NEM SRIA 2025

Community inputs gathered for a white paper on the strategic Research and Innovation Agenda in 2025 contributing to the design of the next FP9

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<mark>Executive summary</mark>

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1) Introduction

This new version of the NEM Strategic and Innovation Research Agenda should be considered as the description of the Media&Content mission. Such a mission should have the objective to design and develop the future European immersive environment. It should be used for entertainment as well as in education but also in manufacturing design or in health services.

In order to achieve such a goal, there is a need to study and to develop a number of technologies that are necessary and also to experiment them in several domains through large scale pilots in order to check the relevance with end users.

Most of these technologies should be part of the Next Generation Internet initiative which should encompass the development of an immersive open platform facilitating the use of immersive technologies in many sectors.

This document is proposing a vision, the potential business impact, the standard and regulation that need to be addressed and the technologies that needs to be studied. To reach the final goal, a roadmap has been designed by 2025 in order to position on a time line the necessary research that have to be conducted.

2) Vision

The media sector current business models are being reshaped by challenging technology and market trends. Media sector is moving to even more personalized services, conceding more power to users, aiming at having users more engaged by powering emotional and social connectivity with the content and people.

Technological innovation will be able to break down many of the functional barriers opening a wide scenario of convergence of broadcasting, internet, and communication services. Convergence will ultimately involve seamless access to content, achieving the idea of ATAWAD (anytime, anywhere and on any device). All the potential combinations of content, networks and devices will provide very different service scenarios, providing adequate quality of experience. These paradigms are going to be further addressed by consolidating new networks capabilities (such as 5G networks) with an improved management (such as SDN - Software Defined Networks). User-generated-content and the media shared by social networks are completely changing the media flows through the network, leading to a need for a higher uplink bandwidth. Since currently the majority of Internet exchanged data is media and content, it is of utmost importance to include and promote content technologies in the new developments for both, research and business development purposes.

Next Generation Internet will take content and media experience to a new era, going beyond improving technical capabilities such as bandwidth, intelligence, scalability and performance. It will include immersive technologies, multimodal interaction and hyper-personalized media services, including social media and social networking.

Immersive technologies are going to enable even more natural experiences and natural interactions with objects and/or remote people very similar as real-time face-to-face experiences and interactions. Immersive content will offer novel experiences aiming to improve connection, information, control, cooperation and interaction. Virtual reality (VR) and augmented reality (AR) transform the way individuals interact with each other and with software systems creating an immersive environment. Immersive experiences with AR and VR are expanding beyond visual immersion to include all human senses.

Immersive, interactive, emotional, aesthetic, entertaining experiences have become the key elements of human existence, having users, even those with no skills or technical knowledge, more active and involved in advanced and interactive experiences. Immersion encompass sensorial and interactive environments to experiment a "sense of presence" in artificial, interactive, virtual created scene or 'world' within which users can immerse themselves. Immersivity tackles with a lot of related technologies: visual rendering and capturing, gaze and gesture tracking, auditory and immersive auditory rendering and capturing, human computer interaction, visual design/user interface (UI), psychophysics and 3D modelling. A strong interdisciplinary approach is going to offer a great opportunity to improve people's lives and jobs by transforming their experiences through immersive technologies, with technology itself tending to disapper, becoming invisible while becoming substantial.

Users demand tailor-made solutions and a personalized customer experience independent of the context of consumption, and service providers are required to achieve a successful seamless cross-device and cross-channel content delivery and user identification. Hyper-personalization aims to adapt a product, service or experience to a specific customer through a deep understanding of each individual needs, preferences and context. Each individual's demands, needs and constraints for content and services should be taken into account before providing a tailor-made solution to that person providing such tailor-made solution in real time i.e. one can have different needs and expectations depending on the situational context (location, time, behaviour, mood, …). Consumption patterns can vary significantly and affect the customer relationship in real-time impacting overall customer experience. Topics as the capturing of user behaviour, user identity and user data management, content discovery, recommendation systems and artificial intelligence become key enablers for the real application of this new paradigm.

Users demonstrated they are keen to give away much personal data in exchange for good and free of charge services. Users should be aware of the level of privacy they get in accessing a given service. The challenge is how to improve user awareness and participation in process of management and exploitation of personal data in personalized service provisioning.

The explosión of Internet of Things (IoT) will generate more synergies between devices and people thanks to the information they exchange. All this devices generating and exchanging information will impact how we work and communicate with friends and relatives and how we spend our leisure time. The evolution of IoT is also about transforming our lives and spaces (home, work, pubblic) into a Cyber-

Physical-Social Hyperspace based on the continuous flow of enormous quantity of personal and often sensitive data.

The integrity, confidentiality and authenticity of content and users data managed within services platforms are going to be key point for the future successful deployment of media services.

3) Business&Market impact

The global Media & Entertainment market, after reaching 1.9 trillions of US dollars, continued to grow in 2017 by almost 5% achieving near to 2 trillion of $, where US market share represents around the 1/3 of the global figure [1]. Many corporations in the Media & Entertainment sector recently experienced significant convergence and moved from their traditional businesses, such as film production, news, etc., to offer a multitude of various services across the sector. The key trends in 2017 which will continue in the coming period are:

• Further industry convergence and consumer involvement as creator and industry driver

• Further development of interactive devices as technical drivers

• Persistent piracy and lack of strong enforcement of copyright laws

• Leading sector's areas are augmented and virtual reality, eSports, streaming and video: OTT/VOD and multichannel networks

Due to significant increase of world population having access to the global Internet, particularly thank to the currently increasing mobile coverage practically allowing that we are all on line, overall consumption of various Media & Entertainment services is significantly growing as well. Thus, while considering humans ability for multitasking, almost 40% of people's time is spent on media consumption and usage of Media & Entertainment technical devices [2]. While analyzing the media consumption only, almost 50% belongs to digital media sources beside classical TV (~ 30%) and radio (+10%) as well as printed and other types of media.

Even, the Media & Entertainment market will continue to grow, in particular in so-called low per capita markets as well as China and India, and the consumers will continue to spent more money to use the related services, but overall share of the global GDP by the Media & Entertainment sector will decrease (Fig. 1) causing also lost of revenues in the sector [3].
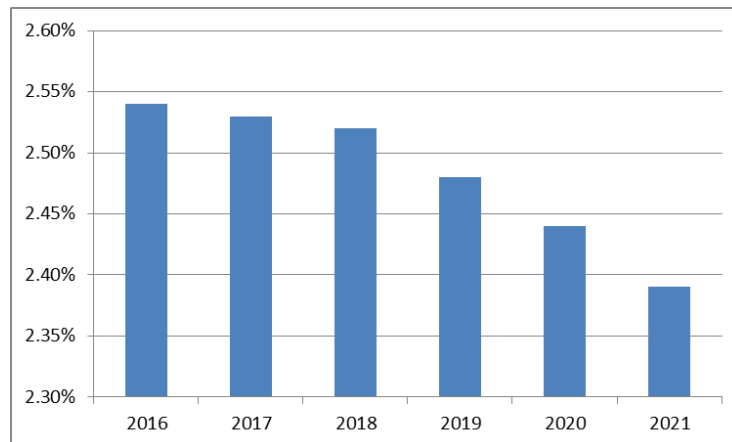
Fig 1: Global GDP share for Media & Entertainment sector

This trend is caused by several factors:

• The time people have to consume media services is finite and the same is with the consumers attention as well as their willingness and need for consumption, which is important for advertising representing the main source of revenues in the sector [4]

• The market in the sector is mature and highly competitive, so that related expenditure streams are and users' subscription models are far optimized

• Number of free offers in the sector is still growing and their quality is increasing

To cope with the negative trend in GDP share for the sector and corresponding consequences in development of revenues, there is a need for novel business models in the Media & Entertainment sector, going beyond traditional, mainly from advertising, revenues streams, and further technology innovation to address, among others, the following trends in the area:

• Virtual reality and interactive technologies

• Establishment of new media services, such as e-Sports, modern TV (different from already collapsing traditional broadcaster services), etc.

• More dedicated content for specific consumers/users groups instead of offers for general public

• Data and big data to be explored and used to enhance Media & Entertainment applications

Even difficult to predict, as already proven in the past, the prognoses show an increase of overall consumption demand on the future telecommunications networks of 71% in the period 2016-2020 [5], [6], with a further potential to grow afterwards. Beside cloud-based streaming services as well as

demand coming from M2M and IoT applications and services, which are expected to grow significantly in the next period, the video consumption will be 20 times larger and around 50% of total streaming services will be consumed from the homes, mainly to consume various media content and for entertainment purposes.

Also, the emerging 5G communications networks with significantly increased features able to serve services with very high demands on networks QoS are opening doors for Media & Entertainment sector to deploy new sophisticated services and offer them to the consumers, and with it, increase revenues and improve future development of the sectorial share in the global GDP. The Media & Entertainment sector is seen as the main utilization power of the future 5G networks and their enhanced features.

Furthermore, the 5G networks are designed to enable establishment of services and applications tailored for various so-called vertical sectors (such as automotive, health, energy, etc., among media & entertainment). Here, while taking a look into the tendencies of various vertical sectors, the future verticals applications and services will significantly consist of features which can only be designed and established by industries around Media & Entertainment; e.g. assisted overtaking service will strongly depend on information/moving image gathering, processing, transmitting, and presenting.

[1]   "2017 Top Markets Report – Media and Entertainment – Sector Snapshot", U.S. Department of Commerce

[2]   "14 Things You'll Want to Know About the Future of Media", Henry Blodget (presentation), BI INTELLIGENCE, https://intelligence.businessinsider.com/

[3]   "Perspectives from the Global Entertainment and Media Outlook 2017–2021", PwC

[4]   "Future of Media & Entertainment", Raconteur, #0433, 22 February 2017

[5]   "Ericsson mobility report" https://www.ericsson.com/assets/local/mobility-report/documents/2017/ericsson-mobility-report-june-2017.pdf., June 2017

[6]   "Demand Forecast for Per Capita Data Consumption (US)", https://de.scribd.com/document/314849011/Nokia-Bell-Labs-Mobility-Traffic-Report, Nokia Bell Labs Consulting

4) User vision & requirements

4.1) Human factors

Human-factors engineering, also known as ergonomics or human engineering, is the science dealing with the application of information on physical, physiological and psychological characteristics to the design

of devices and systems for human use. [Britannica] It provides a scientific approach to human-centred design, applying these "3Ps" principles to optimise the balance of people's strengths and limitations.

Human-factors engineering, as a body of knowledge, is a collection of data and principles about human characteristics, capabilities, and limitations in relation to machines, jobs, and environments. Applications of human-factors engineering have been made to such simple devices as highway signs, telephone sets, hand tools, stoves, and to a host of modern, sophisticated complexes such as data processing systems, automated factories and warehouses, robots, and space vehicles.

Human Factors are concerned with improving the understanding of human behaviour and facilitating the design and development of emerging technologies involving the process of interaction design. It refers to the design of machines, machine systems, work methods, and environments to take into account the safety, comfort, and productiveness of human users and operators i.e. gathering user requirements, designing alternative ideas, prototyping and evaluating prototypes by designing experiments and user studies, collecting and analysing data and iteratively improving the design and development of systems. So Design & Human Factors lead to the need of interdisciplinary research about the relationship between humans and technology in a wide sense, with the purpose of contributing to a more user-centered technology development. [Sharples]

Image source: Shutterstock/violetkaipa

Technology is at the forefront of all new design processes, and in a relatively short period of time, has experienced exponential growth, which has a great impact on almost everything we do, including the way we work. So, to better address this problem, we need to ask: how do we use our technology? And perhaps more specifically: how much do we rely on our technology? Thus, Human factors should play an essential role in the future of technological advances, where people and technology are being integrated more closely and more intensively than ever before as part of our daily lives taking into account physical, cognitive, affective and social aspects. Technologies for human factors/ergonomics research and practice have seen rapid technological change and nowadays are facing new challenges resulting from an increasingly complex technological environment. These technologies have largely resulted from the digital revolution in both software and hardware and now the application of new trends in human factors relies heavily on these new interactive technologies. [AppErg]

There are many areas of activity within human factors but today, the research carried out, almost invariably relies heavily computational, information, and communication technologies in one way or another.

User Experience

User experience encompasses all aspects of the end-user's reaction and interaction with the technology through services, and products. The focus lies on the user's perceptual experience and the symbolic aspects of products and product use. User experience design as a discipline is concerned with all the elements that together make up that interface, including layout, visual design, text, brand, sound, and interaction. It's important to distinguish the total user experience from the user interface (UI), even though the UI is obviously an extremely important part of the design. These factors have become increasingly crucial for many companies' ability to create unique deals. In order to achieve high-quality user experience in a company's offerings there must be a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design. This research area includes design theory and methodology with focus on aesthetics, product semiotics and sensory.

Technology Use and Adoption

Technology use and adoption by users, specially including companies and workers is a critical component of the process of technological change. A solid knowledge of this issue requires studies of the conditions on which people accept and adopt new technological solutions and should assess the causal effects of education on technology use and adoption by using instrumental variables.

Knowledge about how technical products are being used and what they mean in people's everyday lives is an important condition for product development, and similarly, how education impacts on the probability of using "tech tools" on a daily basis as well. A basic concept is that the understanding of users and their usage is a good starting point for, first, innovation, and then for validation and proof of acceptance. Technology use and adoption focus on achieving real understanding of the users' needs and the demands they put on technical products and systems. Functional, social, emotional and aesthetic values are all taken into account.

Human - Machine Systems

Human-factors engineers regard humans as an element in systems, and a human-machine model is the usual way of representing that relationship. Two general premises characterize the approach of the human-factors engineer in practical design work. The first is that the engineer must solve the problems of integrating humans into machine systems. This supposes to be rigorous building upon scientific methods and not rely on intuition, or common sense. For long, the complex and unpredictable nature of human behaviour was obviated.

This approach should develop methodology to analyze, design and evaluate the interaction between man and machine in the broadest sense, independently of the socio-technical complexity of the systems.

Main areas of human-machine systems are related to physical and cognitive ergonomics, interaction, learning, risk assessment and 'resilience engineering'.

Sustainability

Current human activities are seriously eroding the ability of natural and social systems to cope. Human factors and ergonomics can provide relevant skills and knowledge to assist where it can in addressing the commonly identified problem areas (waste management, energy and transport) and to answer questions regarding the technology capability to motivate and support more sustainable behavior among people.

Sustainable development "means ensuring dignified living conditions with regard to human rights by creating and maintaining the widest possible range of options for freely defining life plans. The principle of fairness among and between present and future generations should be taken into account in the use of environmental, economic and social resources. Putting these needs into practice entails comprehensive protection of bio-diversity in terms of ecosystem, species and genetic diversity, all of which are the vital foundations of life." [MONET]

Sustainability focuses on consumption and design theory and methodology with focus on design for sustainable behavior aiming at collaborating to change people behavior as well. An example of sustainable Human Factors Engineering design is of an electric vehicle system to enable energy efficient driving. From a Human Factors Engineering perspective there are a number of sibling systems to consider including the human-software interface, the human-control interface, and the human-human system interactions with passengers and other drivers. [Thatcher]

Human factors research is taking advantage of the advances of key technologies that have been established during last years; mainly virtual reality (VR, due to the fact that can be used in situations when the safety is concerned or those which are not easily replicable), whose application to the field has grown. Researchers are drawn to its interactive and immersive nature, while the intensive interaction through immersive visual fields has strong research benefits, the responses and validity of different levels of immersion remain a question and the physiological and psychological responses of humans need to be further assessed.

The other big family highly involved in human factor is the one related to user interfaces and sensors (depth sensors, accelerometers, gyroscopes, and magnetometers). Depth sensors have become very common in human factor applications. They are able to detect the distances of objects placed in front of them and can provide information useful for evaluating physical exertion and body posture. As technology progress, sensing technologies become smaller while preserving or even increasing their functionality facilitating non-intrusive, easy-to-apply tool deployment. More and more measuring devices can be held in the hand of the user, or directly worn on the body. Specialized wearable systems with multiple embedded miniature sensors can be used to monitor kinematics and physiological parameters. Even smartphones can be used as a rich potential source of parameters directly useful for human factors research as many smartphones contain multiple sensors that can be used for human factors purposes.

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NEM community can provide the most adequate technologies to develop new generation tools for human factors practical application. The kind of interactions and developments implemented for the entertainment area fit rather well to this discipline so the evolution of interaction pushed by media area can boost a new generation of human factors applications including novel solutions for the analysis of effects of physical environments on the operator, human reliability and human information processing (going further into the concept of the human as a sensor), training, workplace design, work organization design and the allocation of tasks between humans and computers and other parts of systems.

Media technology can also provide useful inputs for other key activities in the area that include but are not limited to: training, maintenance, safety, reliability, usability, staffing, security, test and evaluation, manufacturing design, task analysis, workload analysis, task allocation (between human, teams, automation, and systems), human performance analysis, human error analysis, anthropometric analysis and risk management.

And last, to help with the sustainability paradigm, some general principles for designing new and enhancing existent approaches of human factors and ergonomics regarding their orientation towards sustainability are proposed.

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4.2) Areas of applications

Vertical application sectors taking advantage of the media&content such as education, health, manufacturing design, entertainment,

Areas of application: culture, cultural heritage, education, tourism, AAL, eLearning, entertainment, remote collaborative work, smart cities.

Areas of application: all fields of audiovisual entertainment, TV, digital cinema video streaming

Areas of application: cinema, television, culture, tourism, entertainment, education.

To be finalised

6) Policy, regulatory and standardization issues

In recent years, the media sector has undergone a profound transformation process, as a result of the strong growth in video content and online entertainment, posing increasingly complex challenges to policy makers, competition and industry authorities. The Media sector plays a key economic, social and cultural role in Europe. Europe boasts a strong media industry, which creates growth and jobs and represents European life, languages, history, culture and values around the world. Those deeply changes in the media sector are due to the impact of the Information and communication technologies (ICTs) which are revolutionizing the creation, development and distribution of content today. The introduction of new technologies has produced a "disruptive" effect on the traditional media industries. Innovation has become the most important growth driver and has led to the emergence of new operators and business models.

The media landscape is undergoing a transformation, characterized by a steady increase of convergence of media services, with a visible move towards intertwining traditional broadcast and the internet. Audio-visual media content has arrived on non-TV screens and internet content is arriving on the traditional TV screen. Moreover, the emergences of new technologies like, Virtual reality, augmented

reality, IoT, blockchain applied to media sector represent new challenges to be faced and managed in terms of policies, taking in account the advantages but also the risk that they can provide to the end users.

In addition, the growing variety and availability of devices has led to a radical change also in consumer habits, expanding the options and methods of use no longer linked only to traditional devices (i.e, radio, tv). This phenomenon empowers European citizens (including young people) to be able to access seamless and interactive experiences, letting them access any content while being agnostic as to the device or geographic locations from which they interact, but not to the language of communication. Consequently, the proliferation of connected devices and the wide availability of faster broadband connections are affecting existing business models, consumer habits, creating new challenges, and opportunities for the creative industries. The growth of the language industry close to the media industry is a reality in Europe.

In this landscape, TV remains the foremost source of information and entertainment in the EU, but the audio-visual sector directly engages millions of people with other types of media, specifically available through internet, that are spreading more and more in the market. The media and communication sector is therefore increasingly becoming a digital ecosystem, characterised by the group of subjects that produce, consume and exchange information within the area bounded by digital technologies. Sectors previously distinct, such as content and media, telecommunications, information technologies, are now converging, creating a new industrial ecosystem that requires different types of companies with different corporate cultures to compete and collaborate.

Therefore, the impact of the Internet and new technologies on the media and content world is enormous: new business models, new players and new challenges await antitrust and regulatory authorities. The process must find ideas and knowledge from both the "new" and the "old" economy. At the same time, whilst maintaining the focus on the consumer rather than on protecting certain competitors, it allows the benefits of the Internet and new technologies to extend across the economy.

For that reason, one of the most relevant points on the political agenda of the European Commission (EC) is the Digital Single Market (DSM) strategy. It aims to open digital opportunities for people and business, and enhance Europe's position as a world leader in the digital economy. Within the DSM framework some regulations of the Media sector are translated into policies and regulations. In that context, it is important to mention: the regulation on Audio-visual Media Services (2010/13/EU (AVMS directive) and its proposed modification with the "COM(2016) 287; the regulations on Copyrights (1996/9/CE; 2001/29/CE; 2006/115/CE; 2009/24/CE; 2012/28/EU and 2014/26/EU) and new directive proposal COM (2016) 593 on copyright in the Digital Single Market; The directives 2006/123/CE and 2000/31/CE on cross-border portability of online content services and the new proposal COM (2015) 627; the directive 2000/31/CE on E-commerce & geoblocking and the new proposal COM (2016) 320, and the new European Accessibility Act.

The preview mentioned panorama lays the foundation for new challenges to be considered at policy level in order to support on one hand the technologies developments but on the other hand to reduce

the potential risks coming from them. In this perspective issues like data protection, privacy, customers protection but also the policy framework for supporting research and innovation in the media sector represent relevant topics to be constantly addressed for supporting the right growth of the media sector.

In Europe, there has been an increase in competition in the distribution of video content - an area controlled by traditional television operators - as a result of the following factors: the entry of new global players, starting with Neflix; consolidation, through mergers and acquisitions, by the major telecommunications operators, which allowed the development of the "quadruple play" offer, integrating voice, data with fixed and mobile Internet access and video; direct access by new players to exclusive "sports premium content", starting with football (national league and Champions League) capable of increasing demand for data and traffic on networks.

In this perspective, the cooperation of all the stakeholders involved to exchange ideas, current and new needs deriving from these changes becomes fundamental to build in a balanced way an appropriate policy framework that can support the future economic and technological development of the convergence and social media sector.

Standardisation plays a leading role in creating the EU Single Digital Market . Standards support market-based competition and help ensure the interoperability of complementary products and services. Standards play a vital (albeit sometimes invisible) part in supporting economic growth by boosting productivity, competitiveness, innovation and societal welfare. The impacts of standards within businesses and their supply chains are less well understood, and the same is true of the public sector: there is sometimes a lack of awareness and information about the impact of applying standards to public policies.

CENELEC makes a classification of standards in four categories:

1.   Fundamental standards - which concern terminology, conventions, signs and symbols, etc.;

2.   Test methods and analysis standards - which measure characteristics such as temperature and chemical composition;

3.   Specification standards - which define characteristics of a product (product standards), or a service (service activities standards) and their performance thresholds such as fitness for use, interface and interoperability, health and safety, environmental protection, etc.;

4.   Organization standards - which describe the functions and relationships of a company, as well as elements such as quality management and assurance, maintenance, value analysis, logistics, project or system management, production management, etc.

The three European Standardization Organizations (ESO), CEN, CENELEC and ETSI are officially recognized as competent in the area of voluntary technical standardization. The European Union (EU) Regulation (1025/2012) which settles the legal framework for standardization, has been adopted by the European Parliament and by the Council of the EU, and entered into force on 1 January 2013. The three European

Standardization Organizations cooperate on policy and technical matters of common interest. This cooperation is coordinated by the Joint Presidents' Group (JPG). As its name implies, JPG comprises the Presidents and Vice-Presidents of CEN and CENELEC and their ETSI equivalents (General Assembly Chair and Vice-Chairs, and ETSI Board Chair), together with the Director General of CEN and CENELEC and the Director General of ETSI.

There are some basic understanding regarding standardisation:

5. There are many agencies,

6. Participation tends to be as a representative of a state, or a private company, or trade association.

7. A standard is a very lengthy process

8. A standard is anonymous

9. Participation is time consuming, which can be translated into a costly activity. This is for two reasons: the time required to read, write and work in documents, and the time dedicated to meeetings.

Nevertheless it is important to work within the framework of standards since they reduce costs, improve safety, and enhance competition. The EU has an active standardisation policy that promotes standards as a way to better regulation and increase the competitiveness of European industry.

It is important to raise awareness regharding standards towards maintaining and improving the presence of EU industry in international markets since they are key to creating jobs and growth in Europe. Standards facilitate companies' market access worldwide and two main objectives are instrumental in this respect, as identified by the Communication from the Commission to the European Parliament (COM/2017/0453 final)

• strengthening the competitiveness and global reach of European industry by reducing technical barriers to trade (TBTs); and

• enhancing worldwide interoperability by using common technically aligned standards that support trade in goods and services.

These objectives can be achieved, first and foremost, by aiming for the greatest possible coherence between international and European standards, and by facilitating the use of European and/or international standards outside the EU while striking the proper balance between the European, national and international dimensions. In 2018, the Commission will intensify its policy dialogue with international standardisation actors. It will also continue to raise awareness and promote the advantages of the international and European system of standardisation in multilateral fora (e.g. the World Trade Organisation and the relevant United Nations committees) and contribute to the EU's regulatory/policy

dialogues with economically relevant partners and to negotiations on the TBT chapters of free trade agreements.

Also from the annual Union work programme for European standardisation for 2018 states that "A year after the publication of the Commission's priorities on ICT standardisation , the actions outlined in the 5G communication networks, Internet of Things (IoT), cloud computing, cyber security and (big) data technologies as priority domains as well as the sectorial domains on eHealth, intelligent transport systems and connected & automated vehicles, smart energy, digitising industry, smart homes, cities and farming are progressing, in collaboration with the ESOs, global SDOs and the standardisation community. In the same way, the Commissions has initiated actions to improve the ICT standardisation ecosystem including work with ESOs and stakeholders on possible measures to improve the Standard Essential Patents (SEP) ecosystem, promotion of open source and its interaction with standardisation, and to strengthen the EU presence in international ICT standardisation. The Mid-Term Review on the implementation of the Digital Single Market Strategy presented the overall implementation of the standardisation actions.

Certain actions are implemented through the related Public Private Partnerships , such as the Alliance for Internet of Things Innovation (AIOTI) , the 5G Infrastructure Public Private Partnership, the Big Data Value Association (BDVA), Factories of the Future PPP, the European Cyber Security Organisation (ECSO) and through Horizon 2020 research and innovation projects . In addition, the ICT standardisation needs in support to EU policies are outlined in the 2017 version "Rolling Plan for ICT Standardisation" 16 , which is established by the European Commission services in collaboration with the Multi Stakeholder Platform (MSP) on ICT standardisation and has been aligned to reflect the priorities identified in the Communication on ICT standardisation priorities. This work is also useful for the accessibility of products and services in the EU. In addition, effort to mainstream accessibility following a Design for all approach should be step up to mainstream disability issues in relevant standardisation processes.

The ESS is an integral part of Europe's global competitiveness, economic growth, consumer confidence and capacity for innovation. CEN, CENELEC and ETSI agree that the following principles are shared in common in their role as ESOs within the ESS.

The following seven common principles inform each organisation's strategy implementation in their role as an ESO within the ESS:

1. Create standards, both directly and through relationships with other bodies, that consolidate and strengthen the European Single Market and are used globally supporting European industry in the global markets;

2. Use standardization to remove technical barriers to trade, support economic growth, promote well - being and address societal challenges;

3. Antici pate market, scientific, demographic, social and environmental trends and identify emerging opportunities and innovative and converging technologies that would benefit from early, coherent standardization;

4. Encourage European public and private research programmes to use standardization as a means to codify new knowledge and to impact the market;

5. Deliver market - relevant, cost - effective, timely, usable flexible standards, other deliverables and services;

6. Engage with and reflect the diversity of stakeholders and the breadth of their interests in standardization;

7. Invest in awareness - building activities, education programmes and technical training that serves to attract the next generation of standards makers.

Apart from the EU standardisation agencies, there are well well known agencies such as ISO, IEC or ITU, and NEM should take an active role in the EU Joint Initiative on Standardisation, as foreseen under the Single Market Strategy.

7) Enabling technologies

Based on the papers already developed last year:

Immersivity

including holographic, AR/VR

Immersive technologies are consolidating as one of the most intriguing topics of the content sector. Advances in the generation of 3D Virtual/augmented reality services and the gradual appearance of a variety of devices (glasses, 3D Screen, windscreen display, ...) open the opportunity for holographic content, i.e. true 3D volumetric media, give an idea of how fast immersivity is emerging.

Improved VR headsets, which currently are positioned for VR gaming and 360-degree video, are evolving towards consumption of Free Viewpoint video. Contents are being provided for any kind of genres currently positioned for 360-degree video: (live) sports, musical performances, virtual tourism, educational content, adult content, fiction, news and documentaries, eSports video streams. User generated content (UGC) are expected to constitute the second wave of content, in the form of short video clips in a social media context of messaging and sharing and live streams shared on social media platforms. Handhelds (smartphones and tablets) with auto-stereoscopic multi-view capabilities will allow users to enjoy the cases described above when they are not in a position to put on a VR/AR headset.

Immersivity challenges include:

• Robust algorithms to create volumetric media from multiple cameras, stereo cameras, smartphones with multiple cameras and/or depth cameras, multiple robotics cameras (e.g. follow-me drones). Hybrid approaches combining local preprocessing and cloud-based synthesis. Calibration-free set-ups.

• Novel volumetric media representation formats, balancing compression processing requirements, compression efficiency, bandwidth and manipulation capabilities. (UGC holographic communication will require manipulation capabilities similar to current visual messaging like beautification, stickers and comments, backdrop changes, fun masks and transformations etc)

• Bandwidth efficient delivery of volumetric video. Streaming of the complete holographic video is bound to pose substantial bandwidth challenges. Research into novel networking solutions that stream personalized perception-based holographic video to users from CDN's, taking into account bandwidth, latency and cloud/local processing loads.

• Human-machine interaction. Many types of human-machine interaction will be developed in the near future, allowing consumers a wider range of activities and a broader spectrum of experiences that can be gained from their engagement with media. New developments are expected for avatars and robots, haptic sensors, Brain Computer Interfaces (BCI), Enhanced Sense of Presence (ESP), sensing and monitoring, Quality of Experience (QoE), audience monitoring and analysis.

• Usage of multiple audio-visual capturing sensors for creation of multi-angle content for creation of free-viewpoint video for consumption with VR and AR HMDs. Capturing modalities include visual, audio and depth (radar, sonar, lidar, time of light), and could incorporate ground-based tele-operated and autonomous vehicles and airborne drones and balloons and definition and implementation of capturing strategies for robotic camera teams.

• Media orchestration tools for managing multiple, heterogeneous devices over multiple, heterogeneous networks, to create interactive and immersive experiences.

Hyper-personalisation

<mark>Including user personal data management</mark>

Content and Creative Industries, while locally, regionally, and/or nationally implemented or even governed, are moving to a worldwide framework, thanks to the digitisation of the whole value chain, from creation through distribution to consumption. These industries are updating the whole process by paralleling a lot of actions all along that value chain and reducing the production time from capture to access. This diversity often challenges established businesses and their business models, requiring them to be involved in the latest technology research and innovation activities of their sector.

This process opens the sector to apply new paradigms as hyper-personalization bringing new opportunities and challenges technological, infrastructural and regulatory by means of disruptive and focussed approaches.

The European society is based on diversity and only by giving a broad and flexible response, with the assistance of the hyper-personalization paradigm, will this diversity be a resource and not a restriction.

The global trend towards the extreme differentiation of offerings in products and services cannot be foreign to the sector, from the recommendation of content to the integration of the final consumer in the design processes. Hyper-personalization through very precise targeting not only ensures the best potential impact but in parallel increases the added value of products and services.

Hyper-personalization technology will allow the gap between providers' business needs and consumers' desires to be closed, allowing consumers to enjoy an increasing range of products whilst service providers battle against the fragmentation of retailing and media across multiple channels and platforms.

One of the key challenges will be to give back the control of personal data to the end users. These data are key for hyper-personalisation but should be under the control of the end user instead of being managed by each service providers with a global inconsistency.

Content distribution

The media sector is looking for new business opportunities as its current business models are being reshaped by challenging technology and market trends. Media is moving to concede more power to users, to achieve higher levels of personalization, and aims to get them engaged by powering emotional and social connectivity with the content.

These paradigms need to be addressed by consolidating new networks capabilities with an improved management. Content distribution strategies need to be supported by technological advancements driving more appealing user experience within the entertainment & media industry. User-generated-content and the media shared by social networks are completely changing the media flows through the network, leading to a need for a higher uplink bandwidth.

Important pan-European initiatives as Big Data PPP and 5G PPP, especially when referring to content distribution, are taking into account media and content singularity. Content and media are, on the other hand, exceptionally useful material to assess the real potential of both technologies and can really bring European innovation horizon at their maximum performance. Since currently the majority of Internet exchanged data is media and content, it is of utmost importance to include and promote content technologies in the new developments for both commercial and research purposes in Big Data and 5G domain.

Content distribution should be the cornerstone of the so-called New Generation Internet which should take content and media experience to a new era. In the way of offering an answer to this reality, content distribution must go beyond improving technical capabilities such as bandwidth, intelligence, scalability

and performance. The integrity of content and the confidentiality, authenticity and integrity of private data of the users managed within content services are key to the deployment of successful use cases.

One of the key challenge will be the design of a (or several) 5G slices adapted to media&content requirements and offering open APIs able to give access to media&content producers to a number of network function parameters .

Social Media

Social Media used to be defined as a set of computer-mediated technologies that facilitate the creation and sharing of information, ideas, and other forms of content and applications via so-called virtual communities taking advantage of modern network and communications infrastructures. Social media uses web-based technologies to create a variety of interactive platforms through which individuals and communities can share, create, modify, and discuss different types of information and digital content which is available in the global Internet landscape. It can be stated that during last one-two decades the social media applications introduced significant changes to way people communicate, as well as businesses, and more over entire communities organized through common interests. Moreover, the recent developments in Internet and communications technologies, media and entertainment sectors, as well as many other spheres of professional activities and life show that social media becomes a standard part of different services and applications offered to people through a variety of communication and consumer devices; computers, tablets, smart phones, smart watches, etc. Furthermore, so-called classical media services, such as broadcasting and even traditional "paper" based media, are more and more introducing and using various social media technologies, to improve the overall user experience and further extend their offers and businesses.

The social media is currently being used to infer social behavior and derive tendencies, in combination with the big-data analysis tools. Its capabilities are tremendous to obtain information about the acceptance of a new product or service, identification of needs, or even the determination of ways to influence particular social acts and events. A practical example of the above ideas is the still open question of whether social media, in combination with big-data analysis tools, influence world-wide elections or not. Furthermore, a concern about digital competition is acute in Europe because quite often digital markets and the social media platforms are dominated by few, big and foreign companies, accumulating volumes of exclusive operating data on their platforms and services and using it as the raw material for artificial intelligence or machine learning could have an insuperable competitive advantage over new entrants. Users gain good services, and often free of charge, from such platforms but there are also some potential drawbacks; e.g. using a predominant position to collect data (even improper), keeping that data exclusive in order to maintain monopoly power, which even might obstruct further innovations and creation of new ideas, or using it to prevent customer to change the platform providers. Therefore, from the competition point of view it is also desirable to ensure Personal Data and Profile Portability in the future social media services.

We can conclude that in the near future it will be more and more difficult to distinguish among traditional media, if we may say so, and social media. Where is or will be the border between traditional

media and social media (e.g. shift from off-line to on-line media) as well as the border between social media and any future type of service or application, or will there be any borders in the future? What is and how will the future social media look like, how we are going to get there, and what has to be done to enable the future social media? This White Paper elaborates inputs received from broad European media community, to answer these questions and define a set of actions needed to be taken in a coherent and coordinated way in the next period to enable establishment of a future European social media landscape.

Immersive cloud platform (I²C)

Today's audiovisual media industry is considerably fragmented and whilst it has made large in-vestments to deliver content to consumers, efforts have not been made in a consistent manner. The proliferation of media producers and distribution channels is driving key players to seek forms of increasing the quality of their offer. Approaches that do not require additional large in-vestments and that potentiate fast ROI whilst meeting the customers needs and expectations are being investigated. Another aspect that should be considered within this entangled and pro-liferated world of media producers and distributers is that this fragmentation, although having brought a lot of flexibility and choice to the user, did not necessarily bring in all cases increased content quality, as many small producers do not have technological and infrastructural capacity albeit having contents that strike the consumer's interests. In light of this scenario, it is becoming clear to big intervenient players that it would make much more sense to adopt a global and hori-zontal technology, instead of dedicated specific equipment. In particular, IP-based/Ethernet transmission technology and Commercial Off-the-Shelf (COTS) equipment. Virtualised and cloud-based services are also envisaged and may bring additional benefits by making possible to democratise high-quality media production for the benefit of an open economy and the final user.

Human-Machine Interaction

The use of audiovisual media has nowadays become ubiquitous in almost any area of application, businesses, economy sectors or socially. However, in many cases A/V content is merely presented to the user with limited interaction possibilities. Additionally, resorting only to these two senses to illustrate real-world events or to pass information to users may reveal to be insufficient. New forms of interactions with machines and immersive environments should be devised incorporating additional senses other than sight and hearing, which could have a strong impact in our professional and private lives. It is envisaged the use of spatially distributed sensing devices and different rendering technology to provide multi-modal, interactive, augmented reality and immersive experiences to users and replicate such experiences in multiple locations.

Machine Learning and AI

Content creation and distribution methods should evolve in such a way as to embed computational intelligence and semantic knowledge into the media and throughout the media processing, communication and presentation infrastructures. This would enable:

• to increase the ability to dynamically adapt media to the users, different contexts and technical environments

• to generate more realistic digital models of real-world events, registering multiple sensorial properties of the physical space, allowing to replicating those events elsewhere and enabling content repurposing

• to improve user experience by developing new input/output interaction paradigms and considering additional sensorial properties other than auditory and vision.

Cultural heritage

A coherent strategy should be devised to help preserving audiovisual archives as a means to contribute to democratising the access to digital cultural heritage and fulfil the aim of content re-usability. A vast collection of archived records could be open to the public and a common strategy for digitisation, annotation and openness, would stimulate and facilitate the use of valuable material for multiple purposes, namely education and dissemination of culture, expanding public access to important historical and cultural assets. This strategy should focus in particular on the definition of a workflow, data model and usage rights, but as well on the use of COTS equipment and on the possibility of having the contribution of a large community for digitising and annotating assets. This kind of openness, whilst reducing times and increasing the volume and diversity of digitised assets, will create additional challenges namely, the necessity of controlling both the type of content and annotations as well as the quality.

7.1) Position with regards to DEI & NGI

The European Commission has launched two key initiatives that should influence the NEM community as far as Media&Content are one of the main domain embedded in the Digitalising European Industry initiative and in the Next Generation Internet Initiative. The first one is addressing the facilitation of usage of Media&Content technologies in European Industry as the second one is structuring the next internet that should be more human and respective of the digital privacy.

7.1.1 Digitalising European Industry

The European Commission has launched the Digital Innovation Hub initiative in the context of the Digitalising European Industry program aiming at facilitating the adoption of ICT technologies in European Industry.

Media & Content industry have key ICT technologies that could help European industry in their daily life such as Augmented reality, Virtual reality in the design phase of new products but also hyper-personalisation in the commercial phase and also Social media as well as Media analytics to help customer needs identification.

Today, 11 NEM clusters are part of the DIH catalogue and 20 other organisations declared to address media & content activities.

Following a recent survey, it appears that almost 20 organisations are ready to join such a NEM DIH network. Such a network should offer a number of activities supporting DIH are their daily life and NEM Initiative is ready to support this network.

The objective of the EC is one DIH in each European region and also 27 National DEI initiatives able to coordinate regional initiatives

The following action plan is proposed to go further in the Media & Content sector: organisation of workshops in key regions with all DIH in order to present existing services, platforms and share best practices and also infrastructures

Many DIH have infrastructures open to their local ecosystems, it will be good to make them known outside the local / regional ecosystems and open it to any industry in Europe or even duplicate it in other DIH if any interest. There is also a need to align standardization in order to facilitate interoperability.

- Identification of Key regions for Media & Content (several DIH in Smart specialized region)
- Management of the heterogeneous missions of DIH and identify complementarities

A survey has been done asking Media & Content DIH registered in the catalogue about their interest to join such a NEM DIH network, a number of them have responded YES meaning that today 14 organisations are ready to join the NEM DIH network.

Objective of a NEM DIH Network

The network of Media & Content Digital Innovation Hub (NEM DIH) will play a fundamental role in building the community of developers adopting and contributing to Media & Content technologies adoption in European industry, acting at local level. The NEM DIH Programme aims at supporting the creation and the operations of Media & Content DIH nodes worldwide

Business hubs, determined to incubate and encourage new services, play an important role in the global ecosystem that Media & Content is spinning. As in webs, all nodes are essential to build a lasting and strong structure; but, in this case the wider the web, the stronger the structure. To encourage the growth of the digital economy, NEM DIH enables local digital hubs to enrich their services, to spin a network of enabling communities and to further support new internet-based business creation at local level. It is an effort to expand the reach of Media & Content technologies, so that as many companies or

even individual developers as possible can have an easy first contact with Media & Content and take full advantage of it.

<u>Mission of a NEM DIH Network</u>

To support the growth and consolidation of the Media & Content community by working locally on disseminating and introducing the technology to interested parties

To build local communities where the position and role of Media & Content would be developed, boosted and consolidated.

To develop usage of "media and content products and solutions" inside the different industries of their territory

<u>Activities of a NEM DIH Network</u>

- Providing local training and support.

- Supporting the acceleration of SMEs and Startups locally.

- Strengthening the links with domain stakeholders. Connecting with the local academic world and defining action plans.

- Connecting with leaders of R&D programs at a local level.

- Instructing about the Programme and impelling its adoption by more hubs, pushing the Programme a step further.

- Sharing best practices within NEM DIH and between local DIH

- Operating a Media & content competencies exchange

- Connecting market business needs and competencies

- Ensuring promotion of training for students but also SMEs workers (online training)

7.1.2 Next Generation Internet

One of the most important concerns in European landscape is security&privacy linked with service personalisation. Hyper-personalisation is part of the NEM Agenda and related research topic proposals have been clearly identified in dedicated NEM Position Paper. In this context trust is one of the key ingredients to develop the Next Generation Internet fitting user needs and wishes.
IoT will also be one of the biggest sources of content in the future, they should contribute to hyper-personalisation but also augmented reality content.
To achieve such a goal, there is a need to manage and analyse all these big amount of data using new algorithms provided by artificial intelligence, cloud computing and big data technologies.
Worth to say that there is also a need for governance and law in order to avoid problem with such a "Big Brother" running with no rules. Such governance is a huge task, not to be handled by NEM, but

NEM would like to alert the European Commission about such a risk. Data protection is one of the key topics to be regulated at European Union level.

Media&content should have a great contribution in order to bring the entertainment dimension to the NGI. Today most of the social media usages are around pictures&vidéo sharing and NGI should encompass this domain in order to reach the objective of a human centric Internet.

The NEM members have identified the following technology areas and research domains as the most relevant for NGI

1. Personal Data Spaces
2. Internet Of Things
3. Blockchain
4. Artificial Intelligence
5. Distributed architectures and decentralised data governance
6. The future of Social media
7. New forms of interactions and immersive environments
8. Other important technologies
   - **Discovery and identification tools**
   - Software defined technologies
   - Networking solutions beyond IP

*Human centric: At the service of the people and the society, Address present issue, Make "internet for the people"

- NGI: shall enable the next wave of innovations in digital services for citizens and businesses, and shall accelerate industrial transformation and social inclusion including learning and skills
- Secure, energy-efficient and high performance NGI network and service infrastructures
  - NEM contributes media use cases for beyond 5G connectivity and SDN, to drive the developments wrt. bandwidth, latency, reliability and robustness
  - NEM adds the human/user aspect to the Internet of smart things, towards the Internet of Abilities/Skills, for e.g. industrial transformation and social inclusion.
- Advanced consumer applications
  - highly personalised access to digital/virtual objects, information and content, including social media and networks → here NEM contributes to both key enabling technologies (search, metadata, recommendation, …) as well as identifying requirements for the application of such personalized access, for e.g. news, learning, entertainment, accessibility, …
  - ensuring better user control of data;
  - leveraging new interactive technologies (language and interaction modality of choice; mixed real and virtual world) → here, NEM could argue the importance of extended reality technologies (i.e. spanning the reality-virtuality continuum) in general, as the most likely interface at the intersection between the digital and physical worlds, for interaction, communication and consumption.

7.2) Research topics

In order to achieve the vision and the challenge that Europe have ahead in the Content and Media sector, there is a need to address a number of research topics, they are :

1. Sensing and Interpretive technologies - creating and deploying technologies that capture and preserve data from multiples sensors, extract relevant features, and infer relations from an increasing array of data and sensor inputs
2. Wireless sensor networks, immersion and multi-sensory data
3. Interpretative and semantic technologies and metadata
4. Design and human-machine interaction
5. Human-human interactions through devices
6. Augmented reality and virtual reality
7. Holography
8. Immersion and multi-sensory data
9. Semantic technologies and metadata
10. Human-machine interaction including BCI, haptics, vocal
11. Storytelling
12. Data visualization
13. Design
14. On-demand cloud resources
15. Security including block chain
16. Multi-cloud environments (private, public, multipurpose, specific)
17. Virtualization including 5G slices for media&content
18. COTS and open architectures with self-describing, well-documented APIs
19. Annotation and metadata
20. Crowdsourced digitization
21. Interoperable and user-friendly DRM
22. Quality control (end2end)
23. Online catalogues and data visualisation
24. Multi-platform access
25. Multi-device reading software to read standard formats and with accessibility features
26. Standards and tools for the interoperability of learning platforms
27. Standards and tools for the management of copyright information and licences, and rights data management in general
28. Standard technologies and tools for production and distribution of accessible digital books for visually impaired and print disabled people
29. Content discovery online ATAWAD
30. Infrastructure for the use of Big data by SMEs, i.e.: how to transpose the tradition of precompetitive collaboration of the sector about data (with elements such as the ISBN and the books-in-print databases, which allowed ecommerce being launched first in the book sector) to the big data environment
31. Personal data management
32.

7.3) Detailed roadmap 2020/22

To be completed in next step

7.4) High-level roadmap 2020/25

7.5) International cooperation

Involved in the digital economy with R & D & I, societal challenges, industry led media, creative clusters and professional associations/federations/platforms, NEM and its members are ideally positioned to foster excellence of research through worldwide level objectives.

Back in 2014 the NEM EG-group conducted a short survey among NEM members questioning their interest with regard to international cooperation. Since then NEM stakeholders deployed international actions, and thanks to EU financing, various extra European platforms (some are listed below in Figure 1) started – still very modest, but existing – research activities at regional levels.

Figure 2: Worldwide Clusters in connection with NEM members

Today it still appears important to develop a European international research and innovation cooperation strategy. Many European companies are successful in the Europe, but internationalization, in terms of research, export and sourcing remains a challenge and only a few reach beyond EU borders. Therefore it appears crucial to:

1. Foster excellence of research: attract the best researchers around the world to cooperate with European researchers in the field of NEM technologies,
2. Promote NEM projects and results
    a. Widen applicability,
    b. Disseminate project outcomes,
    c. Favour exploitation and go to the market.
3. Share the NEM vision and SRIA,

4.   Take into account specific needs from other worldwide regions: foster international projects with mutual interests,

5.   Help the European industry to develop products/services outside Europe,

6.   Establish strong links with non-European stakeholders (addressing NEM activities):

    a.   Local clusters and platforms: to reach out easily all stakeholders including SMEs and web entrepreneurs,

    b.   Industry representatives (with R&D departments),

    c.   Academia.

The idea is to develop excellence, for example through artificial intelligence for media and access services, but not only, allowing Europe to compete clearly with the US and China.

Between Europe and other world regions, common grounds out of previous surveys are for example: content search, content processing, data analytics, storage/cloud, user interaction, big & open data, new formats (UHD, 3D video and sound), virtual and augmented reality, metadata, brokering/aggregation, accessibility, publishing, books and text based digital media, emotional monitoring, user behavior and to some extent rights management.

Raise awareness and address bottlenecks (through the clusters/TPs) remains a priority

Feedback from international clusters clearly indicates that wareness creation among the stakeholders about what a cluster/TP is needs time. The concerned communities see as major issue to bring over an abstract concept and become operational locally. Individual investments are necessary to get concrete results. These are common experiences for all CSA related EU projects.

The message to repeat and develop is all about being "strong together" with common NETWORKING, SRIA set-up, LOBBYING, contribution to public calls and societal challenges, COLLABORATIVE work to prepare the future and get collaborative PROJECTS, on an industry led basis. NEM, in strong cooperation with the European Commission should be able in the future to identify and support local clusters and communities to facilitate cooperation. After INCO project times clusters are expected to become / should become a strong vector for sustainability of international cooperation.

Special attention and awareness creation should be paid to SMEs and emerging countries and local clusters as they are very few involved in R&D processes. Perhaps the European Commission could envisage co'-financing and allow European industry leaders to play a key role in developing media and content related research and innovation in those countries, especially as industries may bring long term R&D opportunities against short term business needs in most of these regional businesses.

How can NEM members contribute concretely on international cooperation?

Globally, the NEM interest in other regions of the world is economically driven and of strategic interest in terms of R&D/innovation.

NEM members have the following interests in international cooperation:

%	Interest in international cooperation
47,6 %	1/ Business development / Market diversification / Global take-up of products and services for R&D activities
30,6%	2/ Knowledge transfer / Knowledge sharing
16,6%	3/ Networking and partnership building
4,7 %	4/ Cooperation for Trustworthy ITC

To achieve this, the members (academia, industry, SMEs, clusters) would bring at different levels the following actions for example:

- Share relevant information and best practices in a specific domain and experience,
- Participate to identify and promote intra/extra European activities,
- Share international experience in given regions,
- Supervise a publication,
- Conduct workshops,
- Integrate a NEM commission and be active,
- Provide and facilitate contacts in different regions,
- Matchmaking with content industries and SMEs,
- Attending networking events for NEM and preparing specific projects and calls,
- Offering research results,
- Organize seminars / symposia / WS, invite colleagues to WS and conferences,
- Expanding the range of partners,
- Establish collaboration agreements,
- Enlarge the NEM community bringing CCIs and ICT incubators working in the cultural and creative sector coming from those countries.

Beyond those actions NEM stakeholders intend to play a role in education through media, fake news eradicating, and inclusion through media, which means to work on artificial intelligence and deep earning, get involved in IoT, the blockchain and other already highlighted issues above (see section 7.2). For coming initiatives it goes without saying that NEM members will involve international cooperation clusters still operating in different regions and in order to capture their priorities: Maghreb (MOSAIC), Africa (African Media Initiative), Latin America (Connecta2020), East Europe (EECA Horizon), India (FI-MEDIA), ASEAN (Connect2SEA), USA (Picasso) and others.

11) Conclusions
To be completed