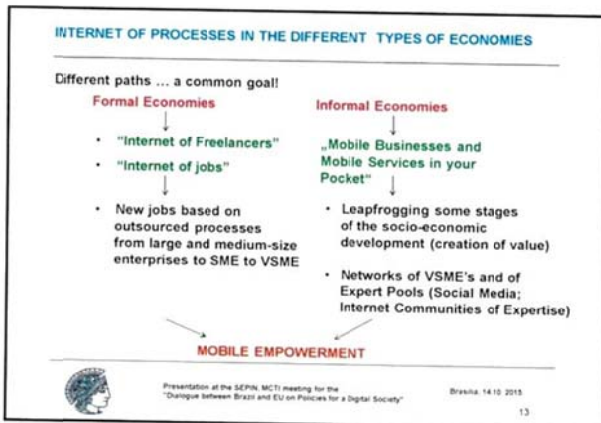
- Industry and Commerce **outsource processes** to the Internet
- **Humans participate** not only as “consumers”, but also as “producers” → user participation
- **New structures** in industry and commerce
- **New business opportunities, new business models**
- **New business structures**
- **New jobs!**

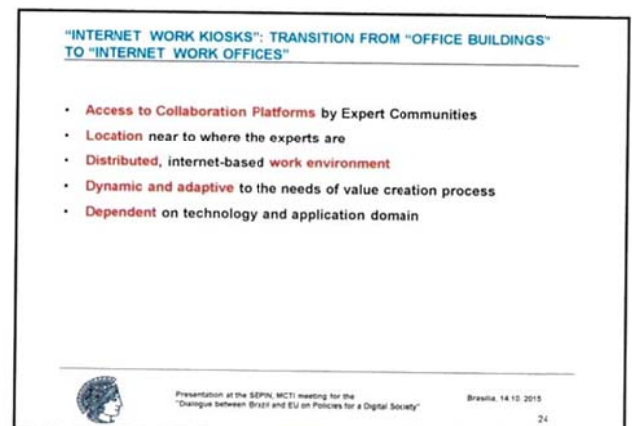
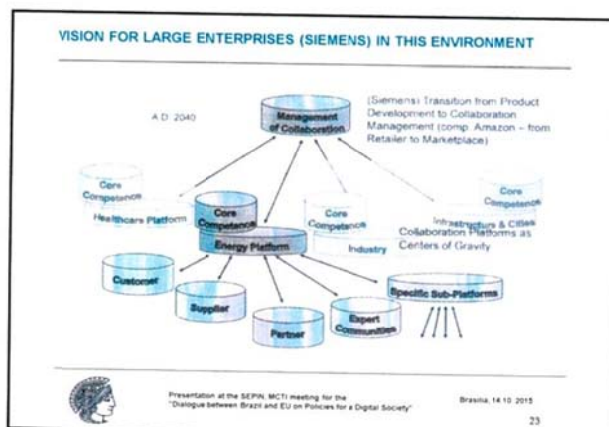
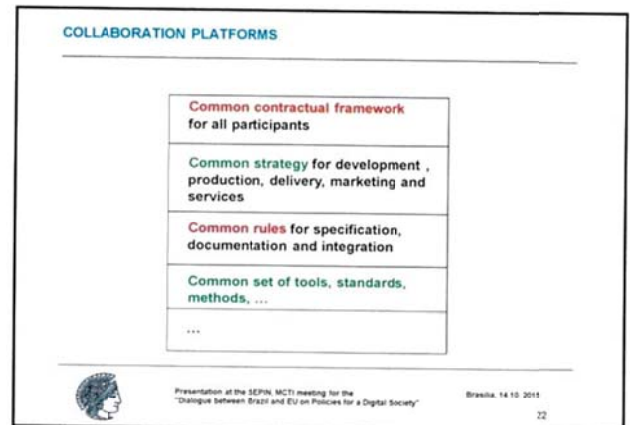
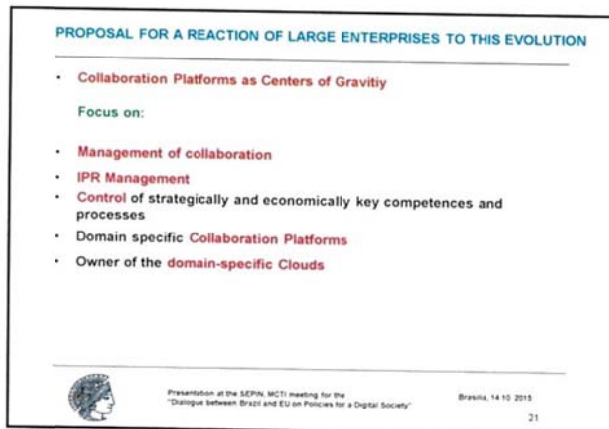
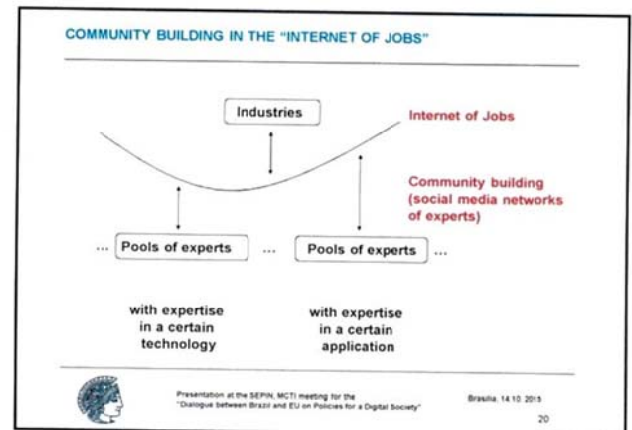
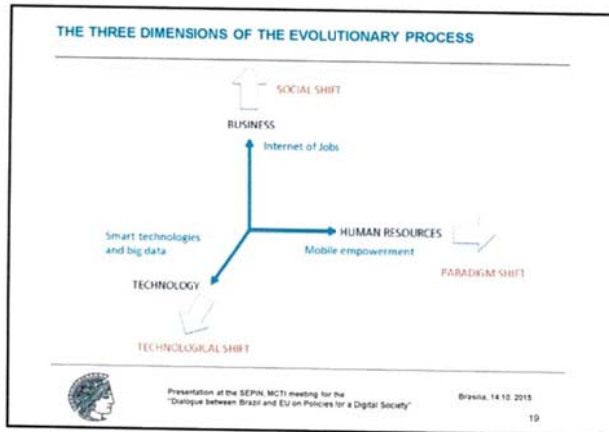


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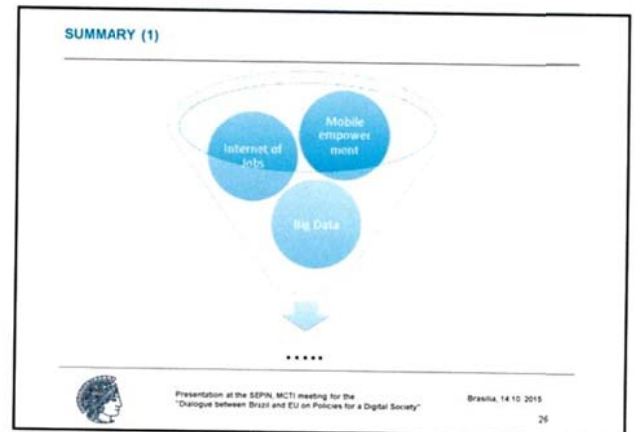
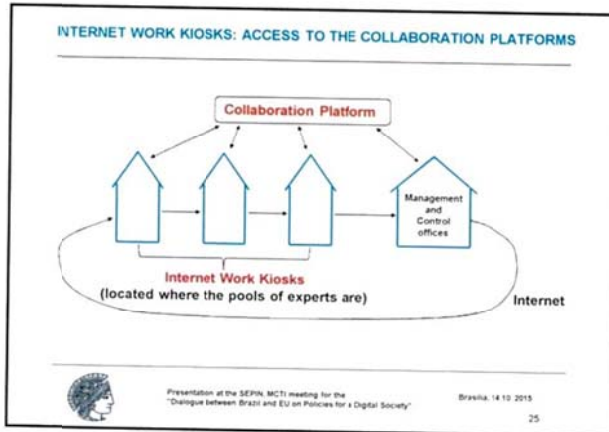
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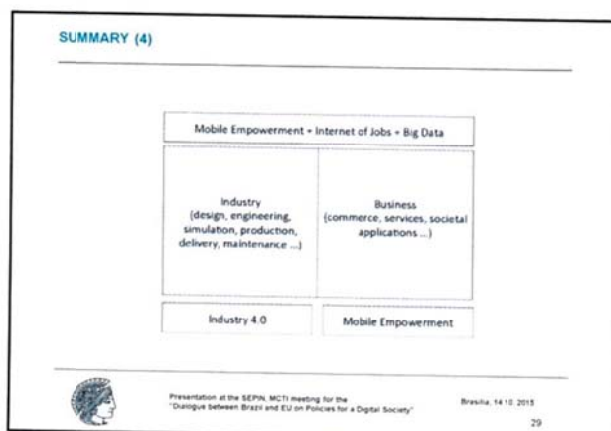






- ### SUMMARY (2)
- #### Mobile Empowerment
- Humans participate and contribute to the economic value chains
  - This is enabled by ICT mobility and smart technologies
  - Cloud integrates "Internet of Processes"
  - New Economies based on Micro-Enterprises (VSEs) and Expert Pools (social media)
  - Socio-economic development based on "Mobile Empowerment"
  - "Leapfrogging" stages in the economic creation of value
- Presentation at the SEPIN MCTI meeting for the "Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015 27

- ### SUMMARY (3)
- #### Internet of Jobs
- Evolution from the "Internet of Processes"
  - Basis for the creation of new jobs
  - Motor for the socio-economic development
- #### Mobile Empowerment + Internet of Jobs
- A Strategy contributing to the solution of the "1.8 billion problem" (global short fall of formal jobs)
- ... the world greatest challenge!!!
- Presentation at the SEPIN MCTI meeting for the "Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015 28



- ### SUMMARY (5)
- #### Possible Reaction of Large Enterprises to these trends
- Collaboration Platforms as Centers of Gravity
  - Ownership, control and management of Collaboration Platforms
  - Large Enterprises evolve to a network or cluster of several technology and application platforms (Collaboration Platforms)
  - Access to Collaboration Platforms based on Internet Work Kiosks (there, were the Knowledge and Expertise, based on "Expert Communities", is located)
- Presentation at the SEPIN MCTI meeting for the "Dialogue between Brazil and EU on Policies for a Digital Society" Brasília, 14.10.2015 30