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D1.1 Conceptual Framework for Roadmapping

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Abstract: This deliverable presents the CRe-AM roadmapping framework. It also outlines the main processes and activities involved. It is intended to guide the work of WP2, 3, 4, and 5.

Keywords: Roadmapping framework, foresight, technology assessment, technology roadmapping

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Executive summary

The present document is a deliverable of the CRe-AM project, funded by the European Commission's Directorate-General for Communications Networks, Content & Technology (DG CONNECT), under its 7th EU Framework Programme for Research and Technological Development (FP7).
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1. Introduction

“Creativity can be recognised and valued at the level of individuals, peer groups or the wider society and considered as an essential element in participating in and contributing to the life and culture of society” (Loveless, 2006)

Technologies have become commonplace and ubiquitous in the creative industries, and often contribute to the enhancement of creativity, and in so doing, as Loveless puts it above, contribute to the life and culture of society as a whole as well. The interaction of the creative sector with technologies has led to: (a) new forms of artistic expression and entirely new genres of art (e.g. new media art); (b) new understandings of creativity (e.g. in-museum and in-gallery apps); (c) new materials and tools for creative practice; (d) new business models, markets, consumer groups and distribution channels, as well as entirely new ways of selling creative products; (e) new forms of user-producer interaction; (f) new virtual communities of creators; (g) new forms of creativity itself, such as human-free and computational creativity. In all these instances, it is a case of generating new paradigms of creation and expression for the creative sector that change the present as much as the future, perpetually innovating and transforming our modes of communication and understanding.

A key example of the role of technologies in creative industries is use of creative tools, the appropriation of data storage and retrieval technologies into the creative sector. Creative industries have been heavily influenced by the convergence of computer, telecommunications, digital media, and internet technologies, as they allow digital storage, manipulation, sharing, reshaping, transmission and reproduction of any media type. For example, digitisation of multimedia has brought about a massive increase in the storage of the data that is crucial to much everyday activity (text, pictures, audio, videos, graphics, presentations, 3D visualisation etc.) – and this facilitates both the individual creator at a micro-level and the development company at a macro-level; moreover, it also affects the distribution and understanding of creativity, since each user now becomes a creator. In particular, the integration of separately existing devices like cameras, smart mobile phones, PDAs, computers and applications (including mobile apps), supports the interrelation and overall management of diverse textural and audio-visual content.

Creativity is always future-oriented, and so tools for forecasting and planning such future(s), most notably Roadmapping, are essential to the enhancement of creativity itself through technology. In other words, influencing the future use and adoption of these technologies effectively, as well as building stable product, process and technology-platform paradigms and tools, provides a way to aid the future uptake of such technology and form more robust communities of creators, particularly virtual communities that cross national boundaries and that are strong enough to shape a sustainable shared European future. This requires a thorough investigation of current practices, the state-of-the-art and the emerging trends in this field, intertwined with careful and strategic planning of future activity.

Roadmapping is a tool for collaborative strategic planning that acts as a learning activity with respect to future strategy in the sector, as a means of knowledge-creation for all stakeholders and a resource for the further formation of communities of creators. Therefore, crucially, Roadmapping does not merely approach this interaction between technologies and the creative industries from a technological perspective. The needs, drivers and concerns of those working within the creative sector are essential to understanding the present and future state of this interaction. This is particularly true since the very idea of ‘prosumers’ – so central to the new forms of user-producer interaction here emerging – is already a reality and has decisively changed the nature of innovation in the creative industries. Hence, the active involvement of stakeholders during a very early stage in the Roadmap-development can play a decisive and crucial role in the success of such initiatives, and as such it needs to be taken into account, both in the planning and the adoption phases.

This project aims to bridge communities of creators with communities of technology providers and innovators, in a collective, strategic Roadmapping effort in order to streamline, coordinate and amplify collaborative work. It will thereby develop, enhance, and mainstream new ICT technologies, processes and tools, to address the needs of different sectors of the creative industries (e.g.
arts, culture, design, e-publishing, media, architecture, music etc.). This will create new long-term horizons for creative sector/technology interaction, particularly helpful for stakeholders in the contemporary environment, when innovation is based on using new technologies to build applications fast, and is aimed at achieving several transient advantages (easily abandoned and re-invented), rather than the long-term development of standalone products. As McGrath argues more generally (Günther McGrath, 2013), “In a world where a competitive advantage often evaporates in less than a year, companies can’t afford to spend months at a time crafting a single long-term strategy. To stay ahead, they need to constantly start new strategic initiatives, building and exploiting many transient competitive advantages at once. Though individually temporary, these advantages, as a portfolio, can keep companies in the lead over the long run.”

Bringing together creators with ICT providers, CRE-AM will enhance creativity by empowering its partners together with its stakeholders to devise Roadmaps for arts and crafts, design, media (including new and digital media), e-publishing, video games, and architecture subsectors. Hence, the project will support the creation of multipurpose and sustainable creative ecologies, work practices, processes and thereby build diverse communities of technology innovators, art-practitioners, and key stakeholders.

Since roadmapping is mainly a tool for collaborative strategic planning, it is important to have in place a value accumulating, ongoing roadmapping process with a high potential for sustainability and to promote a knowledge network of roadmapping that amplifies the efforts of various communities and crystallizes them at European level. In our context, Roadmapping is both a learning activity and a knowledge creation process for the community that builds the roadmap. The knowledge creation process in roadmapping is a continuous process where individuals and groups transcend their boundaries by acquiring a new context, a new view of the subject domain, and new knowledge.

Therefore, a model for Knowledge creation is needed for the interested community which will also serve as a communication platform for the involved stakeholders. In our approach, the SECI spiral knowledge creation framework (Nonaka & Toyama, 2003), is utilized for this purpose as it has been used first in PROLEARN (PROLEARN, 2008) and then in ICOPER (ICOPER, 2008) and TEL-Map roadmaps (TEL-Map, 2013). Similarly to organizational knowledge creation, the Roadmapping process could be seen as a spiralling process that amplifies and systematically combines the knowledge created within a core group of stakeholders (CRE-AM roadmap development groups) and that of other external communities and crystallizes it as part of an enhanced knowledge network focusing on the specific areas of the creative industries. Of paramount importance is to build and maintain places of interaction (Ba) and support them with the appropriate tools for bringing together different groups who share similar goals, in order for them to interact and create new Knowledge together.

Our approach will be built with the following principles:

Roadmapping, being a collaborative strategic planning tool, its success is measured against how effectively it has been communicated to and recognized by the relevant stakeholder groups. Gathering, processing and sharing information is a crucial component of any strategic planning process. This involves numerous sources and stakeholders whose motives and interests can influence the planning process and its implementation. Through roadmapping workshops, online consultations and community involvement, we shall bring in a) the business requirements as well as b) the possibilities for new applications based on the potential promise of emerging technologies. Through networks of technology experts/advanced users/suppliers and other intermediaries, we shall bring in a wide range of stakeholder needs; early-adopter views on innovation opportunities; news of prototypes; and early access to the results of roadmapping and technology studies.

Involving different communities from the early stage of the roadmap development helps to develop a sense of common ownership of the roadmap to be developed and in that sense facilitate its adoption. A common information architecture and knowledge management system is vital to this collaborative process. One of the objectives is to be able to link various roadmaps developed by different groups in a way that provides basis for synchronization of different, inter-related RTD actions towards a consistent whole. Similarly, to ICOPER approach, we will identify, link and make available tools and interaction (social networking) spaces
already currently used by the communities. **The principle here is going where the communities are and interact rather than trying to propose new platforms, processes and tools** (Kamtsiou & Klobucar, 2013a).

On the other hand, as time goes on, the maturity of each technology evolves and new technologies emerge. Also the vision expressed in the roadmap evolves. Thereby the vision is not likely to be comprehensively achieved in the form that we first saw it. The roadmap gives a sustaining direction in this dynamic landscape of rapidly evolving technologies. Synchronization between interdependent actions must be planned in order to assure that the expected final impact will be achieved. **A dynamic process is needed for technology roadmaps in order be constantly reviewed and updated.** Although specialized software for roadmapping is currently available, majority of roadmaps are still being prepared using conventional spreadsheet, word-processing and presentation tools. In most cases, especially in the European R&D projects the roadmap is developed by a small group of experts who document the roadmap in a text document with no possibility for revision, update and validation of its maturity and its influence on the decision making processes. **CRe-AM will use and adapt existing tools and processes and build new easy to use ones when needed in order to facilitate collaboration, modelling of results and easily updating of the resulting roadmaps.**

Moreover, once the financing of the Roadmapping activity ends there is no way to provide for any kind of follow up to **support its broad validation, adoption and take up.** The problem is that the focus has been on the technology roadmap as a product and not on the process so that it can be more broadly and easily used. A dynamic iterative process with integrated feedback loops is needed in order to continuously update the roadmaps. Therefore, in order to keep the developed roadmaps dynamic and agile, their key drivers, uncertainty dimensions and assumptions need to be fed into an **observatory function** that supports the roadmapping groups’ implementation and update process, including scanning for relevant developments in the wider contexts in which the roadmap is operating, which it feeds back to the groups. Thus, the roadmapping groups should regularly monitor the uncertainties associated with future forecasts, trends and signals identified in its foresight projections by continuously checking these against current realities, so that it can review and update its roadmaps as necessary.

Our approach will:

- **Provide a meta-model** for Roadmapping based on TEL-Map roadmapping approach, which provides the framework for the needed interoperability between the roadmaps developed by different communities using different methodologies and increase their chances for sustainability.
- **Provide appropriate tools** to support the different communities that are developing the roadmap and enable them to provide input in the different modules of the process, aggregating the views of truly collaborative communities. Conceptual modelling tools (e.g. Cmaps), interactive tools (e.g. skype, FM, Google hangout, flash meeting), tools and methodologies for foresight analysis (e.g. real-time DELPHI, text mining, Bibliometric tools, and services of how to use these tools.
- **Provide an observatory function**, which will scan and monitor using the uncertainties and drivers identified in the roadmaps.

We will use the concept of different contexts of adoption of technologies with focus on different sectors representing creative industries (arts, design, publications, video games, architecture, ICT community) including those types of users who are excluded from using these technologies (late adopters), those who are currently the mainstream user groups that benefit from such technologies and the early adopters. We will also show the different paths of evolution going from the current state to the desired future and we will provide recommendations and timelines for bridging the identified gaps. **Finally, to build and monitoring the roadmaps we will use and integrate foresight, roadmapping and change management methodologies.** (Kamtsiou et al., 2013c)
2 Roadmaps evolution

As argued before, Roadmapping as a methodology belongs to a larger family of strategic planning methodologies. It combines information and knowledge from various disciplines (foresight, technology management, markets, strategic planning) and emphasizes the importance of collaboration and networking as a critical success factors in the process. Predominantly, Roadmapping process is future oriented. Roadmapping may utilize methodologies commonly used in future studies (e.g. Delphi, Weak Signals, Cross Impact Analysis, Technology Forecasting) and basic understanding of strategic visioning methods (e.g., scenarios planning, discourse management, conceptual modelling). The main aim is to be able to define the future states (where we want to be?) in a clear way so that a gap analysis can be performed.

Technology Roadmapping is used to integrate “business strategy, product development, technology and R&D activities and actions” (Vatananan & Gerdri, 2011). A roadmap helps to develop and implement innovation plans with emphasis on adapting to changes in technology, market trends, new business opportunities, designs and processes. The most important aspect of TRM is the integration of technology developments with business planning, thus it has a great potential in supporting the development and implementation of integrated business, product, and technology plans. It has a graphical format that it is similar to an integrated PERT and GANTT charts.

2.1 Previous Roadmapping efforts in EU R&D projects

This section looks at the methodologies used in three previous developed roadmapping projects, PROLEARN, ICOPER and TEL-Map. It demonstrates how each was building on the methodologies and work of previous initiatives, and thus, how the Roadmapping practice and process has evolved. CRe-AM own Roadmapping methodology is based on the methodology advancements made by these 3 initiatives, i.e. recognising roadmapping as a knowledge creation process and use of SECI framework for knowledge creation (PROLEARN); use of activity theory and disagreement management to schedule the discussions and interactions between the roadmapping actors (ICOPER); integration of foresight methods such as state of play (domain cartography), scenarios development and signals analysis and the use of Observatory; use of change management and adoption methods such as ADNER’S innovation value blueprints TEL-Map). In addition we have included CReATE roadmapping project, as a research and Policy type of roadmap, since it was directly focused on creative industries domain.

The following initiatives are included:
1) PROLEARN Roadmap (research roadmap).
2) The ICOPER Roadmap (research and standardisation roadmap).
3) TEL-Map Roadmap (multi-organizational meso level roadmap)
4) CReATE Roadmap (Policy and Research roadmap)

2.1.1 The PROLEARN Project: IST-507310 (Roadmap 2008)

Methodology and process
PROLEARN project developed its own Roadmapping methodology, based on Time2Learn and a number of other projects such as IMS and IMTI. Recognising Roadmapping as a forward chain activity “invent our future first and then find the current that lead us there” PROLEARN has adopted a normative proactive approach in developing its roadmap for Professional Learning. Following this principle, the starting point was to invent the future first and to “plan backwards” from there in order to link up with today.

PROLEARN employs the following instruments in its Roadmapping methodology:
- A modified version of SECI framework for Knowledge Creation (Roadmapping as a knowledge creation process)
- Foresight activities such as Trend-analysis, surveys, interviews, user requirements analysis, expert workshops and symposiums (learning cafes), literature review, state of the art assessment, scenario development, SWOT analysis and modelling
- Disagreement management based on distributed discourse management
- Conceptual modelling using semantic modelling tools for capturing and extending the knowledge and positions of different communities

**Figure 1: PROLEARN Roadmapping process**

**SECI Framework for Knowledge Creation – Roadmapping as a knowledge creation process**

PROLEARN added another component to its methodology: The application of the SECI spiral of Knowledge creation framework by Nonaka (Nonaka & Takeuchi, 1995; Nonaka et al., 2000; Nonaka & Toyama 2003) in order to a) develop a value accumulating Roadmapping process, which is dynamic and has high potential for sustainability and b) promote a knowledge network of Roadmapping that amplifies the efforts of various groups and crystallizes them at the European level, influencing a large part of the EU TEL community.

In PROLEARN, Roadmapping is a knowledge creating process that spirals outwards from the core partners of the PROLEARN Network (individuals, groups, the whole Network) via the Network's associated partners, to the entire scientific community and industry.

Therefore, it is both a learning activity and a knowledge creation process for the community that builds the roadmap. This knowledge creation process has been modelled using the general SECI process framework (figure 9), known as the “SECI Spiral” (Kamtsiou, 2007).
According to Nonaka (2003, 2000, 1995) the key to knowledge creation lies in the following four SECI modes of knowledge conversion, which occur when tacit knowledge and explicit knowledge interact with each other: socialization, externalization, combination, internalization. Because tacit knowledge includes mental models and beliefs in addition to know-how, moving from tacit to the explicit is really a process of articulating one’s vision of the world – what it is and what it ought to be (Nonaka, 2003).

PROLEARN Roadmapping process framework (Figure 3) is derived from the general SECI process framework (Nonaka, 2003, 2000) by replacing the triplet of social entities (Individual, Group, and Organization) with (Core Partners, Associate Partners, and Scientific Community & Industry).
During the Socialization process, networking activities and community building tools are important. Face to face meetings, various workshops, and virtual meetings have been organized in order to bring together the wider community of the PROLEARN network on a common contextual platform and tap into their collective experience and knowledge. PROLEARN teams played a central role in this knowledge creation process of building the roadmap because they provided the shared context where the team members interacted with each other and engage themselves in common projects and activities on which effective reflection depends. This provides a new individual understanding of the relevant concepts and their relationship.

During the Externalization process, this new “know-how” is articulated and expressed via a constant dialogue where teams pool their information and examine it from different angles, thus integrating their diverse individual perspectives into a new collective perspective.

During the Combination process, the resulting “seed” knowledge is modelled and conceptualized and thus is easily communicated to external groups in order to synthesize information from many different sources and bring in different perspectives and contexts. In that way, an increased collective understanding is achieved where the actual concepts and their contexts are reinvented and extended by others. The principle is to find what we agree on, what we disagree on and presenting it in a way that we all agree on (Naeve et al., 2005; Naeve, 2009).

During Internalization process, the manifestos and the results of gap analysis were further analysed and a portfolio of short-term, mid-term and long-term actions and recommendations were produced. This explicit knowledge, in turn, can be reflected upon and internalized into new tacit knowledge, completing a full turn of the SECI spiral. Reflective analysis tools were used during this stage.

This enhancement of the mainstream roadmapping framework is an especially important improvement for TEL, since the roadmap is a commonly agreed and accepted vision, and not a mechanically derived result. PROLEARN extended the Roadmapping activity to go beyond strategic planning (time2learn), to be dealt as a knowledge creation process specialised for TEL, where the importance of disagreement management through discourse is emphasized. In addition, it added conceptual modelling as a core of the Roadmapping activities in order to facilitate the stages of convergence and synthesis of the new knowledge and transcend individual understandings in increased shared understandings.

The PROLEARN roadmap was focused primarily on the desired future. The roadmap was built in terms of its purpose focus, bringing out the visions and purposes of the TEL community. In the years since PROLEARN, its methodology has spread to other TEL projects (e.g., ICOPER, TEN-COMPETENCE, PROLIX, ROLE, ODS), and influenced STELLAR network of excellence.

The resources available during PROLEARN did not allow for investing effort in developing methodologies to identify threats that could challenge these visions and risk the implementation of the desired future. At the same time, although the SECI model used did provide an understanding of how do we go from representation of Knowledge to the dynamic knowledge creation, and what is involved in this transmission, it did not provide any means for the management of the Knowledge creation. SECI tells us what are the types of knowledge conversion that can apply in knowledge creation and how they appear. In that sense, a complementary mechanism is needed in order to better determine the relevance of the strategic issues identified, the seed input chosen as a starting point for discourse, and the management of knowledge creation in terms of increasing the motivation of communities to participate as well as manage effectively any conflicting interests of these communities.

Results: visions, goals, factors, assumptions, preconditions, gaps, and recommendations.

2.1.2 The ICOPER best Practice Network: ECP 2007 EDU 417007 (Roadmap 2011)

The ICOPER Best Practice Network developed a technology roadmap and a reference model (IRM) for standards development in the domain of Learning, Education and Training. ICOPER raised issues of how to improve requirement gathering when designing solutions for an unmapped territory as competency-driven learning and teaching. Through Roadmapping activities ICOPER worked on models describing how community requirements are fed into the specification design process and valorised in the standards
consensus process. The project provided methodologies of how to utilize conceptual modelling techniques that are publicly available in order to enable different groups to map emerging trends, opportunities and threats and provide a European insights tapping system for their communities and stakeholders. The ICOPER Roadmapping methodology made extensive use of foresight analysis methods, including “visioning” (scenario development), “futuring” (force-field analysis - weak signals analysis), and “gap analysis” (gaps identification, SWOT, gaps assessment and recommendations). In addition, modeling tools (C-Map) were used for capturing and extending the knowledge and modeling activities of the targeted group communities (Kamtsiou & Klobučar, 2013a). The results of these models were compared and contrasted in order to map out the differences and similarities among them and in this way, enable disagreement management among the positions of the different groups.

ICOPER raised the issues of how to improve requirement gathering when designing solutions for an unmapped territory as competency-driven learning and teaching. It had advocated a bottom-up approach with a number of mechanisms to ensure the involvement and cooperation of the relevant stakeholders. This is a good example, where the Roadmapping activities were followed by different stakeholders working under an umbrella organisation of special interesting group in the area. In order to solve the problem with SECI management, ICOPER has introduced the use of the Activity theory (CHAT) (Engeström, 2001), as the theoretical framework to support the interactions among the ICOPER and the different networks, which are linked by specific shared issues/problems they are trying to investigate/solve and through the scheduling of common activities. The SECI model of knowledge creation has been criticized for supporting only conflict free dialogue and the need for reaching a consensus. This implies the creation of safe knowledge, leaving no space for disagreements, and ignoring the tension areas, that are so important to understand the emerging phenomena we are dealing with in the domain. To make sure that the conflicting interests and weak signals are noticed, ICOPER strengthened the requirement gathering aspect of roadmapping by applying some of perspectives of Cultural-Historical Activity Theory and Weak Signal Analysis (Kamtsiou & Klobučar, 2013a).

In addition, although the SECI model provides an understanding of how do we go from representation of knowledge types to the dynamic knowledge creation, and what is involved in this transmission, it did not provide any means for the management of the knowledge creation. SECI only tells us what are the types of knowledge conversion that can apply in knowledge creation and how they appear. In that sense, a complementary mechanism is needed in order to better determine the relevance of the strategic issues identified, the seed input chosen to be used as a starting point for discourse, and the management of knowledge creation in terms of increasing the motivation of communities to participate as well as manage effectively any conflicting interests of these communities (Kamtsiou & Klobučar, 2013a). The aim was to support and strengthen networks of people that are connected by
shared objects (what they investigate, produce, e.g. learning technology specifications, tools, applications, best practices, training, etc.) through activities. The main concern was with the relationships between people and issues, with a special focus on the shared objects of the particular networks and the rules and practices that the different activity systems are built up. Fig. 5 shows an example of how four different types of actors, i.e. standards experts (& researchers), tool developers, curricula developers and teachers are connected via the ICOPER SIG community through their shared objects (support the development of outcome-based education) and their common or complementary activities and networks.

![Diagram](image)

**Figure 5:** Examples of activity systems in outcome-based education (Kamtsiou & Klobučar, 2013)

The acronyms used in the figure indicate standard Activity Theory elements: community (C), artefact (A), subject (S), object (O), social rules (SR), and division of labour (DL). For example, standards experts & researchers identify concepts, specifications, data models, etc.; curricula developers use competency models and specifications to develop curricula and identify learning opportunities and provide feedback to standard bodies and teachers; tool developers develop tools based on specifications, test specifications and provide feedback to standard bodies; teachers use and test tools to develop and share and use content and provide feedback to tool developers. In the case of ICOPER, they have created a network as a specific SIG under the CEN WS-LT workshop umbrella. The invited organizations and networks in this SIG had to already be working on some aspects of competency...
driven – outcome based education. They have tried to use open source tools that can be shared by every SIG participants such as CmapTools and a common modeling Cmap server. Therefore, the different communities in the ICOPER SIG were able to exchange ideas on practices and technologies in shared spaces already used by the communities themselves. Towards these goals, conceptual modeling tools (CmapTools), web-based tools (such as Google documents, media wiki, shared calendar), and a portal were used to support disagreement management by building connections based on shared concepts that link a multitude of different perspectives (e.g., commenting, linking and refining each other’s concepts and/or inter-concept relations).

During the implementation of the long term recommendations, and the monitoring and continuation of this work, it is important for the developers of the competency models to provide evidence of the application and fit of their models in real life, with the actual adopters of their models, whether they are providers or users of competency based education and provide any concrete examples or at least set of requirements that have based their models on. At the same time, SIG needs to find domain-specific cases against which these models can be tested for adoption and fit. This will lead to a better understanding of how the perceived value and impact of the offerings will be measured against how the user community understands rates and understand them. Ideally, according to the ICOPER Roadmapping philosophy, it should be the model trying to adopt/fit the users specific requirements and not the other way around. A bottom up perspective and process for creating standards and specifications using concrete situations, where the actual user needs are taken into account would strongly support the adoption of standards. The European Competency SIG is one of the instruments created for this purpose. Otherwise, any standard will remain an academic exercise of pre-conceived theoretical notions of what a competence should be.

**Results:** desired scenarios, context/domain scenarios, trends, weak-signals, gaps, recommendations, assumptions, top-level harmonised conceptual model. The following Figures set out the main driving and restraining forces impacting on key themes. They can be used a basis for identifying trends and weak-signals to be watched for.

### 2.1.3 TEL-Map Roadmap: IST-257822 (Roadmap 2013)

TEL-Map project built in the approach of PROLEARN and ICOPER roadmaps in order to develop a third generation, meso-level, multi-stakeholder roadmapping, which has evolved from and complements micro- or company-level roadmapping and macro- or sector-level roadmapping. It has been developed to meet the needs of increasingly complex systemic innovation where multiple co-innovators and ‘customers’ involve multiple decision makers and need to be included in the development process as co-innovators. In this approach, the participating organisations identify a common desired future, derive and test their own roadmap for themselves to implement. It sets out a new ‘dynamic’, ‘adaptive’ or ‘agile’ approach to innovation management, designed to enable multiple co-innovators strategically plan and coordinate their efforts to bring systemic innovations through to the point of adoption and mainstreaming, despite a turbulent operating environment. This approach integrates foresight, roadmapping and change management methodologies at a meso, multi-organizational, level. It is suitable for complex domains such as in the field of Technology Enhanced Learning (TEL), which is a diverse and multi-level domain, involving many types of players, working in different cultures, under varying jurisdictions, with differing and sometimes opposite approaches to pedagogy and the task of education (Kamtsiou et al., 2013c in press).

Along with dynamically stress-testing the roadmaps against the emerging realities of the context scenarios, TEL-Map project also adopted Adner’s model (Adner, 2012) for managing their successful implementation and adoption. Under this approach, co-innovation value blueprints are created for each design solution in the roadmap. Each of the actors who create and add value for the implementation of the design solution is identified in a value blueprint. Their willingness to participate is simplified and represented in the map as a green, yellow or red traffic light against each player, indicating respectively whether a key co-innovator will benefit from the innovation and is ready to go, will not benefit or lose and so in an uncertain state, will lose out from the innovation and is therefore unwilling to participate. The diagram below shows all the main stages (sub processes) of TEL-Map dynamic roadmapping framework for building and monitoring the co-innovation roadmaps: this represents a dynamic process, which is repeated for the lifetime of development to update plans in the light of emerging intelligence and changing conditions: In summary Dynamic roadmapping has the following steps: (Kamtsiou et al., 2013b)
Figure 6: main stages for developing and monitoring the co-innovation roadmaps (the main process loop of Dynamic Roadmapping)

1. Start with cartographing the domain of interest, using more conventional Policy foresight and research roadmapping activities. (e.g. Delphi, technology surveys, capturing the voice of different TEL communities, etc.)
2. Form the co-innovation groups.
3. The groups articulate their desired futures and identify common themes.
4. Create a first draft roadmap on how to get from here to there.
5. Map out the present context. Map out assumptions about the future and create future context scenarios. (Policy foresight activities in collaboration with the observatory intelligence network).
6. Stress-test the roadmaps to take into account of the present context and possible alternative futures, and inform the supporting observatory.
7. Prepare value blueprints (of all the necessary co-innovators, adopter decision makers and users which make up the co-innovation ecosystem) to improve the roadmaps and the group composition.
8. Start the dynamic phase of implementing the roadmap.
9. Receive alerts from the observatory about relevant changes taking place.
10. Update and adapt the roadmap, context scenarios, goals and/or the desired future.
11. Inform the cartography of the domain of interest. The previous mentioned initiatives have adapted and built on each other’s roadmapping and foresight methodologies.

A cartography of the TEL domain

TEL-Map partners, have identified the different events and trade fairs that TEL stakeholders usually attend, as well as their online collaboration platforms, and other social networking web-spaces that they interact. The partners have co-located TEL-Map events and other activities such as interviews and surveys as to understand both the state of play in TEL and the future directions of TEL stakeholders. They have also collected and analysed other TEL-focused Roadmaps. In this way, the Co-Innovation groups were set up and later complemented with more stakeholders based on common or complementary interests, activities and assumptions about their future visions. When major conflicts are identified, different clusters of co-innovation groups would emerge. The cartography is created using methodologies based on dynamic modelling and discourse management approaches in order to map,
capture, externalize, aggregate and contrast the views of relevant communities, and provide a landscape for the area in terms of where capacity is building, what are the dominant beliefs and assumptions, who is doing what, using what technologies, approaches, projects, what is perceived as threat and opportunity, what are the main visions and plans of stakeholders. Therefore, the whole system was addressed and mapped, so as to better monitor and act on the emerging opportunities and thus create and sustain systemic innovations.

There are two broad approaches that can be taken to this, which we’ve characterised as top-down, or ‘Invited’, and bottom-up or ‘Emergent’. In case of TEL-Map, due to resources restrictions, they have used the “invited approach” to first build the initial co-innovation groups and then the “bottom-up approach” in order to update them, prepared to split into more groups in case of disagreements. In reality, both approaches are used iteratively, based on the new information that arises throughout the process.

**The Invited or Top-Down Approach: starting point of co-innovation group formation**

The first ‘invited’ approach presupposes a leading agency or organisation that is recognised in the field and is prepared to form the co-innovation group. They can be either from the ‘push’ side, typically a company, but could be a funding agency, with an innovative product, service or a combination that creates a new ecosystem, which they wish to mainstream, or they could be from the ‘pull’ side, for example a schools organisation, a department of education, or an educational foundation. For example consider a school, where a community is developed around it, including teachers, parents, local business, local universities, the school itself, and partner projects such as Microsoft’s “partners for Learning”, working bottom-up via practitioners led innovation models to transform the school’s educational system from “e-mature” to “mentoring school”. A potential difficulty with the invited approach might be the ‘distance from the ground’. Our approach strongly advocates ‘user engagement’ from an early stage. The challenges you may face include finding the costs for their release from normal work or only including the ‘usual suspects’—people who have been invited for consultation before. Therefore, it is important to combine this approach with the bottom-up approach.

**The Emergent or Bottom-Up Approach: expanding he co-innovation group and from other emerging branches.**

The emergent approach requires many people to put forward what they are interested in and then to discover like-minded partners and update or form new co-innovation groups. Following up their shared interests through online discussions, they begin to form a co-innovation group, which, if it strengthens gets enough momentum, will agree to start on the roadmapping process and meet face-to-face. Consultation is an important part of this approach. The information necessary to build these bottom-up roadmaps is gathered in various ways, one of which is capturing and supporting domain-related discourses in the form of conversations. These conversations are often started in a synchronous way, by what we call “knowledge hearings” by a group of people meeting - either in real (face-to-face) space or in virtual (electronically mediated) space – and starting a discourse that is continued in an asynchronous manner on online.” The discourses can then be analysed using standard methods of conversational analysis and standard ontologies, leading to well-characterised (high inter-judge reliability) (Naeve et al., 2012). This approach clearly avoids the ‘distance from the ground’ problem, but may face a ‘completeness’ problem of bringing together the required range of stakeholders necessary to succeed.

But whether emergent or directed, effective innovation in a complex domain requires bringing together the requisite stakeholders. These are the stakeholders without any one of which actively participating, the innovation is likely to be blocked.

**Observatory Function Needed to Adapt Roadmaps in a Turbulent Environment**

Another major contribution to Roadmapping methodologies from TEL-Map was the creation of an observatory as a necessary addition for the successful implementation of a roadmap. They argue that in order to keep any developed roadmap dynamic and agile, the roadmap’s key drivers, uncertainty dimensions and assumptions need to be fed into an observatory function that supports the roadmapping implementation and update process. It uses these to scan for relevant developments in the wider contexts in which the roadmap is operating, which it feeds back to the roadmapping group. Thus, the roadmapping group should regularly monitor the uncertainties associated with future forecasts, trends and signals identified in its foresight projections by continuously checking these against current realities, so that it can review and update its roadmaps, context scenarios, its targets and even its desired future, as necessary.
Key results: co-innovation roadmaps for Higher Education and Schools domains, visions, context scenarios, signals analysis, Gap analysis, and adoption blueprints, TEL observatory.

2.1.4 CReATE ICT Innovations in Creative Industries: 201485 (Roadmap 2011)
This roadmap is of particular interest since it is directly related to creative industries. The CReATE - ICT Innovations in Creative Industries project aimed to link European players from research, business and the public sector and to develop a joint research agenda for promoting ICT-based innovations in Creative Industries. (Clar et al., 2008)

Methodology and Process
(Source: Strategic Cluster Development: Applying Strategic Policy Intelligence to create a Joint Research Agenda, 2008)

The CReATE project developed a methodological framework (see figure 7 below), which affected the decision-making process and contributed to the sustainable success of the whole project. The framework enabled the coordinated linkage of regional and trans-regional activities.

It included:
- the regional analysis and identification of regional research priority areas in the field of ICT for Creative Industries,
- the trans-regional (‘inter-cluster’) matching of these research priority areas and based on this, the drafting of a Joint Research Agenda
- the advanced regional feedback to and support of the Joint Research Agenda, based on the commitment of the relevant regional stakeholders
- the common development of the cross-regional (‘inter-cluster’) Joint Research Agenda
- the regional and cross-regional validation and project development

![Figure 7: CReATE Project: Common Methodological Framework](image-url)
Following the methodological framework the CReATE methodology suggested the following 5 steps:

**Step 1** - Build the relevant regional knowledge base on ICT for Creative Industries: in this step a Strategic Policy Intelligence and management (SPI) tool called Innovation Audit is used to map relevant stakeholder groups including their respective competences and to produce an outline of the regional, cluster-relevant strengths and weaknesses. The Innovation Audit uses methods and tools such as desk research, compilation of data and interviews with cluster stakeholders. The results of the mapping process are presented as a cluster map showing the specialisation of the cluster, the major actors (and competencies) and their interrelatedness along the value chain.

**Step 2** - Identify regional research priority areas in the field of ICT for Creative Industries: uses a forward-looking activity that is tailored to regional characteristics and focused on future market and technological developments. The forward-looking activity includes a Cluster Foresight SPI tool which involves five sub-phases.

- Phase one included a SWOT and a Trends & Drivers / STEEPV study.
- Phase two was the First Regional Cluster Stakeholder workshop.
- In phase three extended SWOT and STEEPV data were collected.
- Phase four was the Second Regional Cluster Stakeholder workshop.
- In phase five a compilation of regional cluster-related research priority areas was made.

**Step 3** – Matching regional research priorities: regions are matched and integrated into a cross-regional, cross-cluster Joint Research Area. The trans-regional matching of the identified regional assets, needs and research priority areas reveals the opportunities of cross-regional, cross-cluster collaboration and cross-fertilisation. The outcomes of this step were discussed in the International CReATE conference in Torino.

**Step 4** - Developing a Joint Research Agenda: based on outcomes from the international conference and input from stakeholders.

**Step 5** - Cross-regional, cross-cluster project development: formulation of cross-cluster and cross-regional project ideas and discussion of their feasibility.

**Outcomes** (drivers, trends, visions/ desired futures and scenarios)

(Source: Joint Research Agenda for ICT Innovations in Creative Industries, 2010)

The project developed a Joint Research Agenda which listed the core topics for applied research with relevance to Creative Industries. The topics provide strategic direction to boost Creative Industries in Europe now and in the future.

The topics are grouped under Research Priorities as follows:

**Research Priority 1: Visual and interactive experience:**
- Virtual environments
- 3D visualisation/animation
- Real-time visualisation, simulation and interaction
- High resolution display environments
- Haptic computing
- User-friendly immersive environments
- User-centred design of continuous interfaces

**Research Priority 2: Tools of productivity & intelligent automation**
- Semantic software for automated recognition, assembling and indexing
- Interactive artificial intelligence
- Enhanced procedural generation tools for digital content and prototyping

**Research Priority 3: Digital distribution**
- Encryption
● Data compression & decompression
● New business models
● Cross-platform distribution

Research Priority 4: Mobility & interoperability
● Data streaming systems
● Web security for online data exchange
● Interoperability of mobile & other devices
● Location based / personalised mobile services
● Augmented Reality solutions

Research Priority 5: User-producer-interaction in development
● Collaborative production & user-generated content
● Web technology for online collaboration
● Interactive testing environments

In addition to the Core Research Topics the project also presented concrete areas where existing support policies and programmes needed to be adapted to the requirements of the Creative Industries as well as where new support schemes are to be established. The areas are:

● Research & skills: How can research be fostered at the intersection of creativity and technology?
● Access to funding: How can funding and support schemes be more accessible for creative researchers and businesses?
● Business interaction: Which actions are needed to improve interaction between researchers and entrepreneurs or companies?
● Clustering opportunities: How can clustering activities strengthen the performance of Creative Industries?

CReATE project uses a similar concept with TEL-Map’s cartography (Innovation Audit and cluster maps) in order to map the domain and understand opportunities and weaknesses. This kind of domain landscaping enabled them to create bottom-up clusters of roadmapping communities. They have also looked at the several interdependencies along the value chains of the foreseen innovations, in an attempt to ensure the roadmaps adoption.

CReATE, resembled to a great extent a research and science macro level roadmapping approach. Research roadmapping usually focuses on the potential emerging technologies and sets them out in exploratory approaches to inform future research agendas. At this macro-level, roadmapping approach often seems to be driven by anticipated technology developments, and environmental changes, a methodology very close to foresight approaches. But although, a good understanding of the possible technology paths and the associated drivers, whether economical, business or social, is achieved, they often lack the exploitation of these ideas at operational levels. The main danger with such an approach, is that these types of roadmaps are usually developed by a group of experts driven by positive technology focused approaches, which are recycled within the comfort zone of the technical community. The bottom-up approach used by CReATE roadmap, and the cartography of the domain, helped minimize this risk. Usually, these types of roadmaps have a long term perspective, the impact analysis of the trends that could affect the industry in the longer term, aiming to provide detailed analysis of alternative technologies and recommendations for future R&D to develop selected technologies.

Often they remain in the form of reference documents or guidelines, sometimes resulting in the development of new industry standards or they are included in European funding programmes. Foresight methods, although succeeding in providing a basis for deriving new policies and directives, often the latter may not be successfully implemented due to lack of innovation management and a framework for detailed planning needed at operational levels from all actors involved in the value chain, aspects usually found in roadmapping approaches. It is therefore necessary to link operational innovation activities with the shared strategic perspectives of the actors and innovators involved in the field.
This is a problem that TEL-Map approach has tried to avoid by integrating roadmapping, foresight and change management and it is what will guide us in the CRe-AM roadmapping approach. (Kamtsiou et al., 2013b)

2.2 Evolution of Roadmapping and Foresight technologies

This section provides a mapping of previous initiatives in terms of methodologies used and the interrelationships between these Roadmapping initiatives. TEL-Map, ICOPER, PROLEARN, Time2Learn, BRIDGES, IMTI and IMS are Technology Roadmaps, while L-Change, LEONIE, LEARNOVATION and VISIR are foresight and Policy initiatives.

![Diagram of roadmapping and foresight methodologies]

Figure 8: Interrelations of Roadmap Methodologies (source: Kamtsiou, D2: First version of the Meta-Roadmapping framework, 2012)

The figure above shows the evolution and the interrelationships between these roadmapping and foresight methodologies.

All initiatives reviewed, have adapted Roadmapping methodologies developed by earlier initiatives. Already started in 1999, the BRIDGES “Roadmapper” built on the experience from the IMS groups (Intelligent Manufacturing Systems Expert Group, Technology Map for Manufacturing) and the IMTI (2012) (The Integrated Manufacturing Technology Initiative is a US industry/government partnership which facilitated collaborative development of critical manufacturing technologies). Time2Learn directly build its
model on the IMTI Roadmapping methodology, while it also incorporated an extensive market analysis and customers drivers for building its roadmap.

PROLEARN roadmap extended the Time2Learn methodology and introduced a new model based on the SECI framework of Knowledge creation process (Nonaka & Takeuchi, 1995; Nonaka 2000, 2003) combined with conceptual modelling and foresight analysis. In PROLEARN, this approach was used in order to conduct a pan-European foresight exercise on the future of technology-enhanced professional learning and present the emerging and future trends and visions describing the desired future state (Kamtsiou, 2007). The study employed a fresh approach to Roadmapping and the task of identifying the prevalent future visions involved a series of consensus-building activities including scenario-building and community-based dialogue, surveys and forums.

ICOPER project has built on the PROLEARN methodology. It incorporated domain scenarios for defining plausible TEL futures, as well as a disagreement management approach in order to reach consensus on a conceptual model for the domain. In addition, the activity theory was used in order to schedule the interactions among the communities and provide the first seed input for discussions based on the communities shared interests (Kamtsiou & Klobučar, 2013a).

Recently, TEL-Map introduced the term Dynamic Roadmapping, which further expanded the ICOPER and PROLEARN methodologies (Kamtsiou et al., 2013b,c). TEL-Map project extended the Prolearn and ICOPER methodologies, by combining the widely adopted Future Search (2000), scenario planning approaches, together with participatory observatory techniques. The TEL-Map project Dynamic Roadmapping methodology seeks to overcome the limitations of earlier European roadmapping projects where “experts” produced roadmaps that were arguably not followed by others or were rapidly outdated by changing circumstances. In contrast, the TEL-Map approach seeks to support clusters of mutually dependent TEL actors with a shared concern or area of interest, whose participants already have a responsibility for moving it forward and between them have the resources, skills, authority, knowledge and need to bring about innovation. It is considered as a 3rd generation roadmapping methodology which integrates methodologies from foresight, visioning, Roadmapping and change management. CRe-AM roadmapping methodology is directly based on TEL-Map.

IN parallel, several Policy Roadmapping efforts were developed based on foresight methodologies. L-Change was the first to introduce the idea of a TEL- Observatory which included a comprehensive market analysis on TEL in different EU countries, and an analysis of policy and research practices. LEONIE project introduced weak signals analysis as a foresight method to identify trends and signals that could affect TEL in the future. TEL-Map and ICOPER projects have also used the weak signals approach developed by LEONIE project in their own Roadmapping methodologies. Learnovation project has built on the LEONIE methodology and results and it additionally incorporated a DELPHI study in order to develop context scenarios for different TEL sectors based on a 2x2 matrix. VISIR extended the LEONIE and LEARNOVATION approach by using a bottom up approach to provide a cartography for the TEL domain based on actual grassroots innovations.

2.3 Roadmaps Generations

2.3.1 First generation of roadmaps (1970s- mid 1980s)
These initial types of Roadmaps focused on technology forecasting (Gindy et al., 2009) and on “managing standard product continuous improvement efforts (Tierney, et al., 2012)”. They were used by both firms (micro level) and industries (macro level). They imply a “single root technology”, strong technology trends, and a stable technology product platform. A representative example of such roadmaps is the “International Technology Roadmap for Semiconductors” (ITRS, 2008). In this roadmap, a single cell technology (e.g. transistor) a stable product process (e.g MOS & Bipolar transistors) and an established base technology process (e.g. semiconductor micro-fabrication) are given at the outset. These types of roadmaps are applied in less complex domains, where there is a well-structured market and a core technology is the predominant factor of the innovation design. The natures of innovations are linear and incremental based on a critical dimension rule for the technology advancement. (Tierney, et al., 2012)
First generation roadmaps major contribution to roadmapping: the generic roadmapping graphical structure (see figure 9).

This structure is a tabular format of a multilayer time based chart showing how the various Roadmapping elements are aligned and connected. It provides a methodology to integrate technology and business planning to a single graphical format close to a combination of Gant and PERT diagrams (Phaal, 2004).

Although Roadmaps can take various forms they all try to answer 3 basic questions.

1) Where we want to go?
2) Where are we now?
3) How we can get there?

Usually the question “Where we want to go” comes before the question “where we are now”, since according to foresight principles, we must imagine the future first, before we try to make it happen. Where we want to go also determines what is relevant in the present.

![Figure 9: Roadmapping critical framework. Based on: EIRMA (European Industry Research Management Association 1997 & IfM Centre for Technology Management model (University of Cambridge) The top layer relates to the commercial and strategic perspectives including their PESTLE drivers and it is concerned with the purpose of “why” we are developing the Roadmap. Related information types are PESTLE drivers analysis, market analysis and competitor activity, user and stakeholder’s needs, etc.

The middle layer is concerned with the Design and production perspectives, and the actual applications and systems we are aiming to develop, “know what”. A portfolio of Applications and services are the information types are typically produced in this layer.
The bottom layer relates to the technology and research perspectives and to all resources that provide the “how” to develop the applications and systems of the middle layer. In this layer, we need to map technology elements to solutions capabilities and produce a portfolio of technologies, R&D projects, and PESTEL related actions (Phaal, 2004).

This Roadmapping structure provides a visual way to present the evolution of markets, products and technologies, including the linkages and gaps between the various perspectives.

In reality, a standard methodology for roadmapping doesn’t increase or a standard Roadmapping process. The different layers of roadmapping chart are customisable depending on the type of roadmap (industry, firm, science/research, sector, etc.) and type of innovations (disruptive, systemic, linear, etc.). Figures 10,11) below shows different visual representations of roadmaps.

![Roadmapping Structure Diagram](image)

**Figure 10:** Multilayer format example: source Walsh 2004 (roadmapping as a disruptive technology)
2.3.2 Second generation of roadmaps (mid 1980s- end 1990s)

These types of roadmaps were set out to improve strategic technology planning (Gindy et al., 2009) and to “explore the disruptive potential of emerging technologies” (Tierney et al., 2012). Unlike the first generation, they do not imply a single cell technology or “fixed market targets or a stable product process paradigm”, but are “still generated from a single root technology” (Tierney et al., 2012). They are used for either product replacement, or for identifying potential applications enabled by emerging technologies, although a clear understanding of how these technologies are related to actual products is missing. The main goal is to identify alternative technology paths and map technology developments on several critical dimensions. Main examples of such roadmaps are Nanotechnologies roadmaps (MEMS, 2004). The extensive use of drivers, technologies life-cycles and assessment of technologies readiness are emphasised in the roadmapping methodology. These types of roadmaps are developed also at both company and industry levels. Figure 12 shows the multiple technology life cycles: Emerging disruptive technologies versus more traditional options.

The disruptive technology roadmaps have numerous technology pathways seeking to compete with numerous traditional technology solutions in the marketplace (as in the case of MEMS).
2.3.3 Third Generation of Roadmaps: (1990 – today)

These types of roadmaps focus on integrated technology management. (Gindy et al., 2009). The foreseen innovations require the development of a number of different technologies that need to improve along multiple dimensions (CDs – critical dimension pathways) and the results needs to be seamlessly integrated (Tierney et al., 2012). Unlike both previous generations of roadmaps, the market is not well structure and these innovations derive from multiple root technologies. Moreover, innovations are made on the interface of more than one technology. Innovation is not linear, single, rooted or independent, but rather systemic, involving several converging and or competing technologies, complex interactions by many players, who have to collaborate in order to develop holistic solutions, rather than simply the introduction of new standalone products. Good examples are TEL or pharmaceutical roadmaps. Hence, these types of systemic innovation have “a nature of integrality” (Jari Kaivo-oja, 2011), and at the same time a nature of multi-diversity, since the applications envisioned usually require for different development pathways per involved technology. Adoption and change management is becoming a critical factor (complex technical and organisational interdependencies). Integrating foresight, roadmapping and change management methodologies is essential (Kamtsiou et al., 2013b,c).

Overall, making predictions about the kinds of technologies that will best meet future needs of the diverse types of stakeholders (suppliers, developers, users, adopters, and intermediaries) is very challenging because there are so many ways for technology predictions to go wrong. Moreover, the new innovations are happening on the interfaces of such technologies rather than on linear development of each technology individually. This calls for new ways of thinking about the future, including how to: take advantage of different perspectives, look at technology from different planning horizons, think through discontinuous, non-linear effects, use technology strategy tools, leverage both formal and informal strategy-making processes, consider risk profiles. Planning the future requires a common agreement that can only be effectively achieved through the mobilisation and engagement of all stakeholders in this direction.

Moreover, in the past, many originally very promising technologies have run into a “last mile” problem, essentially failing to convince either the actors involved in the supply-delivery value chains or the wide majority of users of their benefits. Technology adoption is about making technology available (a delivery process) and most importantly about people, their expectations, and what they imagine and then learn about what a technology can do (a social process). Often users’ response to new technologies undergoes a stagnation or disillusionment stage (HypeCycle), before it picks up again. Failing to identify this development at an early stage - and to deal with the reasons behind it - can have a seriously negative impact. In reality, technology adoption conforms to more complex patterns and is subject to the influence of very diverse factors. The issue of uncertainties in user responses and acceptance of emerging technologies are often ignored, and in reality the future visions simply concentrate on technological potential and supplier’s deployment processes.

As first established in TEL-Map, we argue that an approach to roadmapping that integrates, foresight, technology management and adoption or change management is needed in order to achieve (a) results that accurately reflect the needs of the intended users and (b) a strongly favourable social response to the proposed solutions. Ron Adner in his recently published book, The Wide Lens (Adner, 2012), proposes a useful model which was adopted in TEL-Map. Essentially he points to the dependencies an innovator will often have on co-innovators and also the value chain suppliers and intermediaries. He suggests mapping out these players and their interdependencies in a ‘value blueprint’. The key questions are a) who else needs to be able to co-innovate with you before your value proposition reach your users? and b) who else needs to be able to adopt your value propositions before they reach the end users?
Adner provides an example from the publishers sector, a community also targeted by CRe-AM. The example is called the elusive E-reader, and uses the value print methodology in order to investigate why Amazon succeeded where Sony failed to develop the market for its e-readers. In 1990, Sony introduced its Data Discman Reader, but the venture failed due to very limited content available only on Sony-published CD. Limitations included: they were very expensive, too big, and tiring for the eyes. Then in 2000, online retailers sold 500,000 copies of Stephen King’s novel Bag of Bones, a signal that motivated all major publishers to launch digital imprints. This led to increased sales for the publishing houses and in some cases revenues were doubled. Microsoft and Amazon started to compete for software to support the new e-books. Despite this success the current electronic reading devices were not selling. This was attributed to not user friendly hardware, which was difficult to find and to read the e-books. Sony launched a new e-reader in 2006 the PRS-500 Portable reader. Users could buy the e-reader at 350 dollars, 20% cheaper than the previous model, and could choose from approximately 10,000 titles available at Connect.com, the online bookstore that Sony launched alongside the Reader. It was a two-step process to read the content. First the users had to download the content in a proprietary format to their PC and then transfer it from the PC to the reader. Nevertheless, the reader failed again to successfully become adopted by the market. Main problem was its blue-prints of adoption. The target customer was the book reader. Sony developed both the hardware and the standard for the e-reader. It partnered with excellent suppliers like E Ink and managed to develop a high quality product. At launch Sony saw all green lights across the project, supplier and intermediaries. They planned to bring on board many authors and publishers to Sony’s own retail store. In reality, Publishers as adopters of the innovation saw only red lights (several economic, legal and quality concerns as well as copyrights and security issues).

The figure 14 above shows the various dependencies that had to be managed and the willingness of the co-innovators and intermediaries to come along. These are simplified and represented in the map as green, yellow or red traffic lights against each player. It shows that Sony Reader Value Blueprint was an excellent technical product, but it was not a market success because the
publishers, a key part of the whole innovation ecosystem, were not on board. Particular attention therefore needs to be paid to those players whose traffic lights are red, i.e. whose costs outweigh the benefits. If these key players’ issues are not addressed, then there is little chance of the innovation succeeding.

Amazon in 2007 launched the Kindle and this innovation made e-books into mainstream. As a device, it was inferior to Sony’s reader, heavier and with an inferior screen. But Kinder was a closed platform, which was reducing the risks associated with sharing the content with friends and others, or making it impossible to transfer content from other devices; it was a one stop shop providing a simple and cheap way to purchase and enjoy an e-book. It was positioned as a service and not a device. The figure 15 below shows the Kindle value blueprint.

![Kindle value blueprint](image)

**Figure 15: Amazon’s Kindle value blueprint at Launch, Adner (2012), p.96, Figure 4.4.**

The key difference was the way they aligned the ecosystem to bring their value proposition to the end customer. This was a simplified proposition for everyone involved. No lights are red. In order to transform the orange light for publishers, it was critical to reduce their perception of risks and total costs. Amazon aside from solving the problems with piracy and copyrights, it also paid the publishers 50 % of the list price of the print version but then sold the e-book for 9.99 dollars. Moreover, its retail giant gave them a lot more power to approach publishers and authors with a good proposition.
3 CRe-AM Roadmapping processes

The CRe-AM Dynamic Roadmapping framework is based on the normative approach employed in PROLEARN and TEL-Map roadmapping projects - not addressing only what will be, but rather what should be and what could be, from the perspective of the groups who are creating the Roadmap. It follows that roadmaps are not “objective”. The recent, generation of approaches to foresight is characterized by increasing recognition that the future will be born out of the interaction between the various actors present and their plans and that the foresight process itself can change future events. Therefore, an integration of Foresight and roadmapping methodologies is important.

In this process view on foresight, the importance is emphasized of establishing a discourse management methodology between innovators, suppliers, intermediaries, users and other important actors as their interactions are an important factor that can influence how results of a particular foresight exercise are taken up by various communities of stakeholders. Methods used in iCOPER roadmap (e.g. use of activity theory), will be used in order to identify common activities in the various communities, and their shared interests helping us to establish a CRe-AM presence in the different communities and to enhance our roadmapping groups. The purpose of the roadmap is to enable us to make decisions that take us closer to the desired futures. Adoption models will also be used in order to make sure that the value propositions of the foreseen innovations are successfully delivered to the customers. The reality will focus on negotiation, on-going dialogue and interplay among the various stakeholders.

3.1 Engagement of CRe-AM communities and roadmapping groups formation

With an aim to actively engage the communities actors and to motivate them to get involved, we will use a mixture of “top-down” and “bottom-up” approach - in order to clearly capture, assess and explore the different communities’ expectations about present and future requirements in the respective 7 areas of creative industries: Art (incl. Crafts), Design, Publications, Media, Video Games, Architecture, and Music Technology.

3.1.1 Top-down (invited) approach

Various types of stakeholders per creative industry sector will be invited to take part in our roadmapping activities, including face to face workshops and online consultations. These stakeholders will be assisted by technologies and ICT experts which will form technology intelligence (TI) network. Their primary role of the TI network is to identify potential opportunities and threats stemming from emergent ICT and Media technologies (technology push) and or to discuss potential technological opportunities stemming from the future needs as they are expressed in the stakeholders visions (market pull).

A potential difficulty with the invited approach might be the ‘distance from the ground’ that would lead to the re-cycle of technology ideas within the comfort of the current technical community. Our approach strongly advocates ‘user engagement’ from an early stage. The challenges you may face include finding the costs for their release from normal work or only including the ‘usual suspects’ – people who have been invited for consultation before. Therefore, it is important to combine this approach with a bottom-up approach and with a cartography that will map the Creative industries landscape.

Starting with our existing network of CRe-AM stakeholders, formed by those who already expressed their intent to participate in CRe-AM roadmapping activities, we have created an excel document to provide a first categorisation.

The stakeholders were first categorised according to their geographical regions, type of organization, which sector in the creative industries they primarily belong (core sector) and their Profile Descriptions.
A further categorization will be done, based on the ARE-IN principles used in Future search (Weisboard & Janoff, 2010), methodology in order to bring together all the key players (the whole system) necessary to implement and deliver the innovations in the roadmaps. This will allow us to understand who is missing from the first groups of stakeholder communities.

Starting point: Discussions with the initial stakeholders will provide valuable suggestions of who else in their transactional environments should be invited for input in the roadmapping process.

According to “future search” methodology we will take into consideration criteria relating to:

- the different stakeholders’ key views and perspectives, such as individual, employer, firm, potential user, market, governmental, societal;
- the different types of stakeholders which for example, in the case of creative industries might include industry leaders, innovators, researchers, leading-edge users, sector funders, publishers, artists, designers, ICT experts, etc.
- their ability to manage innovation such as: authority to act, technological excellence, access to resources, possession of issue and sector information, knowledge and skills;
- impact in the creative industry area from each stakeholder perspective;
- the ability to imagine the future, not just any future, but the one they desire together with a commitment to see it implemented; identification of common, complementary and conflicting visions, motives and interests.
- the ability, collectively, to implement the Roadmap and foster change.

We adopted the principle of ‘Get the whole system in the room’ from the Future Search methodology and used their 5 key criteria for identifying future search events participants, for which they use the acronym: ARE-IN (Weisboard & Janoff, 2010).

This unpacks to those people with the: Authority to act: the decision makers in an organisation or community who can authorise or prevent certain critical actions. People with a future perspective in their job description who are plan and authorizes changes in their organisations.

- Resources needed to implement plans: those with time and/or money needed to implement the plan. These will be varied. For example in R&D, these will be those who fund Creativity R&D projects at European and national levels; for those developing products and services, it will be the directors of development in sector related companies; and budget holders responsible for the purchase of such products or services.
- Expertise in the issues being considered: often professionals, researchers or developers with specific knowledge and skills.
• **Information about the topic that no others have**: those who have first-hand knowledge about and/or experience of the area in focus.

• **Need that is being addressed**: those who are the clients of the innovations.

Adopting Adner’s innovation value prints, depending on the type of innovation, we also need to understand the role and involve the following types of participants:

- **End users of the innovations**: who are the final targets of the value propositions envisioned in the Roadmapping vision scenarios.
- **Suppliers**: what suppliers will be needed to build the offers?
- **Intermediaries**: Who else stands between the innovators and the end customers. What changes they need to make in their own practices and processes in order to adopt the innovations and pass them to the end customers.
- **Co-innovators**: complementors that need to co-innovate before the intermediaries can adopt the offer.

Another tool that can be used to check the completeness of the group is the ‘**Recipe for Successful Change**’ model developed in (Golden, 2006) and is adopted for this purpose (see figure 3). Golden’s ‘recipe’ sets out five ingredients for successful change:

1. Vision
2. Skills
3. Incentive
4. Resources
5. Action Plan

Figure 16 below contains five rows, each indicating the type of resulting failure that can be expected when one of these ingredients is missing, and a sixth row, with all five present, that results in successful change.

Clearly these ‘ingredients’ can all be present but still result in failure, so they may be further qualified as follows:

1. Clear Vision that is bought into by all stakeholders – including final adopters
2. Sufficient and appropriate Skills
3. Strong enough Incentive for all Co-Innovators and Adopters to engage in the venture
4. Sufficient Resources to carry out the work
5. An appropriate Action Plan that covers all the required tasks and is adaptive to change.
Finally, a close collaboration with WP6 will provide an analysis of the incentives for each stakeholder to engage in the CRe-AM activities. As mentioned above the activity theory will be used in order to use intrinsic motivation for the targeted communities to get involved, and grouped, based on their own common interests and shared activities. The bottom-up approach will complement this goal.

3.1.2 Bottom up approach

*Cartography of Creative industries landscapes*

A “cartography” of the 7 areas of Creative industries mentioned above will take place as part of our Roadmapping activities. This cartography approach helps to map out the actors (and stakeholders) involved, their activities, visions and motives. We will also involve an active intelligent network of researchers, technologists, creative industries experts, in order to create an Observatory and map out major trends, technologies, tensions, research, industry leaders and other important projects and initiatives and that could affect the domain of Creative industries (using the methods and tools proposed in D1.2, as well as based on the broad principles of the “Capturing the voice of” methodology originated in TEL-Map (Naeve et al., 2012)). We will also collect and analyse other focused Roadmaps and technological studies. In this way, the roadmapping groups will be set up and, later on, complemented with more stakeholders based on common or complementary interests, activities and assumptions about their future visions. In cases where major conflicts are identified, different clusters of co-innovation groups may emerge. A *first documentation of the cartography will be presented in the form of context scenarios per creative industries sector, which will be developed in WP3 with support from WP4.*

Establishing roadmapping groups on this basis will help us to enhance the initial communities with further stakeholders based on common or complementary interests, activities and assumptions about their future visions, thus providing an intrinsic motivation for these communities to participate in the roadmapping process. Continuing viability is based on consensus - when major conflicts are identified, splinter groups may be formed.

*Figure 16: Recipe for successful change (source: Golden, 2006)*
**Capturing the voices of communities**

Aside from the desk-top research (existing studies and roadmaps), we will use the methodology developed in TEL-Map project to schedule events and online interactions with stakeholder communities and their networks who are not included in our current roadmapping groups (see TEL-Map D1.1 describing the “capturing the voice of” methodology, Naeve et al., 2012). The principle under this approach is to meet these stakeholders and experts in their own networks, and perhaps join their events and establish a presence to their social networking sites and online collaboration spaces. Some examples include the following:

The “Technology and Innovation for Smart Publishing (TISP)”. A EU- supported network, which aims at creating a platform for publishers and technology providers to promote wider collaboration between the two sectors. [http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=325109](http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=325109)


“Creativity Works”, a new coalition of the creative and cultural sectors launched by FEP, aiming to start a dialogue with EU policymakers about the economic and cultural contribution made by artists and the creative content sectors in the digital age. [http://fep-fee.eu/IMG/pdf/press_release_-_creativity_works_launch_2_.pdf](http://fep-fee.eu/IMG/pdf/press_release_-_creativity_works_launch_2_.pdf);

Screening Room (http://screeningroom.org.au/screening-room-home/). A YouTube initiative which connects filmmakers with audiences at no cost that helps curb copyright infringement. e.g. ‘Blood Spell’ released under creative commons license

Jamendo (http://www.jamendo.com/en/). The music-sharing site has released 9744 albums by 5586 artists to date with one of the Creative Commons Licenses, which allows everybody to download the music and have free, legal, and unlimited access. Each artist can choose between two revenue programs: Donation and revenue sharing.

Kompoz (http://www.kompoz.com/). Musicians can use the Web to gather contributors (e.g. a violinist if a drum piece). The 'Open Music Agreement', offers artists a legal platform to share creations.

The main aim of this activity is to use structured conversations with these stakeholders as different intelligence streams (market, competitive, technical) in order to inform the roadmapping process around topics of interest, visions, goals, motives, innovative ideas and also to empower those likeminded to use these roadmaps to find and connect with potential collaborators. Normative type of questions (**what it should be...**) as well as exploratory questions (**e.g what if.... Or what can be...**) will be used in order to identify the community's visions, and explore the potential of new technologies. **These events will take the form of workshops at local level, often co-located with other important industry events, and with structured questions embedded in the communities web-collaboration spaces such as their websites, Facebook pages, LinkedIn groups, other online forums etc.** (see above indicative list of forums/spaces).

For this purpose, we will also use any tools that the communities may use in their online networks for collaboration, modelling, discourse management, membership, etc.

The aim is to understand the following questions:

Where things are going given the current activities and planned innovations? What is desirable (the desirability in activity theory is embedded in the objects and shared as common goals)? Where the power structures are developing and who gains and who loses? What could be done? What are the tools and technologies available for different participants and how are they used to construct the shared activity objects? What is the knowledge creation process in these communities? An early implementation plan was produced and shared with the whole consortium during the kick-off meeting, and this document will be continuously updated during the project. The next version of the Implementation Plan contains a detailed description, streamlined with D6.2 CRe-AM Dissemination plan.
3.2 CRe-AM roadmapping stages

CRe-AM roadmaps are developed in 3 main stages:

1. **Initiation stage**
   - Develop the CRe-AM Roadmapping conceptual framework
   - Form a roadmapping management group (task force) by appointing specific individuals of WP1,2,3,4,5,6. This group, under the coordination of WP1, will make sure that the roadmapping framework is followed and that the WPs’ activities and input are coordinated and are in line with the roadmapping processes and methods underlined in the framework. It will also make sure that effective communication is in place in order to ensure proper links between WP2-6 activities and for their data outputs.
   - Decide on the portal support, functionality, type of interaction, tools and functionality
   - Develop a first version of the CRe-AM observatory (see also D1.2)
   - Decide on the time frame and the scope of each subsector roadmap and the nature of innovations addressed

2. **Roadmapping development and management stage**
   - Decide on the types of interactions and tools to be used by the communities (e.g. customer relationships management (CRM) tool, collaboration tools, collaboration modelling tools, Delphi tools, etc.)
   - Decide on the type of analysis and methods. (Scenario planning, Delphi, Gap analysis, SWOT, bibliometrics, data mining, workshops, etc.)
   - Decide on the visual representations of the roadmaps and interim results
   - Initiation and management of the roadmapping processes.
   - Development of the CRe-AM roadmaps.

3. **Dynamic stage**
   - Ways for adoption and mainstreaming
   - Ways of monitoring (e.g. Observatory function) and adaptation
   - Ensure continuation and sustainability after the project finishes

3.3 General roadmapping framework: main activities and outputs

Figure 18 below depicts the general roadmapping process framework and the respective key outputs at the end of each process as critical inputs for the next process.

There are two main parallel processes taking place:

- The first one (blue colour figure) shows the activities and processes involving the CRe-AM stakeholders communities
- The second one (green colour figure) shows the activities performed mostly by the CRe-AM partners (as part of the observatory, in the form of intelligence streams or analysis) that would be fed back to the roadmapping communities.
Figure 17: General roadmapping framework processes

Phase A (M1-M6): Creation of initial fast-track roadmaps per sector and initial contexts per sector (cartography maps).

The first step of this phase will be the organization of a series of international cluster roadmapping workshops engaging the CRe-AM sector communities. These workshops will be scheduled in the first 6 months of the project (organised by WP3 with support of WP1). The purpose of these workshops is to produce a set of initial fast-track roadmaps for the creative subsectors in order to quickly capture current practices, business and technology drivers, and to develop desired scenarios based on the communities' visions for the future. An initial identification of gaps between the current practices and the ones described in the future visions will be identified and explored. These roadmaps will serve as a seed input to start a discourse with the involved communities on a larger scale (see also Figure 23).

Phase B (M7-M18): Negotiation and continuous updating of initial roadmaps

During this phase several local events in the form of local workshops will be organized in order to communicate and further explore the scenarios and gaps identified in the fast-track roadmaps (WP3). In parallel with the face-to-face workshops, online consultations and other forum like events will be scheduled with the communities in order to save resources and be able to reach as many as possible stakeholders. We will organise the interactions and contributions with the communities both at our own portal (Observatory function), and most importantly at the communities own online collaborations spaces and websites, the infrastructure, tools and functionality will be in place by WP2. Moderators will be appointed to manage the discourse in each community, as and if appropriate.

In parallel, the results from the ongoing, continuous technology foresight activities (WP3 context scenarios), technology forecasting and technology assessment activities (produced by the CRe-AM partners mostly under WP4 and WP5) will inform the roadmapping communities as different intelligent streams in order to validate and update the initial roadmaps. The outputs of these discussions will be modelled and the initial roadmaps will be updated.
Phase C (M19-M24): Production of final roadmaps and plans for their adoption and dissemination to wide audience

A second series of workshops will be organised in order to validate and produce the final roadmaps for the creativity sectors and their respective innovation blueprints. The results will be disseminated during a final international conference.

Intelligence streams provided by CRe-AM partners to Roadmapping communities

1. A desktop research will start as early as possible in the project in order to prepare the initial context scenarios for each creative domain, which will include review and analysis of previous foresight, technology studies and roadmaps in the targeted areas. This will form the initial cartography of the domain and will also provide a way to identify and invite new stakeholders with expertise that are currently missing from our initial groups (especially when it comes to technology and ICT experts). This work will be led by WP3 (as initial phase for the context scenarios) but also be supported by WP4 in terms of signals to watch, new business requirements and technology developments.

2. WP3, 4 and 5 will support the roadmapping communities via a) sector-based technology foresight (WP3-WP4: context scenarios, emerging technological opportunities, business opportunities, weak signals and trends analysis, etc.), b) technology forecasting (WP5: technology S-Curves, evolution based on historical trends) and c) technology assessment (WP5: technologies readiness, Gaps assessment, and proposed actions). The results from these 3 Technology Intelligence activities will provide input to both local workshops and online discussions with the stakeholder communities, in order to help them stress-test their initial roadmaps and perform gap analysis of what is needed for achieving the future visions.

3. The value blueprints of the innovation opportunities identified in the roadmaps will be created in order to make sure that everyone who needs to be aligned will be on-board and making sure that the value propositions in the roadmaps have a good chance of adoption. The outputs from all the above processes will be communicated to the stakeholders’ communities and also discussed face to face wherever possible at events.

3.4 Integration of foresight, roadmapping and change management

The identification of emerging technologies and the possible commercialization of such technologies (Technology foresight), as well as their possible evolution (Technology forecasting from existing trends), are both needed in order to identify risks, opportunities and threats related to such developments and the impacts of these technologies at some time in the future (Technology assessment). In addition, for any roadmap to be useful, a plan for adoption of the foreseen innovations must be developed, which would include all the relevant actors involved in the innovation functional logic (innovation value blueprints).

The schema below shows the different methods involved according to roadmap type, the nature of innovation and the foresight activity (whether normative or exploratory).

Each area of activity requires appropriate methods to achieve optimum results. Depending on the roadmap type, for example micro, meso, macro a different methodology is used. In case of CRe-AM, we are aiming on producing a meso level roadmaps for 7 different sectors of creative Industries. These can be seen as networks or communities of co-innovators for each of the 7 sectors. This calls for the integration of both a normative approach (development of desired scenarios), with foresight approaches (identification of relevant context) and with methods for change management in order to ensure adoption of the innovation opportunities.
Forming the CRe-AM co-innovation groups (Lead by WP2 & WP6 with support from WP1):
In section 3.1 we have explained in detail the approaches we will use to form the (co-innovation) groups and schedule their interactions, including both top-down and bottom-up methodologies. More detailed information will be provided in D1.2 and D6.1.

Normative - Desired scenarios (Lead by WP3)
Desired scenarios will be developed by the CRe-AM co-innovation groups and or the individual stakeholders of these communities in a series of workshops and online consultations. These scenarios are taking a normative approach, in which we must imagine (invent) our future first before we attempted to make it a reality. From this point of the future, a backcasting approach is starting using methods such as technology foresight and technology forecasting in order to make sure that the desired scenarios are achieved.

Exploratory Contexts. Types of foreseen innovations. (Lead by WP3, WP4, and WP5 with support from WP2 and WP1)
Depending on the innovation types described in the desired scenarios, e.g. incremental, disruptive or systemic, we are using different approaches and methods in order to assess the related technology gaps. Each of these technology intelligences (including the market and economic intelligence related to adoption of these innovations) will inform the co-innovations groups (CRe-AM roadmapping communities) in the relevant parts of the roadmapping process in order to make sure that the desired futures are achieved under a number of plausible technical and business contexts.

Technology Forecasting: Incremental innovations (Lead by WP5)
In case of incremental innovations, we are using methods used in the first generation of roadmaps, such as technology forecasting. Related activities are:

Figure 18: Classification of methods according to roadmap type
- identifying critical requirements and “products” to be developed (already mentioned in the desired scenarios)
- identify major technology areas and technology drivers; identify technology alternatives and their possible evolution based on strong trends, historical data, hype curves and technology life cycles or S-Curves.

S-curves are growth curves widely used for Technology Forecasting. The growth curves have an “S-shaped” form similar to life cycle over a period of years. “An S-curve represents a technical performance as a function of time or research effort and its shape is influenced by market demand, scientific knowledge and level of investment or innovation” (Phaal et al., 2004). In the beginning of the S-curves, still at incremental growth stage, we expect to be able to make good predictions on the technology evolution. In the top of the S-Curves the picture is very different. Similar to life-cycle analysis, as technology matures further improvements are not possible. At this point, substitute or new emerging technologies are replacing the mature technologies. This is a turbulent time until a new dominant design emerges. (Unstable, volatile and disruptive) (Linstone, 2004). Since, by definition S-Curves of different technologies are not linked, technical discontinuity is a given (Phaal, 2004) and managing the transition to the new technologies is difficult depending on the nature of innovation (e.g. disruptive innovation, innovation on the interfaces of technologies, incremental innovation etc.).

Figure 19: Evolution of S-curves (current and emerging)

Technology Foresight. Disruptive innovations (Lead by WP4 with support from WP3 and WP5)

In case of disruptive innovations, we need to understand the possible innovation opportunities stemming from the emerging technologies and any threats or weaknesses that might influence the roadmaps and their adoption. What will be their potential for commercialization, in terms of desired applications, products or services, and which products, technologies, practices or even markets will be replacing? What will be the resistance from the current players in the market? What it means in terms of the adoption of the new technologies? The analysis of the S-curves in technology forecasting methods will also provide us with a first indication of when a new technology will be most likely to appear as a replacement of a mature one.
Also a comparison of traditional technologies against the S-curves of emerging technologies could be made in order to understand if there is a real superior performance of the emergent technology in comparison with the traditional technology that would motivate the decision makers (suppliers, producers) in the industry to invest in it and replace the previous one.

**Figure 20:** Traditional technologies S-curves, versus emergent technologies (adapted from source: Walsh 2004)

Furthermore, we will use foresight methods in order to identify and understand the uncertainties and changes in the CRe-AM socio technical landscapes (including their PESTLE drivers), in order to analyse drivers for change and their signals, competing technologies (including the possible integration of several technologies) and their disruptions (WP4). In case of innovations developed from the integration of several technologies, these technologies must be grouped and considered as one new technology to assess as well.

**Possible methods include:**
- **Desk-top review:** studies and roadmaps prepared for the 7 areas of creative industries.
- **Delphi studies** to identify potential weak signals, as well as emergent technologies, and new practices, etc.
- **Bibliometrics** in scientific journals and conference papers, in order to identify new areas of research, piloting projects, and researchers and institutions that lead these innovations.
- **Data mining (text-mining) and social networking analysis** in Blog and other web-sites in order to identify new topics of interest and signals of change.
- **Use S-Curves** to understand technology lifecycles and possible disruptions identify and categorize major technology pathways.
- **Context scenario planning** to describe the evolution in each domain area in Cre-AM and new practices, business models, etc.

Collaboration between, WP3, WP4, WP5 and coordination of their activities will be essential as well as supporting tools and observatory infrastructure from WP2.

**Technology assessment (lead by WP5 with support by WP4)**

Whether we have to deal with incremental, disruptive innovations, or systemic innovations a technology assessment in terms of technology readiness of the foreseen technologies to produce the innovation opportunities identified in the roadmap will be performed. This will contribute to the gap analysis and assessment between the current state of the art and the future state envisioned in the desired scenarios and the foreseen innovations in the initial roadmaps (WP5). Most common method for this are
surveys in form of interviews with experts in both technologies (ICT) and business. In case of systemic innovations, it is important to understand how the developed technology integrates in the bigger system and what disruptions it causes in the system value chain and its subsystems value-chains. For example, how the suppliers of the system are influenced by the innovation (backward integration), or the customers (forward integration), or makers of other elements and subsystems (lateral integration).

In addition, innovation today is more and more happening on the interfaces of more than one technology rather than as a result of the development of one single technology. Similarly to the S-Curves discussed above, Technology Readiness usually measures individual technologies and not systems. Therefore, the operationability and the adoption of the whole system in its transactional and operational environments must be assessed as well. (see also adoption and change management section below).

See below an example of a generic questionnaire used in the Nanotechnologies roadmaps (source: Tierry et al., 2012).

Stage 1:
Has the Technology solution feasibility to implement the new capability been supported by conceptual studies with a likely R&D pathway.
Yes___ No___

Stage 2:
Has an analytical study been performed that confirms the potential usefulness of the new solution?
Yes___ No___

Stage 3:
Is there a viable path forward that would lead the experiment and or analytical result forward to a future application that solution risk can be evaluated?
Yes___ No___

Stage 4:
Has the new solution been successfully modeled and tested and a viable path forward to experimentation or demonstration of the potential application identified.
Yes___ No___

Stage 5:
Has the new solutions laboratory demonstrations been successfully and consistently performed with key elements being tested individually and or in an integrated fashion.
Yes___ No___

Stage 6:
Has rigorous system-level demonstrations been performed successfully in a relevant environment with results consistent with the levels of performance, cost, etc that the new solution must posses for the intended application.
Yes___ No___

Stage 7:
Has verifiable system-level demonstration of the solution been performed successfully in a relevant environment with the results consistent with the levels of performance, costs, etc. that the new solution must posses for the intended application in the actual environment of use?
Yes___ No___

Stage 8:
Has a production solution been fully described and successful manufactured with no additional commercial barriers to overcome and all interactions between each technology understood and qualified to the satisfaction of one or more customers?
Yes___ No___

Stage 9:
Is the solution producible at the critical dimensions levels such as performance, cost, quality, reliability that were originally anticipated and all unforeseen barriers been removed with complete customer satisfaction?
Yes ___ No__
In case the responders were saying NO in a question to a stage, they were asked to stop and if possible to forecast what would be the period in years required for the technology to progress to this stage. Similar questionnaires have been used in TEL-Map project to assess the technology readiness using surveys and interviews with experts. We are proposing slightly modified stages for a similar survey process, adopted specifically for CRe-AM, in the following figure.

**Figure 21:** Technology readiness questionnaire 0
Adoption and change management (lead by WP5 with support from WP3)

In case of systemic innovations, where an innovation introduces changes to the whole eco-system and affects a wide range of players in it, we will use adoption and change management methods in order to facilitate adoption. As pioneered by IBM, (REF: Kenya Creative Industry Proposed Roadmap IBM CSC 2012.pdf), it is important to “identify and understand the New value networks based on combination of technologies, partnerships and business models...However, the supply of creative and digital content and services is dependent on a robust value chain that cuts across the Creative Industry”.

For this purpose, we will use the Ron Adner model of innovation blue-prints, published in his book, The Wide Lens (Adner, 2012), as it was adopted in TEL-Map. (See also in section 2.4, 3rd Generation of Roadmaps: (1990 – today).

TEL-Map had used a questionnaire similar to the one proposed in Adner’s book as presented below: (source, D2.6 TEL-Map, Kamtsiou et al., 2013b)

1. **Identify your end user/adopter**
   - Who is the final beneficiary of your value proposition?
   - Who has to adopt our innovation for us to call it a success?

2. **Identify your own project**
   - What do we need to deliver?

3. **Identify your suppliers**
   - What inputs will we need? Who from?

4. **Identify your intermediaries**
   - Who do we pass out innovation on to? and,
   - Who do they pass it on to on the way to the end user/adopter?

5. **Identify your complementors/co-innovators**
   - For each intermediary, ask: Does anything else need to happen before this intermediary can adopt the offer, add value and move it on?

6. **Identify the risks in the ecosystem.**
   For every element on the map, ask:
   a. What level of co-innovation risk does this element present?
      How able are they to undertake the required activity?
   b. What level of adoption risk does this element present?
      How willing are they to undertake this activity?

   (Assign a traffic light:
   For co-innovation risk
   - **Green** = they are ready and in place
   - **Yellow** = not in place yet, but have a plan, maybe late but should get there
   - **Red** = not in place and no plan to get there. They have blocks and are a block

   For adoption risk
   - **Green** = they eager to participate and clear benefits
   - **Yellow** = neutral but open to persuasion
   - **Red** = prefer the status quo and not participate – as it stands)

7. **Turn all the traffic lights green**
   With every partner that is not green:
8. **How do they relate? What are the co-innovation, value chain and decision making dependencies between them?**

3.6 Initial workshops: fast track roadmap based on communities visions, initial lists of innovations, & gaps

This first series of workshops in phase A of the roadmapping process will produce the initial fast-track roadmaps for each Creative Industry sector. These events are foreseen in the DoW as “International Cluster Consultation Workshops”. Below is a tentative plan for these International Consultation events:

These events will be linked to WP3 (task 3.2: Collective scenario development) and will be organized by BRUNEL with the support from task leader MENON, BCC, FLUX, HOPE, ULiv, IMA, ELIG. As described in Phase A above, these workshops will produce a first track roadmap for each sector, with emphasis on current practices, business and technology drivers, desired scenarios and perceived gaps. The output of the workshop will be captured as an internal report which will provide input for D3.1 and D4.1 as well as a starting point for WP5 (D5.1 Gap analysis report). Therefore, as this is considered an important milestone in our roadmapping process, it is important that all WP leaders are participating.

The draft template below shows the process, and main elements of the workshop outputs.

![Figure 22: Template for International Consultation Workshops](adopted by Phaal, 2004)
Once the individual subsector roadmaps are ready, we will consider the opportunity to provide a synthesising, Overall Roadmap, which will define: What are: The cross-links, if any, between the sector roadmaps? Combining tasks? Emerging meta-themes? The common gaps? and The further R&D needed?

Project Workshops/Events
The project will organise several workshops/events to engage stakeholders during the various phases of the project. These include local workshops, small scale international events in conjunction with related to creative industries, international cluster consultation workshops and one big conference and public seminar.

PLANNING OF EVENTS
The Art group will co-locate with the January 2014 FET-ART event in London. Other sector groups will invite participants from the Creative Industry Sectors, including Media (digital media, TV, Film, Music, 3D visualization), Design, publishing, gaming, architecture, music technology, and also practitioners from the ICT community. In order to save resources and involve a wide range of stakeholders, as well as a cross-sector engagement, we will organize these events by grouping the stakeholders according to the specific subsectors.

The distribution of the events is shown in Table 2 below:

<table>
<thead>
<tr>
<th>Description of events</th>
<th>Total Events</th>
<th>BRUN</th>
<th>MENO</th>
<th>BCC</th>
<th>NCSR</th>
<th>LMU</th>
<th>IMT</th>
<th>Flux</th>
<th>Sigma</th>
<th>Latanzio</th>
<th>HOPS</th>
<th>Uliv</th>
<th>IMA</th>
<th>ELIG</th>
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</thead>
<tbody>
<tr>
<td>Local workshops and Bilateral f2f meetings</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Reaching Out (dissemination) events</td>
<td>4</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small-scale international events</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Cluster consultation workshops</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Seminar</td>
<td>1</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The distribution of the events
The project partners are expecting to engage stakeholders from Art (incl. Crafts), Design and Fashion, Media including digital media (TV, Film, music, new media), Video Games including visual effects/new media, Publishing, Architecture and Music Technology.

The type of workshops, area/sector to be covered, location, date and expected participants is to be decided by the organising partners. Brunel as a coordinator will coordinate these events and the detail will be updated as part of dissemination plans and activities.

Once the individual subsector roadmaps are ready, we will consider the opportunity to provide a synthesising, Overall Roadmap, which will define: What are: The cross-links, if any, between the sector roadmaps? Combining tasks? Emerging meta-themes? The common gaps? and The further R&D needed?

The project is currently in the process of finalising the timeline & schedule of the stakeholders’ workshops and events. The first consultative roadmapping event in this regard will be in the UK, to be held on 19th January in London, aiming to conduct visioning and foresight for the Art sector, producing the first visions, scenarios, and future trends.

Stakeholders engagement plan phases and activities and target number of stakeholders:

As explained above in section 3.3 General roadmapping framework: main activities and outputs, we have identified 3 main phases in our roadmapping processes.

Phase A (M1-M6): Creation of initial fast-track roadmaps per sector and initial contexts per sector (cartography maps).
Phase B (M7-M18): Negotiation and continuous updating of initial roadmaps and cartography map
Phase C (M19-M24): Production of final roadmaps, stakeholders clusters, and plans for their adoption and dissemination to wide audience

We will engage number of stakeholders from various EU countries in all sectors/subsectors of creative industries. The initial target is at least 20 per month from those sectors/subsectors.

We will extend this first stakeholders groups categorisation, name, website, organization, email, role in the organization, region, sector type, core sector, description profile with additional one or two open questions:
Just for example:
  a) Your / your organisation’s TEC (Technology Enhanced Creativity) sector Future Focus & Vision; b) name some historical technical turning points in the sector that have affected your organization. This information will be shared with all stakeholders via the CRe-AM portal roadmapping community building platform. It will be the first space that will see when new members joining the groups.

We will identify success factors and revise methodological steps and stages that would lead to a framework for a successful roadmapping implementation. Moreover, the need and importance of developing a practical framework by identifying stakeholders requirements and studying existing tools (video tool, multimedia tool, simulation tools & visualisation tools, 3D virtual environment, interactive tools, film and TV production tools, Facebook, twitter etc.), digital cameras, software applications, state-of-the-art processes, innovative practices, analysing and evaluating them and carrying out assessment in order to make positive impact on project outcome. Our implementation process include how we will collect and visualise answers from the stakeholders and which tools and processes will be used for engagement, benchmarking, measuring, analysing and impact.

Further, CRe-AM will map the creativity-enhancing technologies and other creativity-enhancing usage platforms, social software, collaborative tools, methods & applications, tablets & pads, PCs, notebooks, smartphones, handheld devices, interactive
whiteboards, multi-touch devices, and games-based creative activities. This will offer an online roadmapping service/capability for the creative industries and match making capability to stakeholders.

Finally we will develop dynamic roadmaps that will serve as process models, based on state-of-the-art creative tools, technologies, applications and methods.
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