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COnCEPT

Collaborative CrEative design PlaTform

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1 INTRODUCTION

The main scope of this deliverable regards the review of existing technologies and tools used by professionals at the main areas of interest of the COnCEPT project and the selection of the main features that have to be supported in the COnCEPT collaborative toolset, taking into account the requirements imposed by the definition of the COnCEPT design process. Focus is given on the areas of creativity/innovation in design, collaborative design platforms, creative brainstorming and innovative problem solving. Methods regarding how these technologies in their current disconnected form assist the professional designer during the creative stages of the design process are detailed, while techniques for taking advantage of the interconnection of the diverse collaborative tools in the different stages of the design process are also presented.

The following process is followed towards the selection of the most suitable technologies and the definition of the COnCEPT collaborative toolset. Initially, as presented in section two, the main stakeholders that interact with the COnCEPT platform are identified and presented based on their role and characteristics, accompanied with the COnCEPT design process as it is identified based on the needs of the associated end users/stakeholders. Four stages are defined, namely the Discovery phase where the problem space is explored and questioned in full, the Definition phase where a clear problem space is defined to be addressed, the Development phase where possible solution scenarios are investigated in further detail, evaluation of concepts is realised and the design of the final version of the product is provided and the Delivery phase where the winning concept is launched and implemented according to the specifications documented in the previous phases.

Following, in section three, existing collaborative technologies, tools and platforms are classified and shortly evaluated based on the end-user requirements analysis in D1.3 [2]. Part of these tools is envisaged to be integrated in the overall COnCEPT platform, as it will be defined and implemented in WP4. These tools regard social media tools, mind mapping and brainstorming tools, moodboard and storyboard tools, sketching tools, annotation tools, modeling tools and tools for dissemination/sharing of content through social media. The evaluation is taking into account the support of the envisaged functionality within each component, the existence of configurable and extensible modules that the tools can be based on, the compatibility with existing widely-adopted open-source Content Management Systems (CMS), the licencing type (e.g. open-source licence, commercial project) and the existence of active support community. Based on the short evaluation results, indicators are provided regarding the most prominent tools to be used in COnCEPT. However, it should be noted that the final selection of the individual components that will consist the COnCEPT architecture will be realised within the framework of WP4.

Regarding the envisaged functionalities per tool, the following categories are identified:

- Project Management tools supporting the overall management of the creating projects taking into account the need for team creation and management, tasks assignments and progress overview, collaboration among the team members and support of reporting functionalities.
- Social Media tools for content sharing among the team members, external collaborators as well as the clients of the under design product, collection of comments and feedback from various stakeholders and evaluation of the popularity of the proposed solutions.
- Collaborative editing tools for collaborative preparation of the project description documents, addition of ideas and concepts from multiple parties, advanced text processing and interconnection with the Linked Data world.
- Mind Mapping and Brainstorming tools for assisting the ideas collection and interlinking, the collaboration among designers in terms of ideas sharing, leading to advanced creation of mind mapping and brainstorming graphs.

- Moodboard Tools for collection of images, text, illustrations, screenshots and samples of object to be used during the design of the product as well as visually illustrating different version of the identified concepts and ideas.
- Storyboard Tools for creating narrative sequences of the under design product based on the material available in the MindMapping/Brainstorming and Moodboard Tools enriched with visual representations per stage of the design process and annotated context where necessary.
- Sketching Tools for designing in a collaborative manner the specified product along with proper logging/tracking of the actions of each team member and the support of export functionalities in various formats.
- Annotation Tools for the support of knowledge annotation functions in text and media files and the provision of proper interfaces to end users for addition of annotations.
- Modeling Tools for conceptually modeling specific design areas and interconnection of identified concepts with relevant concepts in existing models (by exploiting also techniques for proper interlining of data).

Upon having defined the COnCEPT design process as well as reviewed the existing technologies and tools in the COnCEPT's areas of interest, in section four, the concept collaborative toolset is detailed. The workflows followed for the realization of the envisaged functionalities based on the provided design process and the use of the COnCEPT tools per stage are defined and described. The toolset aims to provide a holistic description of the technologies and software modules to be adopted within COnCEPT and supported by the COnCEPT architecture.

Following, in section five, description is provided regarding the definition of a communication strategy and a process for monitoring and liaising to related research activities inside and outside of the EU, in order to ensure synergy and avoid duplication of effort. Main research collaborations are identified along with the opportunities for establishment of collaboration in various domains based on each project objectives. Finally a set of conclusions as well as the use of the available material in other Tasks and WPs are described in section six of the deliverable.

2 CONCEPT DESIGN PROCESS

2.1 END USERS/STAKEHOLDERS

This section presents an inventory of end users and stakeholders for the COnCEPT platform. This does not aim to be an exhaustive list, but a compilation of the end users and stakeholders identified throughout the use cases for the COnCEPT platform described in D1.6 [3].

The inventory is sorted in two main categories. First, the **professional setting** includes designers, project managers, clients, and stakeholders which use the platform for business activities. Second, the **academic setting** includes professors, students, and stakeholders which use the platform for educational purposes.

Table 1 and Table 2 elaborate on details of the end users and stakeholders for each of these two categories (professional and academic setting respectively), describing users in five different aspects:

1. **Occupation:**

Specifying different design types, disciplines and roles in organization.

2. **Level of usage:**

Detail how often a user logs in to the COnCEPT platform.

- *Casual users*: include infrequent users (e.g., client who logs on when an update has been shared) or temporal users (e.g., students who log on for a short project).
- *Frequent users*: log on to the platform on a daily or nearly daily basis, since the platform is closely related to their design and/or professional activities (e.g., Professor who logs on to control and evaluate student's project; Product designer who logs on every day for design activities).

3. **Level of expertise**

Deals with the skills in the design process and tools of users. To categorize the level of expertise, we use the "five stage model for skill acquisition" proposed by Dreyfus and Dreyfus in [1], which characterizes how practitioners acquire skills over the years of experience.

- *Novice*: little to no experience in the skill area.
- *Advanced beginner*: have solved some real problems, which make them able to recognize and deal with similar situations.
- *Competent*: perceive long-term goals on different situations, planning consciously their activities.
- *Proficient*: reflect holistically on situations, breaking free from rules, and troubleshooting problems on their own.
- *Expert*: make decisions based on intuition, which is grounded on a deep tacit understanding of a variety of situations.

4. **Characteristics**

List the characteristics for each group of end users that may be relevant to understand their needs while using the COnCEPT platform.

5. Reference in Use cases

For further cross-reference and clarification, the inventory indicates the reference of each end user and stakeholder in COnCEPT's use cases (D1.6) [3].

2.1.1 USERS AND STAKEHOLDERS FOR PROFESSIONAL SETTINGS

TABLE 1. USERS AND STAKEHOLDERS FOR PROFESSIONAL SETTINGS.

1. Occupation	2.Level of usage	3.Level of expertise	4.Characteristics	5.Reference in Use cases*
Professionals of design & engineering disciplines				
Industrial Design Product Design Visual Communication Design Usability/UI Design UX Design Graphical Design Design Engineer Software Engineer Industrial Engineer	Casual to Frequent	Proficient & Expert	• Different backgrounds and specializations. • Intensive users with strong needs for specialization and personalization.	UH.1, VW.1, DL.1, DL.2
Project management				
Project Manager	Casual to Frequent	Proficient & Expert	• Different backgrounds and specializations. • Deal on projects of different nature.	UH.1, VW.1
Stakeholders				
Clients (internal & external) Suppliers (external)	Casual	Novice, Advanced-Beginner & Competent	• Different backgrounds and specialization. • May access COnCEPT to send and/or receive input about design. • May have restricted access to the platform.	UH.1, VW.1, DL.1, DL.2
End-users	No access to COnCEPT	No access to COnCEPT	• End-user of the designed product.	UH.1

2.1.2 USERS AND STAKEHOLDERS FOR ACADEMIC SETTINGS

TABLE 2. USERS AND STAKEHOLDERS FOR ACADEMIC SETTINGS.

1.Occupation	2.Level of usage	3.Level of expertise	4.Characteristics	5.Reference in Use cases*
Students				
Industrial Design Architecture Architectural Technology & Surveying	Casual to Frequent	Novice & Advanced-Beginner	• Different backgrounds and levels of education (from Bachelor onwards). • Intensive usage of platform for projects that may vary in length (from couple of hours to several months). • Strong need of tutorials and manuals.	RGU.1, RGU/TUE.1
Supervisor of projects				
Professor Course leader	Frequent	Proficient & Expert	• Different backgrounds. • Use platform to assess and manage several student projects and workshops.	RGU.1, RGU/TUE.1
Stakeholders				
End-users	No direct access to COnCEPT	No direct access to COnCEPT	• End-user of product created by students. • Exchange/sharing of material produced in the COnCEPT platform	RGU/TUE.1
Workshop technicians	No direct access to COnCEPT	No direct access to COnCEPT	• University's workshop support staff for specialized software for design (e.g., 3D printer, laser cutter…). • Exchange/sharing of material produced in the COnCEPT platform	RGU/TUE.1

*** Code of use cases:**

UH.1 – Touch Screen Application for a Bistro
VW.1 – Innoview Augmented Reality Viewer (AR Viewer)
DL.1 – Self Quantifying Device (Breathing Trainer)
DL.2 – Family of Storage Solutions (Ironing Storage System)
RGU/TUE.1 – Student Project on Industrial Design
RGU.1 – Multidisciplinary Student Project on Architectural Design

2.2 DESIGN PROCESS MODELLING

The creative process has been defined and described in many different ways throughout the history of design. Young describes it as an "operative technique" that can be learned and controlled and that it's effective use is just as much a matter of practice in the technique [11]. As Young puts it, the most valuable assets when producing ideas is training the mind in the method by which all ideas are produced and gathering as much raw material as possible to input to the

method. Currently there is a lack of computer based tools to support these phases, which makes it particularly challenging for designers in small and medium enterprises to stay competitive.

2.2.1 DESIGN PROCESS: OUTLINE OF PHASES

The design process is inherently different depending on a number of factors such as design discipline, specific project, and the design team's working approach. However, the Design Council's Double Diamond diagram outlines four broad areas which are generally considered to be followed in most types of design practice (Figure 1). The stages outlined by the Design Council are: 1) discover, 2) define, 3) develop and 4) deliver.

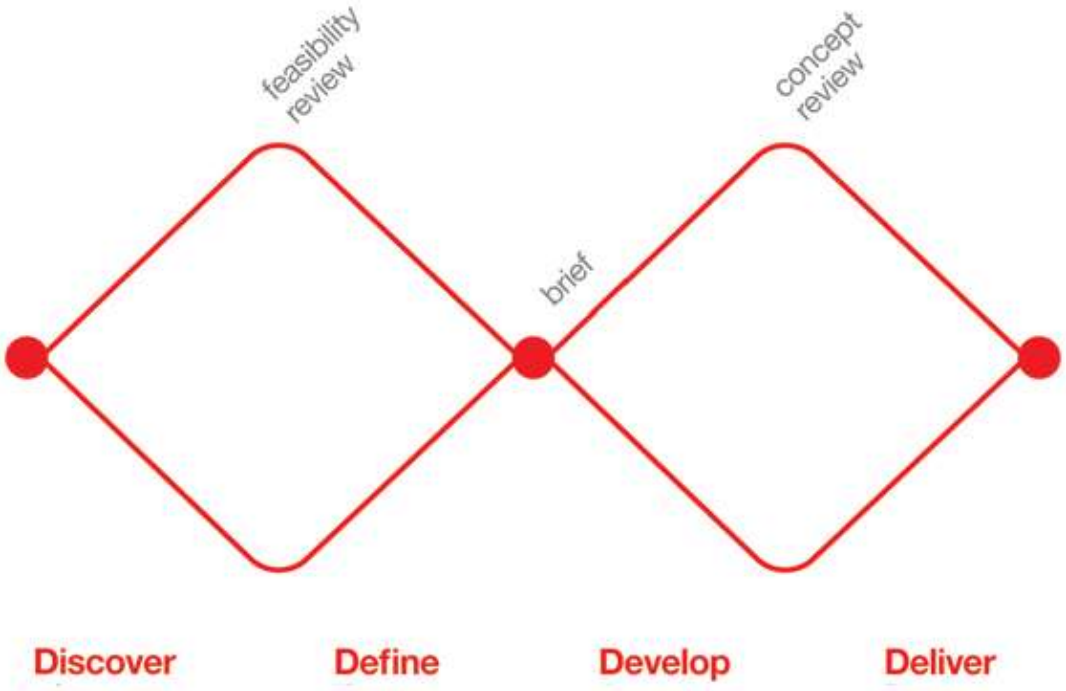

FIGURE 1. DESIGN COUNCIL'S 'DOUBLE DIAMOND' MODEL OF THE DESIGN PROCESS. (SOURCE: THE DESIGN COUNCIL[1])

The double diamond model is useful to the development of the COnCEPT tool since it acknowledges the different modes of thinking that designers engage in throughout the process. Hence, the tools included in the COnCEPT platform can be designed to meet the needs of participants across the process. The phases of the design process are marked by a sequence of convergent (broad and externally focused) and divergent (narrow and internally focused) thought processes. The overarching aims of each of these stages are summarised as follows:

- The 'discovery' phase is where the problem space is explored and questioned in full.
- The 'definition' phase is where a clear problem space is defined to be addressed.
- During the 'development' phase, the possible solution scenarios are investigated in further detail.
- The winning concept is then launched at the 'delivery' phase.

It is important to take into consideration that new information enters the equation at different points in the process, forcing continual iteration. The characteristics, tasks, and tools required during the design process vary depending on the type of project. These are described in Table 3.

[1] http://www.designcouncil.org.uk/news-opinion/introducing-design-methods

TABLE 3. SEQUENCE OF ACTIVITIES, METHODS AND COLLABORATION IN THE DESIGN PROCESS.

STAGE	ACTIVITIES / TASKS	TOOLS / METHODS / APPROACHES
Discover ***Period of divergence***	***Kick-off*** ***Contract drafted and signed*** Formation of the design ***team-assigning roles*** ***Brainstorming*** around the design problem ***Research*** (primary and secondary): e.g. meeting users, developing empathy with users, observation and ethnography (digital, field, enactments, personas), participatory methods, interviews, filming, collecting user diaries, focus groups, surveys and questionnaires, market research… ***Managing information***	· Creating the project 'zone' – a space to meet and collect work and materials · Creating the work-in-progress story of the project – organizing the materials, presenting it visually: e.g. mind mapping, story boarding, post-it charts, walls of evidence, images and tables, mood boards · Sifting and sorting of information · Visualization of initial ideas through sketches
Define ***Period of convergence***	***Defining*** the precise nature of the problem ***Project development***: define the parameters of the design problem Converge to clearly set the brief and define the area of investigation Project management	· Assessment criteria – refine a list of characteristics of the project outcome, based on the priorities of each of the stakeholders - e.g. technical, cost; feasibility factors. · Customer mapping journeys
Develop ***Period of divergence***	***Brainstorming*** ideas where the technology could assist that problem ***Selection*** of one solution to develop ***Further investigation*** and prototyping of this idea ***Testing*** of this idea ***Sign off*** for production and manufacture	· Describe and define personae of typical users from target user groups · Use case scenarios and role play to understand users' interactions with product · Prototyping and physically building the product · Multiple testing of the prototype either alone, in group or outside of project team · Iterating the idea, providing fine details

Deliver ***Period of convergence***	Client ***presentation***, including the rationale and story behind the framing of the problem ***Presentation*** of the prototype ***Approval*** ***Launch*** ***Evaluation*** ***Feedback*** loops and iteration	· Building CAD/CAM file showing the product in 3D · Product manufacture · Synthesizing the 'story' (rationale) of the winning concept · Visualizing the story, presenting client with a storyboard · Ideas for marketing the product using the story · Researching product's performance on the market, and iterate (if rehired)

COnCEPT is focused on the phases of discovery, definition and development, which can be summarised as follows:

Phase.1 – Discovery phase consisting of the following stages: • Initial brief • Research • Inspiration • Formulating the design problem	**Phase.2** – Definition phase • Arriving at the design brief • Review research material • Assessment criteria	**Phase.3 –** Development phase • Idea and concept generation • Evaluation of concepts and ideas • Presentation of initial concepts • Further investigation of concepts • Concept freeze & review

2.2.2 CREATIVE PROCESS: DISCOVERY PHASE

The goal of the discovery phase is to develop knowledge that will act as a springboard when forming the design guidelines and addressing design challenges. This is part of the analysis of the initial brief, but depending on the type of relationship the designer has with the client, it may involve the definition of the original brief through a process of dialogue and exchange of ideas.

Initial Design Brief - In the design industry, the client usually comes to the designer with an idea regarding a new or a better product that they wish to see developed. The extent to which this idea for the new product has been evolved varies. There are cases where the client has done extensive market research beforehand and comes with a very detailed proposal, measurable research results and specific guidelines. In other cases the client might only roughly know the kind of product he wants to design. It is part of the designer's responsibilities to discover the clients' intentions during the exploration phase and guide them to forming an appropriate design brief.

Design Research - The exploration phase begins the moment the client approaches the designers. During this phase, the designers immerse themselves in acquiring and analysing as much information as possible regarding the issue in order to define the final design brief and set the design guidelines based on the requirements of the anticipated end users. Design research is the primary activity, and it is a process with a vast diversity of inputs and outputs to contemporary design practice. Within the design cluster, one can encounter research methodologies drawn from many disparate scientific fields, ranging from social sciences and the humanities to market analysis, involving both qualitative and quantitative research methods. Some of the most common methods are focus groups, interviews, questionnaires, ethnography (digital ethnography, field ethnography, enactments, personas etc.), participatory methods and market research. It is also a very common practice amongst designers to research the competition in order to ensure that what they will be designing doesn't already exist, as well as to identify trends among the competitive products that would later on help them identify the innovative aspects of their own product. Better identification of the opportunities of design innovation is essential in

order to create a product that can stand out of the competition. Design research is a rational practice, but differentiates itself from other applied research disciplines because it involves intuition and emotion; two important factors enabling designers to understand the existing and possible future needs of users. The goal of the exploration phase is to develop enough knowledge that will act as a springboard when forming the design guidelines and addressing design challenges.

Inspiration – Designers get inspiration from practically everything around them. They are curious and observant by nature and are constantly seeking new starting points that can trigger their imagination. From research in disciplines as distant as neuroscience to simply going through other creative work, all can fuel design inspiration and help generate new ideas. The resources for this process vary from books, scientific journals, papers, magazines, websites, exhibitions, material libraries, nature (biomimicry) and are usually project specific depending on the designer's current work. Finding inspiration is associated with design research. However, design research tries to address specific research questions by adopting recognized methods aiming to produce measurable results. Collecting raw material that can inspire and inform a designer's creative practice is an on-going operation happening in the background, sometimes even involuntarily. This information might remain "idle" for a long time, but ultimately connecting the dots between these disparate bits of knowledge is key to producing innovation.

2.2.3 CREATIVE PROCESS: DEFINITION PHASE

Arriving at the design brief - The research outcomes set the design guidelines and help to pinpoint some preliminary opportunity areas for innovation. By the end of the exploration phase, the designer has identified the needs of the anticipated end user and is able to set clear project objectives. The initial brief gets redefined and phrased in a way that is specific enough to help the designer focus and address the user's needs, without predetermining the final deliverable.

Review research material – The research outcomes are also filtered in order to collect the material that may be used towards the concept elaboration. This material may be proven extremely useful in the first stages of the development phase, since it may be re-used or appropriately extended in order to consist part of the overall concept development.

2.2.4 CREATIVE PROCESS: DEVELOPMENT PHASE

Concept Generation

- **Brainstorming** – Designers currently use a wide variety of brainstorming methods and tools to facilitate idea generation, since it is a "relaxed" approach to problem solving, inducing lateral thinking. It is a process that can happen individually or collaboratively. The majority of brainstorming methods are usually built around the process of generating ideas regarding a topic, writing or sketching them and then sharing them with the rest of the session participants (if it is a collaborative brainstorming session). It encourages people to come up with unconventional or unanticipated thoughts and ideas that might later be crafted into original, creative solutions to a problem. Usually brainstorming sessions follow the basic principle of "reserving judgement" of ideas; ideas are evaluated later on in the process. This increases the potential for innovation, since it is an open environment encouraging all participants to contribute and share their thoughts. There are plenty of brainstorming techniques one can adopt [15]; for example brain-wiring, reverse brainstorming, 3-6-5, roleplaying, random input, Why? Who? How?. The most common tools used during idea generation sessions are paper, pen & pencils, craft materials (i.e. glue, markers, tape, coloured paper) and Post-It notes.

- **Mind mapping –** Mind mapping tools are used to create diagrams of relationships between concepts, ideas or other pieces of information. Its popular uses include project planning, collecting and organising thoughts, brainstorming —

all in order to help creatively solve problems and uncover new ideas. Some of the properties of mind-mapping that make it an effective technique for developing new concepts include:[2]

- Keyword orientation: the structural elements of mind maps are not sentences but keywords.
- Loose syntax and semantics: association is the only relationship between linked keywords.
- Fast and easy-to-use: use mind maps as real-time shorthand minutes for meetings, interviews, and other conversational sessions.
- High-level view: overview of a whole mind map in a glance.
- Evocative: a mind map evokes the context of the scene in which it was created.
- Semi-structured: a mind map can have a template structure but it can grow branches on demand to capture real-time verbal communication in semi-structured interviews
- Non-hierarchical: concepts are given a hierarchy after generation.

Mind mapping can be used together with brainstorming techniques supporting the identification of opportunities for innovation. By mapping out the ideas generated during a brainstorming session and feeding in parameters from other contexts, it is possible to cluster similar ideas, or ideas addressing the same aspect of an issue. This facilitates the categorisation and the creation of a hierarchy of complex ideas and systems, as well as enabling an individual to have a more comprehensive overview of a situation and to discover hidden potentials among the ideas.

- **Evaluation of initial concepts** – As previously mentioned, judging ideas during brainstorming is considered a potential inhibitor to innovation. All the ideas that are generated in the ideation session are considered valid until the evaluation stage. This can happen in simple ways of voting for the most popular ideas or through more elaborate idea evaluation methods such as six thinking hats [12] decision matrix analysis (e.g. [13]) and paired comparison analysis.(e.g. [14]).

Sharing, communicating, presenting – Sharing information and communicating during the creative process is essential for achieving a meaningful and well-informed solution. Particularly during the Ideation Phase, designers regularly find themselves exchanging ideas and reflections in form of emails, sketches, and images with a group of experts from different backgrounds, working together through the creation of a series of concepts and their development. Traditional ways of collaborating include practices like face-to-face meetings and conversations. However, the technology currently available has made it possible to share information with other people in real time via online services regardless of location. Collaborators during this phase primarily need to communicate and exchange files between the group, whereas at the culmination of the ideation phase there may be a presentation delivered to the client to explain the generated concepts.

2.2.5 POTENTIAL APPLICATION OF CONCEPT BY DESIGN PROCESS PHASE

It is clear from Table 3 that there is a broad spectrum of activities occurring during the design process. Having analysed this data, we can conclude that many of these activities have their focus in three key areas: 1) creative research, 2) administrative and managerial, and 3) collaborative and sharing. There is considerable overlap between these areas, and as such, it is expected that the COnCEPT platform will assist designers throughout the design process.

However, some of the tools will be used more frequently at different stages of the design process:

1. Research tools in COnCEPT are focused at the early stages of the process, chiefly in the discovery and definition phases.

[2] http://www.change-vision.com/en/ExploringUserRequirementsThroughMindMapping_Letter.pdf

2. Project management and administrative tools are important throughout the process, as designers seek to organise their data, and share their work with the wider project team.
3. Collaboration is an important dimension of the design process. If we consider design as a complex business transaction, it follows that the collaborative interfaces (with clients, manufacturers, users are crucial throughout the process. Collaboration is an important dimension of the COnCEPT platform. We therefore look at the nature of collaboration, and the potentially useful tools to solve the challenge of communicating during the creative process, detailed in Figure 2.

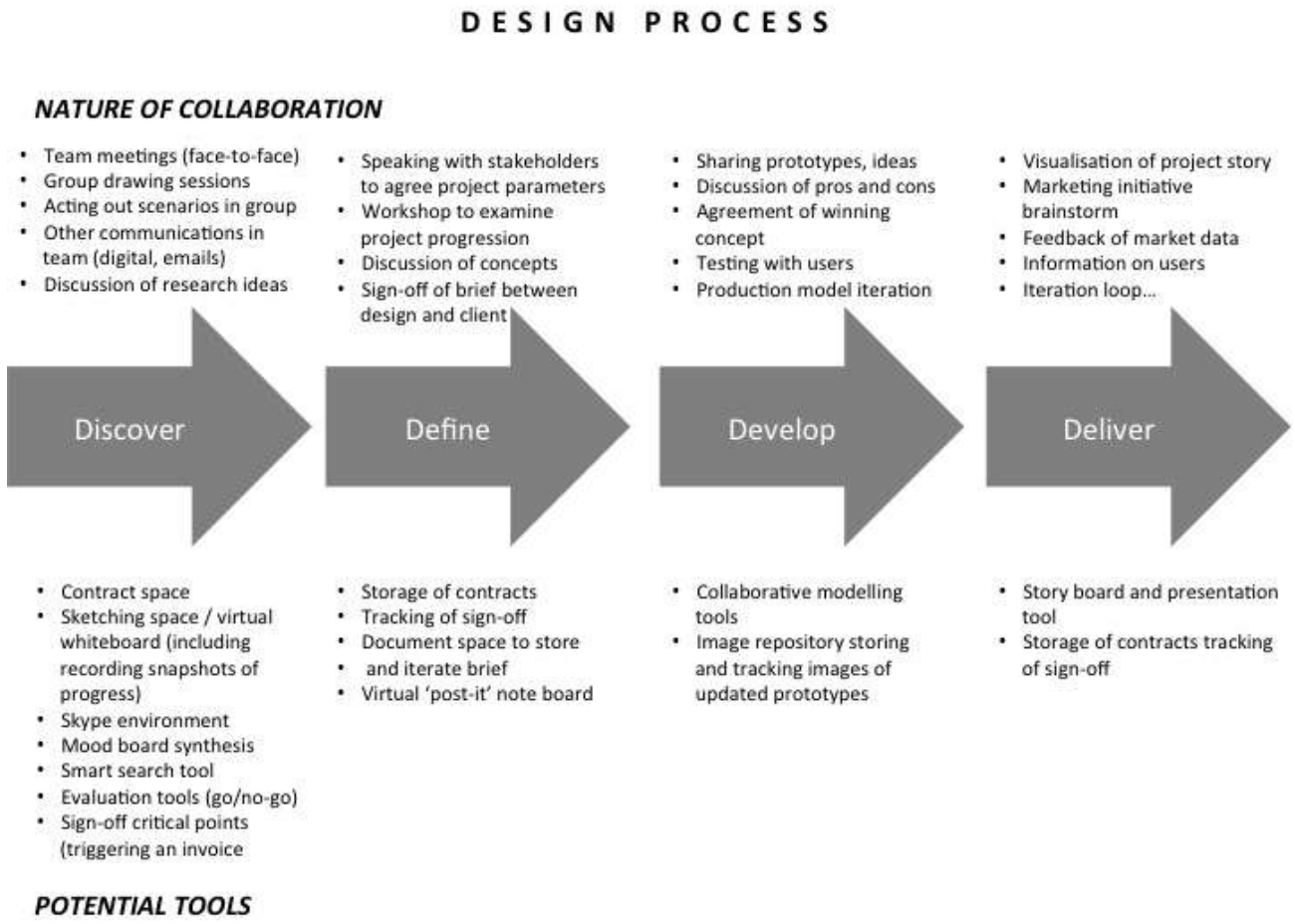

FIGURE 2. POTENTIAL COLLABORATIVE APPLICATION OF COnCEPT

Opportunities for COnCEPT

From the above analysis, we can conclude that there is scope for the COnCEPT platform to be used across the entirety of the design process. There are three particularly useful application areas for COnCEPT:

First, research and the organisation of information, undertaking research, as well as sorting and organising the data accrued during the discovery and definition phases is a substantial task. This is especially pertinent for a creative-minded professional, since according to studies on the creative process, it can be learned and controlled [11]. Hence, learning to produce ideas and gather copious volumes of material is crucial for designers, and it is suggested that this can be aided by computer-assisted means. COnCEPT therefore has a clear application in undertaking the tasks of collection and organisation of project material. In addition, COnCEPT's ability to retrieve visual information as well as text-based information is a key feature and is of particular importance in the ideation phase of the design process.

Second, administrative and project management activities are a growing concern, especially in today's context where there is an added imperative for firms to respond quickly to changing markets, and hence for designers to engage in speedier design processes.
Third, collaboration is a key focus of COnCEPT. There must be cooperation, and sharing between members of the project team throughout the project. This is particularly important since design is becoming an increasingly interdisciplinary process. It is crucial that input is derived from a multitude of sources at the earliest possible stage, to arrive at the best possible solution that will be successful in the market.
It could be argued that COnCEPT has the potential to fill a gap in the market for creative professionals since few other computer-based tools exist which offer support during the design process. For designers in small- and medium-sized enterprises, small design consultancies which represent the majority of business in this sector (as illustrated in the data described in Deliverable D1.3 [2]) and independent designers, such tools may assist businesses to remain commercially viable, especially in times of increased commercial pressures, reducing time to market.

3 CLASSIFICATION AND EVALUATION OF COLLABORATIVE TECHNOLOGIES, TOOLS AND PLATFORMS

3.1 PROJECT MANAGEMENT TOOLS

Effective project management is considered crucial towards the facilitation of the collaboration among team members since it can provide them the necessary tools and workflows for supporting their interaction and the resolution of possible conflicts. Project management techniques can be used to plan, coordinate, control, and monitor distributed and complex projects. The clear definition of roles and assignment of tasks within the project team, the accurate definition of inputs and outputs per task as well as the dependencies with other tasks, the description of the material that has to be exchanged among the team members and the design of tasks that support the interaction among them consist important characteristics that via proper project management contribute to fruitful collaboration and exchange of ideas and knowledge.

In COnCEPT, project management functionalities are going to be supported in various phases of the design process. The project manager will be responsible to define the project management team and assign roles to each member. Then, assignments for the various phases of the design process may be realized along with the definition of the feedback that has to be provided between tasks as well as the objectives and the corresponding milestones. The use of advanced communication and voting tools are also considered important for dissemination of information among the team members, proper interaction when necessary via synchronous/asynchronous messaging and conferencing (video and audio) functionalities and collaborative decision making/commenting/evaluation where required. The most promising candidate tools for project management along with their assessment to fulfil the COnCEPT requirements are listed in Table 4.

TABLE 4. PROJECT MANAGEMENT TOOLS.

Tool, description, functions	**Assessment, impression**
Orbis - Core Features: Manage projects, add projects and connect them to companies, manage persons, add persons and connect them to companies, manage companies, add companies, use the standard WordPress functionality to add pages, use posts for intranet, support comment on pages, projects, persons and companies.	- Free and commercial versions - Extensible - Plugins for timesheets, connection of tasks to projects - User friendly and easily integratable in Wordpress. - Nice graphical interfaces
TaskFreak – Core Fearures: create public and private projects, add attachments and comment your tasks, mobile devices friendly (smartphones, tablets), integrates seamlessly with your WP theme, users are associated to projects by WP roles.	- Open-source - Easy to install, - Full integration with WordPress users and roles - Interfaces for mobile devices - Support community
TASK ROCKET – Core Features: front-end project & task management theme built for Wordpress. Add/edit/delete projects, advanced UI and UX, support both desktop and mobile devices.	- Commercial - Easy to install, User friendly - Device agnostic - Responsive design features
WP Project Manager Pro – Core features: Projects (Create a new project, Set title and details of that project, Assign users for that	- Commercial - Wordpress plugin

project), Messages (Messages are used for discussing about the project with co-workers of that project, You can add attachments on messages, Comments can be made for discussion), To-do List (Add as many to-do list as you want with title and description, Add tasks, assign users, assign due date, See progress bar on the list, Add comments on individual to-do lists and to-do's, Mark to-do as complete/incomplete), Milestone (Create milestone, Assign messages and to-do list on milestone, 3 types of milestones are there, a) upcoming, b) completed and c) late milestone), Files (See all the uploaded files on messages and comments in one place and navigate to individual attached threads).	- Various PM functionalities - Easy integration - Advanced GUI - Multilingual support
Freelancer – Core Features: Project Dashboard, Task Management, File Management, Project Calendar, Task Timer, Activity Stream, Global Search	- Open-source - simple, elegant, and intuitive interface - responsive design
Collabpress – Core Features: adds project and task management functionality to WordPress. Easily create projects and assign tasks to users, Unlimited projects, task lists, tasks, and comments, Easily edit/delete projects, task lists, tasks, and comments, Front-end shortcode support, BuddyPress group integration, File upload on projects, task lists, task, and comments, Email notifications for new tasks and comments, Task due dates with a calendar view, Uses built-in WordPress user accounts, Activity log tracking all activity	- Open-source - Wordpress module - User friendly - Easy integration - Support Community

Taking into account the selection of open-source tools to be used for integration and extension in the COnCEPT platform, Taskfreak, Freelancer and Collabpress seem to be the most prominent tools to be used within COnCEPT. All of them support a wide set of project management functionalities and can be easily deployable and customized within Wordpress.

3.2 SOCIAL MEDIA TOOLS

A collaboration platform is a category of business software that adds broad social networking capabilities to work processes. Recent years has been characterized by new class of IT-enabled collaborative tools, commonly referred to as social media and typified by tools such as Facebook, Twitter, and Linked In. Social media interaction is required in the various phases of the design process for sharing and providing comments and reviews on created or uploaded content from the various stakeholders of the COnCEPT platform and especially designers and clients. In the discovery phase, proposed ideas or identified material may be shared among end users and communicated to various audiences while existing material on the web may be also collected and shared among the project participants. In the definition phase, available or interlinked material may be used for inspiration purposes and extension of existing ideas and concepts based on social media interaction functionalities within the deployed tools (e.g. mindmapping/brainstorming tools). In the development phase, different versions or prototypes of the under development product may be communicated among the team members and the clients for the collection of comments and the validation of the support of the identified requirements. Finally, in the delivery phase comments on the final product may be collected along with feedback from polls.

In CoNCEPT, the integration of the social medial tools is envisaged to be realised within the deployed Content Management System in order to provide a set of functionalities along the various tools that are going to be deployed. Such functionalities include the addition of social media buttons to sidebars or the footer, the capacity for sharing content and addition of comments in Facebook, Google+, or Twitter, the interconnection with Pinterest, the support of follow and like buttons as well as the support of rating functionalities. There are a variety of tools available to facilitate the designer work. Some most promising candidates along with their assessment to fulfil the COnCEPT requirements are listed in Table 5.

TABLE 5. SOCIAL MEDIA TOOLS.

Tool, description, functions	**Assessment, impression**
WordPress Social Media Feather is a super lightweight free social media WordPress plugin that allows you to quickly and painlessly add social sharing and following features to all your posts, pages and custom post types. The WordPress social media following offered by the plugin includes all major social network providers and tools like Facebook, Twitter, Google+, Pinterest, Linkedin, YouTube, tumblr, instagram, flickr, foursquare, vimeo or RSS.	- Wordpress module - Easy to install and configure - Lightweight social sharing and following - Sharing and follow-us functionalities - Can be integrated in all Wordpress pages - Active support community - Open-source
Digg Digg: This versatile plugin by Buffer comes with plenty of customization options and integrates with virtually any social media platform. With Digg Digg, you can create either a floating social media bar with left or right scrolling options, or sharing buttons that automatically populate at the top or bottom of each of your blog posts. Digg Digg can be used with Twitter, Facebook, Buffer, Google+, LinkedIn, Pinterest, Reddit, Tumblr – just about any social channels you might use. Facebook options include both Like and Share, and "lazy loading" helps you cut down on load times for your website.	- Wordpress module - Easy to install and configure - Capacity for lot of customizations - Integrated floating bar feature - Last updated: July 2013 - Open-source
BuddyPress: lets users sign-up and start creating profiles, posting messages, making connections, creating and interacting in groups, and much more.	- Wordpress module - Easy to install and configure - Lots of functionalities based for sharing/access to social media based on a series of plugins - Creation of ad-hoc social networks (e.g. per project or per topic) - Active support community - Open-source
ShareThis: With great customization, tons of features, and more than 120 supported social media platforms, ShareThis is one of the popular social media plugins for WordPress that's been downloaded more than 1.5 million times. This plugin tool offers more than social buttons, which come in the form of a Hovering Bar that can be displayed on the right or left side of your pages, with counters and your choice of small or large buttons. In addition, ShareThis	- Available for various CMS - Easy to install and configure - Seems to affect the overall load time (increased load time) - Active support community - Open-source

has built-in social analytics, a CopyNShare widget that helps you track shares when your content is copied and pasted, and more.	

To sum-up, as can be seen from the table, several open source software social media tools exist and are actively maintained today. These tools regard the most well-known CMS, including Wordpress that regards the most prominent solution to be used as the basis for the development of the CoNCEPT platform. Given that focus is given on the deployment of solutions that can be easily integrated, customizable, user-friendly and with active support from a wide community, it can be argued that Social Media Feather and BuddyPress consist the tools that fit better the overall CoNCEPT toolset.

3.3 COLLABORATIVE EDITING TOOLS

Collaborative editing is considered as a very useful functionality for the specification and update of the project's and design's description at the initial phases of initiating a new project. Collaborative editing among the involved stakeholders during the various phases of the design process may be also proven valuable for right dissemination of the available information as well as source of inspiration for the involved designers.

Within COnCEPT collaborative editing functionalities will be mostly used in the first phases of the design process and namely the discovery and definition phase. Detailed description of each project will be provided and accompanied with text and metadata analysis, further addition of metadata as well as suggestions to end users. Text analysis is envisaged to be realized based on Named-Entity Recognition (NER) techniques while the text may be in word, pdf or plain text format. Suggestions based on the interconnection with existing free web dictionaries as well as the association of recognized entities with relevant entities in the Linked Open Data (LoD) Cloud will be supported. The most promising candidates along with their assessment to fulfil the COnCEPT requirements are listed in Table 6.

TABLE 6. COLLABORATIVE EDITING TOOLS.

Tool, description, functions	**Assessment, impression**
Google Doc Embedder lets you embed several types of files into your WordPress pages using the Google Docs Viewer - allowing inline viewing (and optional downloading) of the following file types, with no Flash or PDF browser plug-ins required: Adobe Acrobat (PDF), Microsoft Word (DOC/DOCX*), Microsoft PowerPoint (PPT/PPTX*), Microsoft Excel (XLS/XLSX*), TIFF Images (TIF, TIFF), Apple Pages (PAGES), Adobe Illustrator (AI), Adobe Photoshop (PSD), Autodesk AutoCad (DXF), Scalable Vector Graphics (SVG), PostScript (EPS/PS), OpenType/TrueType Fonts (OTF, TTF), XML Paper Specification (XPS), Archive Files (ZIP/RAR).	- Open-source - Wordpress module - Suitable for presentations to team members and exchange of knowledge - Not suitable for work in parallel among the team members
Participad enables realtime, collaborative editing on WordPress content. Co-write and co-edit content, totally synchronously, and watch as the other people's text appears instantly on the screen. It supports three modules: Dashboard – puts Etherpad editors into the WordPress Dashboard, Frontend –allows users to edit WordPress	- Open-source - Wordpress module - problems with stability with the deployed module - provides several shortcodes and widgets that

content from the front end of the website – no Dashboard required and Notepad –collaborative note-taking documents, which can optionally be linked to existing static posts or pages.	make it easy to create new Notepads from the front end of your website.

Taking into account the existing tools, the short evaluation results as well as the available technologies for implementing collaborative editing frameworks, it could be argued that the COnCEPT collaborative editing tools will be based on specific plugins (Google Doc Embedder and Participad) that will be integrated in Wordpress along with the design and development of customized extensions in order to support further functionalities.

3.4 MIND MAPPING/BRAINSTORMING TOOLS

Mind Mapping

Mind Map is a thinking "tool" which reflects how the information is stored and retrieved in the brain. It is an "intelligent" way of expressing individual ideas and its associations in an organized way.

Having understood the Mind Map thinking theory and practices, Mind Map is and can be used in almost every situation of life where we normally write linear notes or writing down a list of words. It enhances creativity and thus generates more ideas in structured and organized presentation. Mind Map has been used widely by many individuals and organizations mainly in decision making, analysis, problem solving, planning and to do list, note taking, brainstorming and presentation.

Mind map is a technique which uses graphical illustration in expressing thoughts and ideas based on the concept of Radiant Thinking; a natural function of human mind. In Mind Map, the user places the subject of attention in a central image, radiates the Basic Ordering Ideas (BOI) from the central image and hierarchically expands and associates the branches and its sub-branches with keywords. It promotes idea generation, information categorization and classification; and layouts the subject or problem in a "snapshot" and organized way. Mind map is represented with shapes, pictures, symbols or even making the words or letters into pictures. From the research done by Ralph Haber [4], and later by R. S. Nickerson [5], it has been proven that images are more stimulating than words and thus generate more creative ideas and encourage better memorization.

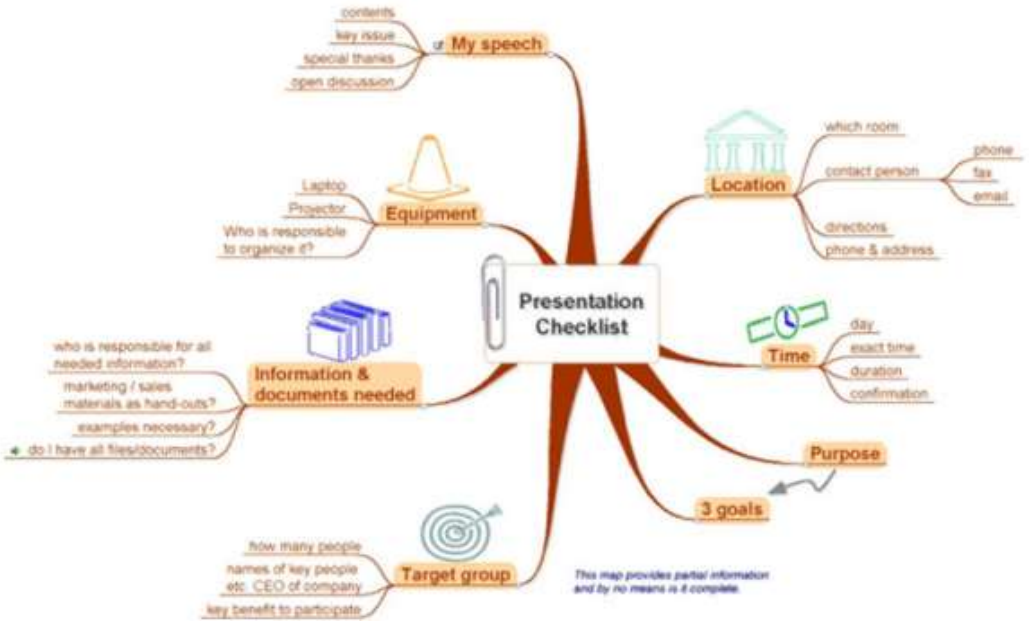

FIGURE 3. MIND- MAP EXAMPLE

Mind Map Law and Mind Map Recommendation:

Laws of technique	- Use emphasis – use central images, incorporate images where appropriate though the mind map, use different colours, use variation of sizes for the keywords, images and branches and use appropriate spacing - Use associations – use arrows for connection, use colour coding to categorize and grouping - Be clear – make it easy to capture the overall picture, the associations, the keywords and categorization and classification. - Develop a personal style
Laws of layout	- Use hierarchy and categorization - Use numerical orders – (where appropriate) to indicate prioritization or chronological orders
Buzan recommendations[3]	- Place an image or topic in the centre using at least 3 colours - Use images, symbols, codes, and dimensions throughout your Mind Map. - Select key words and print using upper or lower case letters. - Each word/image is alone and sitting on its own line. - Connect the lines starting from the central image. The central lines are thicker, organic and flowing, becoming thinner as they radiate out from the centre. - Make the lines the same length as the word/image. - Use colours—your own code—throughout the Mind Map. - Develop your own personal style of Mind Mapping. - Use emphasis and show associations in your Mind Map. - Keep the Mind Map clear by using radial hierarchy, numerical order or outlines to embrace your branches

According to Tony Buzan in his book "The Mind Map Book" [6], there are seven main stages in the group Mind Map process.

1) Define the subject – The topic and objective must be clearly defined and understood by all team members. Also, all relevant information to be considered in the discussion must be conveyed to all group members.

2) Individual brainstorming – Each member must be given at least one hour to construct their own individual Mind Map.

3) Small group discussion – Then, the groups will be divided into small groups to exchange and share their ideas. Members must maintain totally positive and accepting attitude.

4) Creation of first multiple Mind Map – Combine all the ideas and start building the group Mind Map.

5) Incubation – A process where the pursuit of ideas tends to non-stop verbal and analytical activity until a result is achieved.

[3] Collaborative Mind Map Tool to Facilitate Requirement Engineering, University of Manchester, http://studentnet.cs.manchester.ac.uk/resources/library/thesis_abstracts/BkgdReportsMSc09/JaafarJ.pdf

6) Second reconstruction and revision –iterate the step 2, 3 in order to capture the results of the newly considered and integrated thoughts. Output of this activity is another group Mind Map that can be used to compare as preparation for the final stage.

7) Analysis and decision making – Make decision, set objectives, device plans and edit it accordingly.

Advantages of mind mapping
- ‘‘free-form’’ and unconstrained structure - No limits on the ideas and links that can be made, and there is no necessity to retain an ideal structure or format - promotes creative thinking, and encourages ‘‘brainstorming”
Disadvantages of mind mapping
- The types of links being made are limited to simple associations - Absence of clear links between ideas is a constraint - Mind maps have been said to be idiosyncratic in terms of their design, often hard for others to read

Other tools for showing information in a structured way

Concept mapping is a type of structured conceptualization which can be used by groups to develop a conceptual framework which can guide evaluation or planning. In the typical case, six steps are involved:

1. Preparation (including selection of participants and development of focus for the conceptualization);
2. The Generation of statements;
3. The Structuring of statements;
4. The Representation of Statements in the form of a concept map (using multidimensional scaling and cluster analysis);
5. The Interpretation of maps; and,
6. The Utilization of map.

The difference between mind mapping and concept mapping is also at the level of precision and formality. Mind maps are less formal and structured. Concept maps are formal and generally more tightly structured. Mind maps emphasise diagrams and pictures to aid recall of associations; concept maps generally use hierarchical structure and relational phrases to aid understanding of relationships.

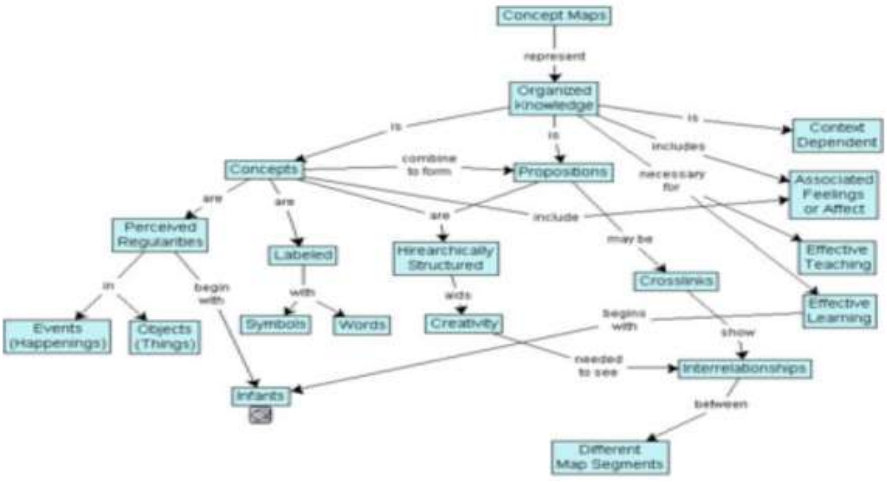

FIGURE 4. CONCEPT MAP EXAMPLE

Brainstorming

Collaborative brainstorming can be a challenging but important part of creative group problem solving. Mind-mapping has the potential to enhance the brainstorming process but has its own challenges when used in a group. The hierarchical mind-map structure also imposes important framing effects on group dynamics and idea organization during the brainstorming process.

In recent years, specially, academics and educators have begun to use software mapping tools for a number of education-related purposes. Typically, the tools are used to help impart critical and analytical skills to students, to enable students to see relationships between concepts, and also as a method of assessment. The common feature of all these tools is the use of diagrammatic relationships of various kinds in preference to written or verbal descriptions. Pictures and structured diagrams are thought to be more comprehensible than just words, and a clearer way to illustrate understanding of complex topics.

This subsection offers an outline of the various types of tools available and their advantages and disadvantages. It argues that the choice of mapping tool largely depends on the purpose or aim for which the tool is used and that the tools may well be converging to offer educators as yet unrealised and potentially complementary functions. We also present design ideas to assist in the development of future tools to support creative problem solving in groups.

Brainstorming is a great technique to identify issues, solutions and opportunities. It can help organizations challenge their thinking, create openings for doing things differently, and get different (hopefully better) results. We have identified five of the most popular brainstorming techniques. While they vary in form, they are all designed to generate as many ideas as possible around a topic within a specific amount of time (usually 20 -30 minutes). To choose the best brainstorming model you need to be clear about your topic, objectives and the nature of the participants. In brainstorming we are interested in quantity, not quality. Groups tend to self-censor their comments unless they are reminded of this goal. It is important to remind the group of the defined goal so they don't self-censor, as well as to tell the group that focusing on quantity will produce “jewels” and “junk”. The following techniques are identified:

1. Free-Form Brainstorming: This is the type of brainstorming where participants express their ideas as they occur, as described in more detail in [16]. One of the key disadvantages of this type of brainstorming is that quieter, more self conscious members might not participate unless actively drawn in the process

2. Round Robin Brainstorming: People contribute ideas in turn, feeling free to “pass” if they have no idea to share in that round. The session is over when everyone passes. This ensures everyone participates.

3. Mind Mapping: this offers a more graphic approach to scribing responses, than simply listing ideas on a flipchart. One or two people are used as scribes for the group.

The process begins by creating a large writing space, at least 4 feet by 4 feet, on a wall. Then, the topic statement is written in circle in the center of this space. Then, responses are gathered and scribed as lines branching out from the center circle.

Participants can either offer new ideas – scribe as new main branched around the circle; or extensions of earlier ideas – scribe as sub-branches of the appropriate main branches. The completed map thus contains a record of key associations among ideas [7].

It may be a good idea to start a process with one or two rounds of round robin brainstorming, and then set the group loose into a free form continuation of the activity. This is particularly useful if the group has not worked together before, and needs some encouragement to begin opening up.

4. Pencil and Paper Brainstorming: Participants write their ideas first, and then share them, either in turn or anonymously. The advantage of this technique is that it encourages participation by people who might otherwise feel intimidated.

5. Nominal Group Technique: This is a very structured form of brainstorming that results in the generation and prioritization of ideas. It is particularly useful when a large group is involved in the brainstorming process and when there is a need to take a brainstormed list and synthesize it into several prioritized items. Another advantage is that it reduces the dominance of outspoken individuals and encourages participation by everyone. This is brainstorming technique is lengthier and much more structured than the other approaches, but well worth the effort if the group is large and the topic is complex.

Mind mapping is a great way to brainstorm, make a plan, or turn ideas into the steps needed to make it real. Thankfully, there are great tools out there to help you build mind maps, organize them, and save them for later. A list of the most well-known mindmapping and brainstorming tools is presented in Table 7.

TABLE 7. MINDMAPPING AND BRAINSTORMING TOOLS.

Tool, description, functions	Assessment, impression
Mindjet is more than just mind mapping software—it's a total suite of applications and tools designed to help you and the people you work with brainstorm, stay on top of projects, collaborate on tasks, and stay organized together. It's more like a complete project management and collaboration suite. It has an extremely powerful mindmapping and brainstorming tool however, designed from the ground up to help you organize your projects, assign different arms of your projects to different people, flesh out all of the individual to-dos and jobs required to make the whole project a success, and it works just as well if you're working with a hundred people, a dozen people, or just organizing your own to-dos. Plus, it integrates with web services and tools you already use, like Microsoft Office, Box,net, and more. Anyone familiar with the old tool MindManager will be happy to learn it's been rolled into Mindjet's individual apps. Most of Mindjet's users are companies willing to pay for it though: It's $15/mo per user for the individual plan, and $30/mo per user for the enterprise plan.	- Platform: Microsoft Windows, Mac Os, Apple iOs, Android mobile - Multiple Languages: Yes - Open Source: No - Licence: Proprietary - SaaS: Yes - Export: Word, Power Point, Key Note, PDF, HTML - Website: www.mindjet.com
XMind has been around for a good long time, and it even made the roundup the last time we looked at mind mapping apps. It hasn't lost its power though; it's still extremely flexible, works great on any desktop OS, and makes it easy to organize your ideas and thoughts in a variety of different styles, diagrams, and designs. You can use simple mind maps if you choose, or "fishbone" style flowcharts if	- Platform: Mac OS X, Windows and Linux - Multiple Languages: Yes - Open Source: Yes - Licence: Depends on version, LGPL and Proprietary - SaaS: No

you prefer. You can even add images and icons to differentiate parts of a project or specific ideas, add links and multimedia to each item, and more. If you're a project manager, you can even use XMind's built-in Gantt view to manage tasks in a way your colleagues may be familiar with. Best of all, XMind is completely free and open source. If you have some cash to spend, XMind Plus and XMind Pro offer some additional import/export and presentation features, along with some featured targeted at project managers and businesses who want to use XMind on the enterprise level. Plus will set you back $79 one-time, Pro is $99 one-time, and a subscription to Pro and all of its updates is $79/yr.	- Export: Word, PDF, Image, Excel etc - Website: www.XMind.net
Coggle is a completely free, simple to use mind mapping tool that's easy to get started with. Sign in with a Google account of your choice and you're off and away. Double-click on any item to edit it, and click the plus signs on either side to add branches to your mind map. Click and hold to drag them around the canvas to design your mind map any way you like. Coggle will automatically assign different colors to your branches, but clicking on a branch will bring up a color wheel so you can personalize it yourself. When you've finished a map, you can download it as a PDF or PNG, share it with others who can just view it or, if you allow it, edit your mind map. You even get auto-saving and revision history, so if you want to see what your mind map looked like before someone you invited started working with it, you can. Best of all? Coggle is completely and totally free.	- Platform: Internet Explorer 9+, Firefox, Google Chrome, Safari, Opera - Multiple Languages: No - Open Source: Freeware as a Service - Licence: Freeware as a Service - SaaS: Yes - Export: PNG, PDF - Website: www.coggle.it
Freemind is a free, GNU General Public Licensed mind mapping app built in Java, so it runs on just about anything you throw it at. It's a pretty powerful mind mapping tool too, offering complex diagrams and tons of branches, graphics and icons to differentiate notes and connect them, and the option to embed links and multimedia in your mind maps for quick reference. Freemind can export your map as HTML/XHTML, PDF, OpenDocument, SVG, or PNG. Compared to a lot of the newer tools it may look a little dated, but it's still powerful and useful.	- Platform: Microsoft, Linux and MAC - Multiple Languages: Yes - Open Source: Yes - Licence: GNU GPL - SaaS: No - Export: XML, XHTML, PNG, JPEG, SVG, PDF, OpenDocument - Website: http://freemind.sourceforge.net/
MindNode is an elegant mind mapping and brainstorming app for OS X and iOS. The iOS version is designed to work well on touch devices, specifically the iPad, and makes it easy to drag branches around, add new nodes, connect nodes, share documents with others, and more. The Mac app is similar, and supports sharing your mind map with others and exporting as PDF and as a Freemind project. MindNode can automatically hide branches that have nothing to do with the items you're working on, embed images and	- Platform: iPhone, iPad, MAc - Multiple Languages: No - Open Source: No - Licence: Free - SaaS: No - Export: PDF, PNG, Plain Text, Rich Text - Website: http://mindnode.com/

screenshots onto nodes, create links on nodes, and even automatically organize your branches for you if they get messy. It can also support linked mind maps. The UI is relatively clean and hides a lot of its features in order to keep things clean, but that doesn't mean it's not powerful. Many of you who nominated it pointed out it's one of the first mind mapping apps you've seen that really does things right on a tablet. MindNode is $20 for the Mac app, and $10 for the iPhone/iPad app.	
Post-it adds a simple 'Post-it' widget to the Dashboard that allows you to leave yourself or other authors a note. The plugin can be configured and moved around as any other Dashboard widget. It will accept plain text or HTML.	- Platform: Plugin in Wordpress, Multiple Platforms - Multiple Languages: - Open Source: Yes - Licence: Free - SaaS: No - Export: Plain text, HTML - Website: http://wordpress.org/plugins/dashboard-post-it/
Gliffy https://wordpress.org/plugins/gliffy-plugin-for-wordpress/ - The Gliffy plugin allows you to create diagrams and insert them into your posts or pages. Draw all kinds of diagrams: flowcharts, UI mockups, UML, etc	- Platform: Plugin in Wordpress, Multiple Platforms - Multiple Languages: - Open Source: Yes - Licence: Free - SaaS: No - Export: Plain text, HTML - Website: https://wordpress.org/plugins/gliffy-plugin-for-wordpress/

There are several options to choose a tool if we need to work in MAC, Windows, Linux in web format or in Android or IOS. In addition, we can use a tool without payment (Coggle) or have the option to see the source code (XMind) because it has two type of license: Dual license under LGPL v3 and Eclipse Public License v1.0, both open source and in XMind Pro: proprietary software. XMind is possible to use also in several languages. On the other hand, if we take an account the functionality of tools, we can summarize that all of them work as project management with Gantt charts or organize in a variety of different styles, diagrams, and designs. It is possible to export PDF, PNG, HTML or XHTML or link to other suites like Microsoft Office. In all these cases not natural interaction is used. Augmented Reality could be the way to enhance user experience (UX).The way gamification could contribute to this task it not clear enough. Post-it and Gliffy are considered as the most basic tools to be used within COnCEPT since they constitute Worpress modules and may be easily integrated and extended in order to fulfil the requirements for the deployment of the COnCEPT mindmapping and brainstorming tools.

3.5 MOODBOARD TOOLS

A digital Moodboard is a type of collage that may consist of images, text, illustrations, screenshots, colours and samples of objects in a composition. Mood boards can be used by designers to assist in visually illustration of the style they are

pursuing. However, they can also be used to visually explain a certain style or an imaginary setting for a storyline. Moodboards should not necessary be limited to visual subjects, but they are served as a visual tool to quickly convey the overall "feel" (or "flow") of design idea. There's no "right" final presentation for a mood board, it can be a poster, a .pdf or even a video. Creating the functional working moodboard is a time consuming challenging task. There are a variety of tools available to facilitate the designer work. Some most promising candidates along with their assessment to fulfil the COnCEPT requirements are listed in Table 8.

TABLE 8. MOODBOARD TOOLS.

Tool, description, functions	**Assessment, impression**
Pinterest, https://www.pinterest.com/ Pinterest is a free website in which users can upload, save, sort and manage images, known as pins, and other media content (e.g. videos and gifs) through collections known as pinboards. Pinterest acts as a personalized media platform, whereby users' content and the content of others can be browsed on the main page. Users can then save individual pins to one of their own boards using the "Pin It" button, with Pinboards typically organized by a central topic or theme. Users can personalize their experience with Pinterest by pinning items, creating boards, and interacting with other members. By doing so, the users "pin feed" will display unique, personalized results (wiki, http://en.wikipedia.org/wiki/Pinterest). The developer site for Pinterest can be found here, https://developers.pinterest.com/ Creative blog about Pinterest provides with more examples and explains how moodboards can be created with Pinterest, http://www.creativebloq.com/creative-careers/pinterest-career-1232752	Attractive tool for end user Online and collaborative i.e. moodboards can be shared using facebook, google+, however it seems tool is not supporting collaboration beyond 'like it' Free for use, however not open source API provided to be able to search for Top clicked Pins, Related Pins, Domain search, etc. Some application is required to be filled to get APIs. Efficient functionality to collect images (i.e. Pins), but software is not suitable for further extension and development Tool is also interoperable (plugin) with WordPress and Drupal platform. Plugins allow integration of Pinterest's 'Pin It Button' into platform allowing share images and content in the social media network. Integrating 'Pin It Button' in own site, in practice means that one allows own images to be Pinned Very popular platform
Moodstream http://moodstream.gettyimages.com/ It's able to create the 'stream' of Getty images. The type of image streams can be configured from user interface provided (cold, warm, topic). The concept is generally interesting.	Online tool which may provide some inspiration in general as a concept for R&D Tool is not open source and not extendable
MoodeShare, https://moodsha.re/ MoodShare allows making and sharing multi-user collaborative mood boards. Find media and create boards, and then connect with	Well developed tool, nice experience for end user, simple UI, attractive Online tool, allows collaboration with other users

the wider team to build consensus in real-time.	in MoodShare space Images, videos and other multimedia can be searched through different media such as google, getty, flickr, and so on Text, color, notes can be added Moodboard can be exported to pdf and saved to own computer/hard drive This tool seems to be most attractive compare to all other tools in this list It's not open source and not extendable
Gimme Bar, https://gimmebar.com/ Gimme Bar allows the creation the collections of bookmarks, including the facility to take entire screenshots. It can be used to show the team or clients examples of similar styles or colours.	Online collaboration tool, sharing functions are supported For end user UI is very simple, not very attractive, during test it wasn't easy to find out about how to get the content In principle API are provided to manage user content There is a possibility for Pro Account for $2/month, while it's not clear what is offered there.
Mural.ly, https://mural.ly/ Currently in beta, Mural.ly describes itself as 'Google Docs for visual people'. An easy and user-friendly way for creative teams to think, imagine and discuss their design ideas, many of its 45,000+ users use the service to create mood boards.	Online tool providing nice experience for end users, easy to use, various functions are provided such adding images, notes, text, searching for images in internet and locally, various canvases to organise material, etc. Sharing functions are supported through the integration with dropbox and evernote It's not open source software and there is no developer support Free use functions are very limited, for studios – $29/month
Skwibl, http://skwibl.com/ Skwibl is the fastest way of getting feedback on designs. You can upload your designs, invite collaborators, discuss design, etc.	Online tool is meant mainly for sharing and discussion of ideas, it's possible for example to point a particular area of content. Content/image can be downloaded from own

	computer of Dropbox, however there is no support for searching images or organising them into nice presentation It's not open source there is no developer support
Canva, https://www.canva.com/ Canva supports search for graphics, photos and font as well as drag and drop functionality to easily upload selected item into own space. It provides also some collaboration functions.	Very nice moodboard creation tool, easy UI, images can be searched, different layouts supported, text, notes, comments can be done Created material can be shared through facebook, twitter, however it's not meant really for collaboration in team setting Results of design can be published to pdf and image format It's not open source, no developer support, not suitable for extension
LucidPress, https://www.lucidpress.com/ LucidPress is an online portal and a layout application that lets users create various print and digital documents. Designers can make flyers, brochures, newsletters, magazines and photo books speedily easily.	FREE only for single user and for very simple functions $7,95 – basic account but again for one user, only starting from $40/month there is a support for collaboration
Cacoo, https://wordpress.org/plugins/cacoo-for-wordpress/ - Cacoo is a user friendly online diagramming application. The Cacoo plugin for WordPress allows you to create diagrams and insert them into your posts. The Cacoo plugin for WordPress works with your Cacoo account.	Open source tool. Wordpress module. User friendly application for creation of online diagrams
Widget Context, http://wordpress.org/plugins/widget-context/ - Widget Context - With the Widget Context WordPress plugin, you'll be able to pick and choose which pages you want sidebar widgets to appear on. You can literally create different sidebars for different pages and sections of your site with this.	Open source tool. Wordpress module. Use of sidebars in order to provide various menus within the COnCEPT tools

To sum-up, as can be seen from the table, while some interesting moodboard tools are available, they are not actually open source software and not suitable for further extension in the project while can be considered to be integrated as it. The Pinterest is the most popular platform to support the designers' needs. In addition it is interoperable with some existing popular CMS systems such as WordPress and Drupal for example. Other less known option is MoodeShare that can be considered due to the pleasant user experience and versatility of provided functions.

3.6 STORYBOARD TOOLS

Storyboards are visual representations linked together with a narrative sequence. They are useful communication tools for conveying ideas among people from different backgrounds. This because the visual narrative of storyboards allow users to understand the context and situations in a more natural, intuitive way.

With origins in the movie industry, and neighboring with comics strips, storyboards are powerful tools for designers to narrate "a story about (parts of) the interaction(s)" with a product [8]. Images, text, and animations are common elements of storyboards, among many others. The selection of these individual elements and style of the storyboard are in large part determined by the individual choices of its author(s).

Table 9 presents a technology assessment of 8 software tools for creating storyboards. As storyboarding can be done in several types of tools (e.g., comics tools), we considered a variety of tools that support storyboarding.

TABLE 9. STORYBOARD TOOLS.

Tool, description and functions	Assessment and impression
Open source tools	
Twine http://twinery.org/ *Open source tool for creating interactive, nonlinear stories.* Twine allows its users to create scenes with images and text, which can also be linked to other scenes for telling an interactive story. Annotations can be added to each scene. The interactive stories can be visualized with a web browser.	Free, open source tool, with the possibility to set up a development environment. Standalone tool (online preview available on Twine website). Not interoperable with WordPress. Stories are saved directly to HTML format. Possible to export stories to .RTF file, and import HTML and .TXT files. Does not support collaborative work. Images and fonts can be imported from the web or own computer. Allows to import fonts and images from web or hard drive. Basic functionalities to create stories are easy to use, but the UI is not very attractive. Advanced functionalities may require coding.
Diagramo http://diagramo.com/ *Open source tool for creating online flowcharts and diagrams.* While no specific storyboarding functionality is available in Diagramo, it allows users to insert, **Pencil**	Free, open source tool, with the possibility to set up a development environment. Online tool based only on HTML 5. Does not require browser plugin or extension. Not interoperable with WordPress.

import, and reuse images and text.	Possible to share files for collaborative reviewing/editing (limited functionalities). Possible to import and reuse images previously imported from web or own computer. Files are saved as HTML files and can be exported to SVG, GIF, and JPEG files. Simple UI, and fairly easy to use, but it has very limited capabilities.
http://pencil.evolus.vn/ *Open source tool for GUI prototyping*. Pencil is a popular tool, offering a variety of built-in collections of elements to create mockups, diagrams, and flowcharts. It is possible to create storyboards with Pencil, including elements such as text, images (i.e., clipart images).	Free, open source tool, with the possibility to set up a development environment. Standalone tool, available for Linux, Windows, and Mac OS platforms. Not interoperable with WordPress. As Pencil is built on top of Mozilla technologies, it can also be installed into Firefox as an extension. Pencil does not support collaborative editing. Possible to export files to PNG, PDF, SVG, ODT files, or as a single web page. Connected to clipart library (OpenClipart.org), that allow users to browse and import clipart images. Elements in drawings can be linked to another page in the same document. Easy to use using, adding elements with drag and drop operation
Js-impress, http://wordpress.org/plugins/wp-js-impress/ - Quickly create beautiful presentations in 3 dimensions with help of impress.js and WordPress. Allows you to use present your posts, pages, media or the Impress slides with the power of Impress.js.	Free, open source tool. Worpress module Extensible libraries that can be used in the project.
WP Storyboard Gallery, http://wordpress.org/plugins/wp-storyboard-gallery/ - A simple plugin that adds a storyboard style gallery to posts and pages. The plugin uses the WordPress image manager, so you can add already uploaded images to a gallery.	Free, open source tool. Worpress module Easily create storyboards by using Wordpress functionalities.
Mobile application tools	

Bitstrips http://www.bitstrips.com/ *Application for creating comic-like storyboards*. Bitstrips is a good example in terms of easiness of use. It has been widely popular due its social functionalities (e.g., create and share strips among Facebook friends).	Free application, but not open source. Download available from App Store, Google play (Android version), and Amazon apps. Facebook application is also available. Not interoperable with WordPress. Does not support collaborative editing. Comics can be shared by Facebook, Twitter, Tumblr, Email, and SMS. Easy to use, attractive UI. A wide range of pre-defined scenes. Facial expressions and positioning of characters can be changed. The scenes cannot be changed.
Storyboard 3D http://tamajii.com/storyboards3d/ *Mobile application for creating 3D movie-like storyboards*. Storyboard 3D is a storyboarding tool for mobile devices with useful functionalities, such as built-in characters and scenes. Another relevant tool for movie storyboarding is **IdAnimate** (http://www.idanimate.net/), created by Javier Quevedo at the Concept Lab of TU/e. idAnimate is available for free at the App Store.	Free application, with an in-app store to buy additional content. Only available for iOS. Not interoperable with WordPress. Audio can be recorded and played back while viewing storyboard. Images and text can be added to predefined elements (actors, background, effects…). Actors and scenes can be customized, and scene order can be easily rearranged. Possible to share storyboards via email (PDF file) or between iPads through iTunes (native format export).
Commercial tools	
Toondoo http://www.toondoo.com/ *Free online application with focus of children creating storyboards*. Toondoo offers a wide variety of features for a free storyboard tool (e.g., free sketching, clone/reuse elements…).	Free online tool, but it's not open source and does not offer developer support. External images can be uploaded from web or own computer. Possible to share storyboard by email and send private messages among registered users. UI is cluttered, not intuitive, and mildly difficult to use.

Storyboard That http://www.storyboardthat.com/ *Online tool for creating comic-like storyboards with a drag-and-drop functionality*. Storyboard That offers a free, basic account with limited functionality, requiring to pay a membership for advanced features. This tool is oriented towards both entertainment and professional usage, offering functionalities for business such as a plugin for JIRA to create visual agile user stories. A similar tool for comic-like storyboards is Pixton (http://www.pixton.com/uk/). It also offers limited functionality for free account, but the user experience is less pleasant and its features are not as professional-oriented as those of Storyboard That. Two interesting features of this tool are an integrated chat for the free version, and grading and assessment tool for the educational version.	Free online tool, but it's not open source and does not offer developer support. Not interoperable with WordPress. Free account offers limited functionality (e.g., large watermark on scenes). Individual account from $5.95/month and corporate account from $19.95/month. HTML5 website works on different devices (e.g., iPad) without need of installing an app. Free version does not support collaborative editing. Possible to export storyboard to a PNG file and to create an animated Power Point/Keynote presentation. Easy to use, with drag-and-drop functionalities to create storyboards.
Indigo Studio http://www.infragistics.com/products/indigo-studio *Online tool for creating storyboards, wireframes, and prototypes*. Indigo Studio claims to be "the fastest UI prototyping and interaction design tool". It offers three relevant features for storyboarding: (1) integrate prototype and state screens directly to the storyboard, (2) create branched storyboards for illustrating different user paths, and (3) create a presentation with the capability of running prototypes directly from storyboard. Another commercial tool popular among UX/UI designers is Balsamiq (http://balsamiq.com/). Much as Indigo Studio, it requires a paid membership, but it does not includes a specific module for storyboarding.	Standalone tool available for Windows and Mac OS platforms. It is not open source. License from Indigo Studio starting at $495. Not interoperable with WordPress. Supports reuse of elements across different projects. Team collaboration supported by exporting/sharing folders of project. Offers over 100 different pre-defined scenes for storyboards, possible to link and add annotations to scenes. Possible to import images (e.g., digitized sketches) for creating storyboard scenes. Easy to use, clear UI.

From this technical assessment, we learned about the challenges of finding a suitable storyboarding tool oriented for professional design practitioners. This gap has been already described by researchers, who have proposed tools such as the COMuiCSer tool [9] for collaborative storyboarding. However, these tools are usually not publicly available.

While there are plenty of tools for creating comics, movie storyboards, and storyboards for children, it was difficult to find open source tools especially designed for collaborative storyboarding as well as tools interoperable with WordPress.. However, as explained before, storyboarding can be done with non-specialized tools. Therefore, for the COnCEPT

platform it is feasible to find a suitable tool which overlaps storyboarding with other functionalities, such as moodboard or diagram tools.

3.7 SKETCHING TOOLS

Sketching is considered as the most important functionality that has to be provided to designers in order to be able to depict concepts and ideas and proceed to the final design of products. Sketching tools in COnCEPT will be mostly used within the development phase by using as a basis material produced in other tools (e.g. moodboards and storyboards). Collaborative sketching tools may be used by designers in order to highlight, scribble or draw to get a point across to team members, introduce new elements or finalize the product design and share it with all the involved stakeholders. Collaborative sketching may be realised in a synchronous or asynchronous way, concern the design of part or the entire product, support advanced tracking mechanisms regarding the activities of each user as well as a set of export functionalities of the final product to re-usable image formats (e.g. vectorized images to be integrating in photo editing tools, visio etc). Furthermore, the capacity to improve designs by getting immediate and meaningful feedback will reduce the typical communication overhead. The most promising candidate tools for collaborative sketching along with their assessment to fulfil the COnCEPT requirements are listed in Table 10.

TABLE 10. SKETCHING TOOLS.

Tool, description, functions	Assessment, impression
Balsamiq Mockups is a tool that is considered useful to be examined for use within COnCEPT. Balsamiq Mockups is a graphical user interface mockup builder application. It allows the designer to arrange pre-built widgets using a drag-and-drop WYSIWYG editor. The application is offered in a desktop version as well as a plug-in for Google Drive, Confluence and JIRA. In Balsamiq, there are not many dialog windows interrupting information flow, neither a lot of options for end-user decisions. Mockups offers the same speed and rough feel as sketching with pencil, with the advantage of the digital medium: drag & drop to resize and rearrange elements, make changes without starting over, and working clearly enough that you make sense of them later.	- Free and commercial versions - Not supported via Wordpress - Stable implementation - User friendly - Asynchronous collaboration among end users - Real-time notifications for changes in team members. - Versioning support and Access control
Scribblar (http://www.scribblar.com/): Real-time multi-user whiteboard, Image and document upload, Text chat with user list, Crystal-clear live audio, Run unlimited sessions.	- Commercial - Integration functionality in existing websites - API that gives Scribblar Pro customers programmatic access to all core Scribblar features
Flockdraw (http://flockdraw.com/): Unlimited amount of simultaneous users can watch. Ten can draw at once. Registration not Needed. Live text chat with lots of smooth functions.	- Free to use - Synchronous sketching functionalities - Limited functionalities compared to other tools.
Google Chart Generator (http://wordpress.org/plugins/google-chart-generator/): this plugin allows the user to create and insert a Google Chart within Wordpress.	- Open-source - Wordpress plugin - Supports a wide set of Google Charts - No collaborative sketching functionality

	- Could be used as an add-on
WordPress Canvas plugin (http://www.fmeaddons.com/wordpress/canvas-plugin.html): WordPress Canvas plugin allows users to draw on paint book and add colours. Users can send images to any one via email, they can download and print those images as well. On the backend, Canvas drawing plugin has its own menu from where admin can add, edit and view images. This plugin adds two pages on your website as mentioned above, one is a canvas drawing page and other one is a gallery page. The drawing page displays an image slider on top from where users can select any picture to edit; once they select the image, it is loaded in the canvas.	- Open-source - Wordpress plugin - Asynchronous collaboration
Shared Whiteboard (http://wordpress.org/plugins/shared-whiteboard/) is a WordPress plugin that makes it easy to add interactive whiteboards to your posts and pages. The whiteboards are compatible with desktop browsers, tablets and mobile phones. The plugin supports two kinds of whiteboards: standalone and shared. Standalone whiteboards: Standalone whiteboard is a whiteboard that any visitor can use to draw and post (or save) images, but each visitor only sees what they draw (there is no sharing). You can have as many standalone whiteboards as you need. Shared whiteboards: Shared whiteboards can be used by many visitors at the same time, and they all see what everyone else draws. This makes the whiteboard an excellent sharing, communication and teaching platform.	- Open-source - Wordpress plugin - Asynchronous and Synchronous collaboration via the standalone and shared whiteboards - User friendly - Stable
DrawBlog (http://wordpress.org/plugins/drawblog/): DrawBlog lets those who comment on your blog add a quick drawing to accompany their comment. They can select colors or pen widths, then use the mouse to doodle a picture on a small canvas. Additionally, they can choose an image from your blog post and copy it to the canvas, and doodle on top of it.	- Open-source - Wordpress Plugin - Useful for collection of advanced comments including proposals for modifications in the current design
Doodl (http://wordpress.org/plugins/dooodl/) is a fun plugin for your blog that allows your visitors to draw a little doodle and save it to your sidebar together with a little note. It's a bit like a guestbook but less boring and more visual aka more fun!	- Open-source - Wordpress Plugin - Flash viewer - Asynchronous ollaborative sketching
Processing for wordpress (http://wordpress.org/plugins/processing4wp/) is a plugin that allows you to easily manage and include processing sketches into a wordpress post or page. It automatically adds the right libraries and	- Open-source - Wordpress Plugin - Include sketches within existing pages - Responsive design

offer different features and templates to present the creation in a minimalist and elegant way.	
Cacoo, https://cacoo.com/ - Cacoo supports a variety of diagrams such as site map, flowchart, mind map, wire frame, UML diagram and network diagram, real-time collaboration, multiple sheets and background	- Commercial - User friendly
Scribblar, http://www.scribblar.com/ - Scribblar offers a collaborative flash application, which allows to setup individual 'rooms' and invite participants to collaborative create sketches. It supports the ability to 'embed' the room on a third party website and the ability to import 'assets', including images, Powerpoint presentations and PDF's, all of which can be shared with other users. Live audio and chat is also available.	- Commercial - User friendly - Supports live interaction with other users

Taking into account the selection of open-source tools to be used for integration and extension in the COnCEPT platform, a combination of functionalities provide by Shared Whiteboard, Drawblog and Doodl seem to be best solution to be adopted within COnCEPT. All of them support a wide set of collaborative functionalities and can be easily deployable and customized within Wordpress.

3.8 ANNOTATION TOOLS

During the early stages of the product design process, designers rely on existing practices and resources available from a local company's databases such as documents and sketches produced in the course of previous designs, also including external information sources to help in the generation of new ideas. The external resources may include electronic books, images, music, online design journals and sources of background and domain specific information. To facilitate the process of knowledge exploration by designers, the availability of large quantities of annotated resources is essential. Research in this area has been undertaken for several decades and an extensive number of various tools and frameworks have resulted for the support of knowledge annotation functions. A variety of existing open source annotation tools (such as Stanbol, LMF, Zemanta, FRED, DBPedia Spotlight…) are extensively reviewed and assessed in Deliverable D2.1 [10]. The results of the assessment in relation to the project's requirements are further summarised in the Table 1 of this deliverable.

The assessment has revealed that a majority of tools focuses on knowledge extraction from text. This area of technology is more advanced compared with multimedia content processing. Keeping in mind that information extraction from images and videos is not that reliable, while knowledge extraction from text is much more mature, it's reasonable to take this into consideration in developing COnCEPT based support for collaboration and creativity in particular. Many tools also fail to support collaborative activity (i.e. reuse and sharing) in the process of knowledge extraction and annotation. The usability of knowledge extraction and annotation tools is the area which is still in infancy. The available technology is mostly developed keeping in mind application developer needs or in the case of semi-automatic annotation, providing support for individuals performing web authoring tasks or simple tag based functions in a non-professional context. Considering that product designers are not data exploitation professionals or either application developers, existing user interfaces need considerable effort to hide the complexity of existing knowledge extraction technology.

The final selection of knowledge extraction and annotation technology (if this will be for example LMF or some other less versatile but lighter technology or several systems together) will also depend on the selection of the COnCEPT Content Management platform. If for example Drupal or WordPress is adopted with its extensive Content Management functionality, then we might consider the selection of lighter services for knowledge extraction and annotation. Generally, it is apparent that there is no single tool that would support all the requirements identified in D2.1 and ones resulted from WP1, so most probably we will need several tools integrated into the COnCEPT platform to address the needs of the designers for the knowledge exploration process. In addition to tools mentioned in D2.1, for example recently tested Onki service is considered to be useful as a vocabulary and concept lookup facilitated by SKOS ontology. Performing the annotation of documents created by designers or design-brief analysis, gathered keywords and notes can be further semantically enriched combining the Entity Recognition and indexing services provided by DBPedia Light, OpenCalais and FRED beneficing their different level of efficiency in different application domains. Also TextRazor tool is for example thought addressing use cases related to the annotation and ranking of internet pages. While LMF-Stanbol framework can be pondered as a candidate for extension targeting the annotation of multimedia content and interlinking enterprise content with web based resources.

3.9 MODELING TOOLS

Multiple ontology support per application domain can be proven extremely useful for knowledge management and extraction in the various phases of the design process. Systematic organization of the ontological knowledge and its formalization in accordance with the selected ontology representation paradigm facilitates content's re-use and extension with the addition of new or interlinked concepts as well storage of the context aware information. It is envisaged that an upper-level ontology supported by LD semantic backbone will be defined to support the needs of designers in the data management process.. The key idea behind this approach is to implement a flexible ontological schema with formally defined semantics that enables the capturing and reuse of design knowledge while stimulating creativity. Towards this direction, a core upper-level ontology for the general early design stages will be developed and then specific extensions are going to be provided focusing on the particularities of each of the areas (e.g. industrial, graphic, web etc.).

Within COnCEPT, a tool for model creation will be deployed that will permit the integration and extension of existing ontologies per application domain. User friendly editing interfaces will be provided. This tool will be realized with custom development based on the Protégé API - http://protege.stanford.edu/ (using Protégé and WebProtégé tools). Protégé is a free, open-source ontology editor and framework for building intelligent systems that is supported by a strong community of academic, government, and corporate users, who use Protégé to build knowledge-based solutions in areas as diverse as biomedicine, e-commerce, and organizational modeling. It provides a growing user community with a suite of tools to construct domain models and knowledge-based applications with ontologies. In a similar fashion, WebProtégé is an ontology development environment for the Web that makes it easy to create, upload, modify, and share ontologies for collaborative viewing and editing. WebProtégé fully supports the latest OWL 2 Web Ontology Language. The highly configurable user interface creates the perfect environment for beginners and experts alike. Collaboration features abound, including sharing and permissions, threaded notes and discussions, watches and email notifications. RDF/XML, Turtle, OWL/XML, OBO, and other formats available for ontology upload and download.

4 THE COnCEPT COLLABORATIVE TOOLSET

Taking into account the description of the design process in section two as well as the different types of tools and technologies that will be supported within the COnCEPT platform, in this section the overall COnCEPT collaborative toolset is shortly presented. The use of the various tools in each phase of the design process as well as the communication interfaces among the various tools are defined and described. The description of the toolset is going to be provided as input to WP4 in order to be used for the instantiation of the proposed architecture (taking into account the need for custom development/extension of part of the envisaged components and the specification of interaction interfaces among the tools).

The COnCEPT platform will be based on the use of an open-source CMS (e.g. Wordpress) and the deployment of CMS modules/plugins or the integration of external/customly-developed software components. Within all the components, some vertical functionalities will be supported such as the access to material prepared in other components –following the design process-, the tracking of activities of each user, the support of synchronous interaction among the team members and the provision of access to the COnCEPT database. The following functionalities are going to be provided by each phase of the design process by the various components of the COnCEPT toolset (see Table 11).

TABLE 11. CONCEPT TOOLSET FUNCTIONALITY.

COnCEPT Tool	Phase	Functionality
Project Management Tools	Discovery Phase	Kick-off of the project, Definition of project team and assignment of roles, Preparation and signing of contract, Definition of focus groups, Creation of questionnaires, Management of design research, Define cost model, Real time interaction among the team members
Project Management Tools	Definition Phase	Management of the tasks assigned to the definition phase, Set clear project objectives and update project management plan where necessary, Define assessment criteria, Real time interaction among the team members
Project Management Tools	Development Phase	Selection of the solution to be developed, Manage communication with the client for final agreement on the under design product, Describe and define personae of typical users from target user groups, Define use case scenarios, Real time interaction among the team members
Social Media Tools	Discovery Phase	Share initial material with the involved stakeholders, Collection of initial feedback and ideas
Social Media Tools	Definition Phase	Share design brief and alternative implementation scenarios with the involved stakeholders, Collection of comments and feedback for

		addition/changes
Social Media Tools	Development Phase	Share versions as well as the final design of the product with the involved stakeholders for comments and approval
Collaborative Editing Tools	Discovery Phase	Preparation of contract, Formulate the design problem, Prepare the initial design brief
Collaborative Editing Tools	Definition Phase	Preparation of the design brief, Collaborative editing and updates by the involved stakeholders, Text processing and analytics functionalities, Suggestions for addition of further concepts
Collaborative Editing Tools	Development Phase	Iterations of the initial idea, Modifications based on further ideas and information via the evolvement of the design process
MindMapping/Brainstorming Tools	Discovery Phase	Brainstorming around the design problem, Inspiration, Depicting results from design research
MindMapping/Brainstorming Tools	Definition Phase	Mindmapping of existing ideas and extension of brainstorming based on the design brief
MindMapping/Brainstorming Tools	Development Phase	MindMapping/Brainstorming regarding the final concept.
Moodboard Tools	Discovery Phase	Collection of material from design research in a common dashboard
Moodboard Tools	Definition Phase	Collect and depict material relevant for the project, Collect material from the visual search engine and associated web sources
Moodboard Tools	Development Phase	Further collection of material towards the development of the final concept.
Storyboard Tools	Definition Phase	Prepare initial storyboard for the project based on the existing material, getting input from the design brief and the material collected in the Moodboard in the discovery and definition phase, Propose a set of alternative solutions for the development phase
Storyboard Tools	Development Phase	Finalize the storyboard of the selection design, Provide guidelines with sketches/material per step of the development and testing process

Sketching Tools	Discovery Phase	Visualisation of initial ideas through sketches
Sketching Tools	Definition Phase	Creation of sketches based on the design brief and the material prepared in the various COnCEPT tools
Sketching Tools	Development Phase	Design of the final product, Iterations with additions/modifications from the team members and feedback from the clients and the involved stakeholders
Annotation Tools	Discovery Phase	Annotations of the material related to the initial product descriptions and on the collected material to be used in the upcoming phases
Annotation Tools	Definition Phase	Annotations on the design brief and the collected text, audio and video web sources, Annotations on the provided sketches and ideas in the Moodboard and Storyboard tools
Annotation Tools	Development Phase	Annotations on the final sketches of the product
Modeling Tools	Discovery Phase	Interconnection of concepts with the COnCEPT ontology as well as the existing ontologies
Modeling Tools	Definition Phase	Extension of COnCEPT ontology, Interlinking with other ontologies
Modeling Tools	Development Phase	Extension of COnCEPT ontology, Interlinking with other ontologies

Furthermore, the type of interaction envisaged per design phase is analysed and depicted in the following figures. In each phase, the COnCEPT tools used along with the main functionalities provided are included.

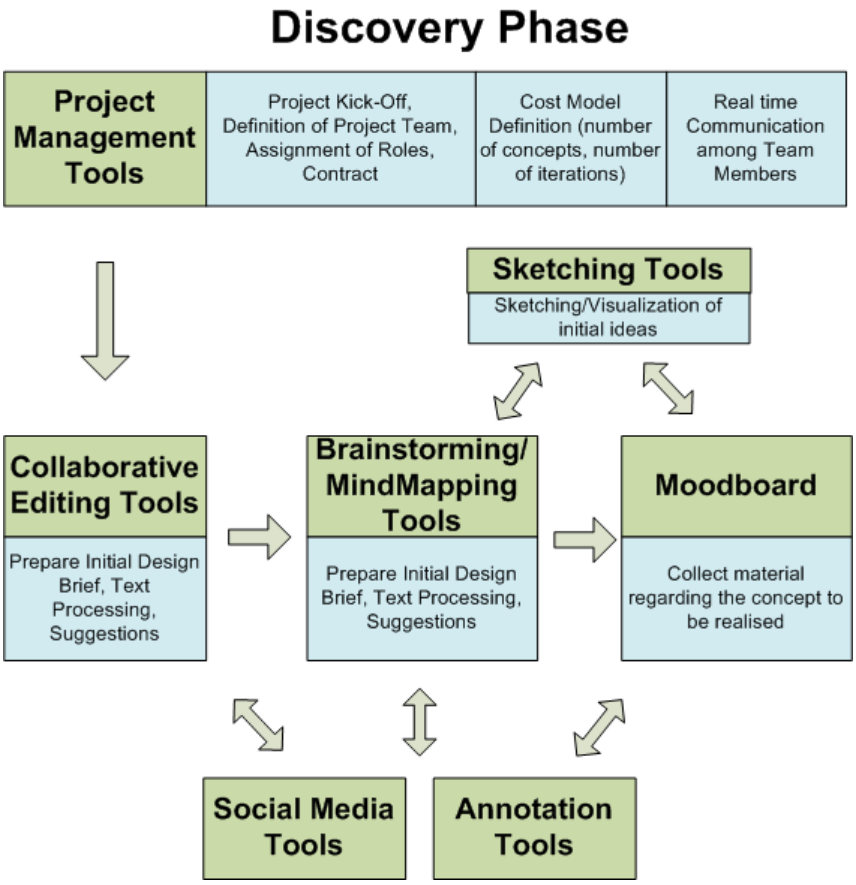

FIGURE 5. USE OF CONCEPT TOOLEST DURING THE DISCOVERY PHASE

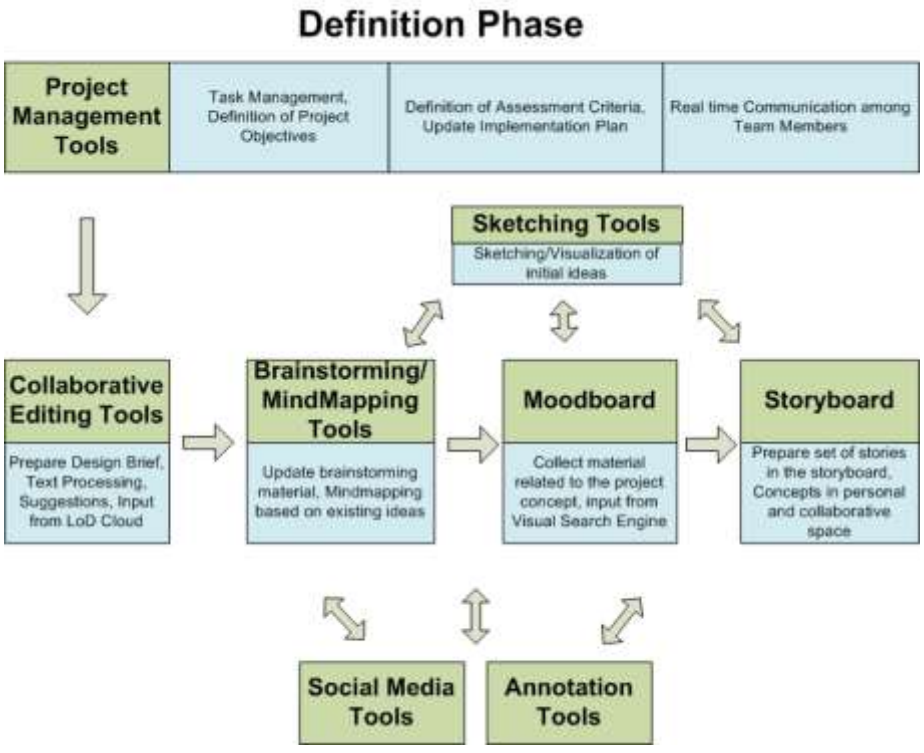

FIGURE 6. USE OF CONCEPT TOOLEST DURING THE DEFINITION PHASE

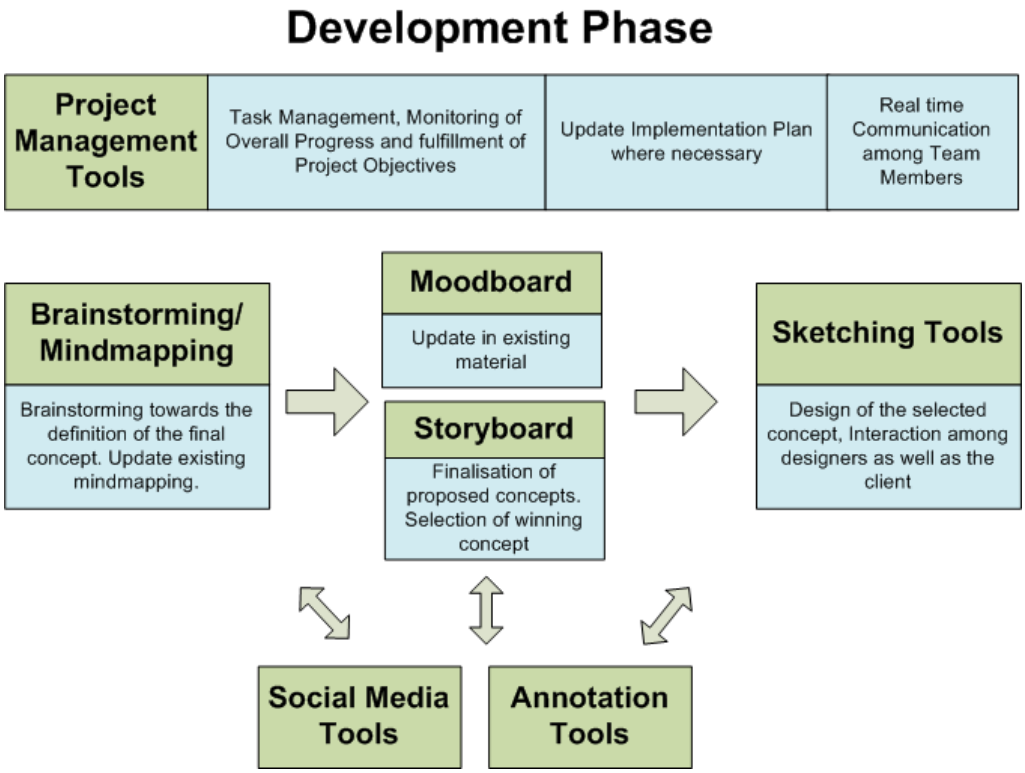

FIGURE 7. USE OF CONCEPT TOOLEST DURING THE DEVELOPMENT PHASE

5 COMMUNICATION STRATEGY AND LIAISON WITH RELEVANT RESEARCH ACTIVITIES

In order to ensure synergy and to avoid duplication of effort we provide below an overview of research projects whose activities are related to the research being undertaken for COnCEPT. We have also indicated opportunities for liaising and/or monitoring the projects that have been reviewed.

The following projects and activities have been identified as being of particular relevance:

Name of project	**CIBIS – Creativity in Blended Interaction Spaces**
Website	http://cavi.au.dk/research-areas/cibis-creativity-in-blended-interaction-spaces/
Aim	The project aims to develop and explore blended interaction spaces for supporting and developing the creative potential of young people at high school level. The project focuses on the following research themes and questions: • "What kind of software infrastructure can handle a dynamic mix of individual and shared, analog and digital devices and artifacts, and which interaction paradigm(s) scaffold the interweaving of individual and collaborative computer use?" • "How can Blended Interaction Spaces facilitate the seamless integration of individual creative sessions with collaborative ones, allowing ideas to travel across platforms and contextual boundaries?" • "What is the nature of constraints on creativity, and how can they be balanced and managed in a creative process?" • "How can we conceptualize the emergence of design ideas, and the transformation of design ideas across devices in Blended Interaction Spaces?" • "How can generative design materials, digital and analog, spark ideation, and generate momentum in a creative process?" • "How can creativity be supported and/or augmented by Blended Interaction Spaces, and how can new approaches harness the potential of Blended Interaction Spaces?"
Current status	CIBIS is led by Aarhus University with the participation of Copenhagen Business School, DesignIt, LEGO education, Academy of Talented Youth, Viby Gymnasium, Aarhus TECH – Viby, Université Paris-Sud, City University London, and Eindhoven University of Technology. The project has recently begun (currently hiring PhD students to start in February 2015).
Relation to COnCEPT	The CIBIS project is related to COnCEPT as it also focuses on creativity support and tools for sharing and creativity development. The project is however, quite different in the sense that shared spaces are targeted, not distributed, or remote working environments, and that the target users are high-school students, not professional designers or design students in an academic environment. Many professional aspects will not apply to the school context, and also many (later) phases of the design process are not targeted by CIBIS. While the environment is seemingly bound to a single physical space, still, tools and technologies of remote working apply, such as cloud storage for file and artifacts sharing, and digitalization means to improve more traditional creative practices using Post-it® notes and whiteboards.
Opportunities for collaboration	Possible ways of collaboration (which is still possible since the project is ongoing) range from the exchange of developed technologies and joint test-beds to the joint development of cloud-based creativity support tools that apply to both the high-school learning environment and academic / professional design

	teams. By examining in detail the six research themes of the CIBIS project, it seems that two approaches related to individual and social activities, four approaches related to transformation of design ideas, and six approached related to support of creativity are the most interesting and relevant to COnCEPT.
Name of project	**idSpace - Tooling and training for collaborative, distributed, product innovation**
Website	https://web.archive.org/web/20140208030237/http://www.idspace-project.org/
Aim	The idSpace project seeks to research solutions that allow designers of innovative products to collaborate with each other, but most importantly to elaborate on ideas and designs that have emerged earlier on, in previously held sessions with their own group or even in other groups. This is achieved through a dedicated platform which facilitates collaboration and, what is more, in which ideas are stored, reused and reworked - thus allowing the COnCEPT project researchers to learn from this project. The ultimate goal of the idSpace project was to build, in prototypical form, the *idSpace environment* that should come to the aid of distributed teams of innovators who want to collaborate on product design, thereby making use of earlier results by themselves or even others. The *idSpace environment:* • Contains an integrated toolset which helps to track and store semantic relationships among conceptual models, which is used to describe ideas, goals, features and values. • Exhibits extensible, informal, pluggable pedagogical approaches, which drive specific uses of the platform. • Instantiates a flexible, context aware, web-based platform, which forms the substrate for communities of practice to grow, thrive and learn
Current status	The idSpace project was led by the Open University, the Netherlands, in participation with Aalborg University (Denmark), University of Cyprus, Landesinitiative Neue Kommunikationswege Mecklenburg (Germany), University Piraeus Research Center (Greece), Stiftung Universität Hildesheim (Germany), Morpheus Software (Netherlands), Space Applications (Belgium), Extreme Media Solutions Ltd (Greece). The project started on April 1, 2008 and ended on March 31, 2010.
Relation to COnCEPT	The idSpace project is related to COnCEPT as it focuses on the empowerment of distributed designers with the aim of making collaboration more effective and offering designers a platform to capture and build on ideas. It differs from COnCEPT in that it focuses more on the educational aspects of (training for) creativity.
Opportunities for collaboration	The results of the project that are accessible online, are reviewed by COnCEPT. Also, a recently published paper on the deployment of the idSpace platform (Van Rosmalen et al. 2014) offers insightful conclusions with regard to the usability and uptake of a COnCEPT-like platform. Van Rosmalen, Peter, Jo Boon, Marlies Bitter-Rijpkema, Rory Sie, and Peter Sloep. 2014. "Supporting Co-Creation with Software, the idSpace Platform." *Computers in Human Behavior*. Accessed June 30. doi:10.1016/j.chb.2014.04.036.

Name of project	**DESIRE network**
Website	http://www.desirenetwork.eu/
Aim	This project is an interdisciplinary partnership composed of partners from computing, design and business schools in Denmark, Italy, Portugal, UK and the Netherlands, alongside the Philips organisation. The network seeks to make *"theoretical contributions to the field of creative design by bringing together expertise in human computer interaction, psychology, arts and design. The network aims to advance our understanding of creative design processes applied in scientific and technological problem solving areas"* The outcomes of the project are more theoretical than practice-focused. The project seeks to build theory around the creative problem solving process. In doing so, it supports 13 PhD researchers.
Current status	Complete (Framework 7 Marie Curie programme funding 2009-2011)
Relation to COnCEPT	Parallels to COnCEPT • Balance: Its focus is on building theory in creative problem solving, while COnCEPT seeks to enable this in a practical and industry focused setting. • While largely theoretical, its focus on interaction design and industrial design is highly relevant to the COnCEPT project.
Opportunities for collaboration	• Interdisciplinary: HCI, psychology and design collaboration. The research may provide a useful base of knowledge to act as a springboard for the prototyping of COnCEPT • 13 PhD studies commenced in 2010 across the institutions included in the Desire network. It is unclear as to the current state of these projects, however much material has been published by these researchers, and the academics involved in the partnership (e.g. conferences, The Design Studies Journal).

Name of project	**TISP - Technologies and innovation for smart publishing**
Website	http://www.iminds.be/en/projects/2014/03/06/tisp
Aim	The project creates a platform for publishers and technology providers with its main aim being the sharing of expertise and tools for innovation and technology. The project results will include a smart book consisting of business cases and other relevant material.
Current status	Ongoing, from 01/01/2013 to 31/12/2015
Relation to COnCEPT	Similar to COnCEPT, the project considers a platform for collaboration. However, the outcome of the project will not be a digital platform that is comparable to the COnCEPT platform, but will concern a smartbook, containing business models and recommendations for future collaborations. Furthermore, the project is not focusing on designers in particular.
Opportunities for collaboration	Because there are limited similarities between TISP and COnCEPT, at this point collaboration seems not relevant. However, the COnCEPT consortium will follow-up the results of this project.

Name of project	**ARISTOTELE**
Website	http://aristotele.crmpa.unisa.it/default.aspx
Aim	ARISTOTELE aimed to enhance learning and training of the workers within their organizations by defining and developing models, methodologies, technologies and tools to support the emergence of competences and creativity by self-organizing acquisition, processing and sharing of new information and knowledge with peers. To achieve this ARISTOTELE aimed to design and develop a prototype platform. The project investigated three types of processes: organizational processes, learning processes and social collaboration processes. Consequently, ARISTOTELE aimed to enhance workers' learning and aimed to support creativity.
Current status	Completed on 26/02/2014
Relation to COnCEPT	→ similarities: the project focused on collaboration and creativity, furthermore, aspects such as knowledge management and collective intelligence were considered in the project, which is also part of the research topics to be considered as part of COnCEPT. → differences: ARISTOTELE is not focusing on designers in particular. Although there are similarities between COnCEPT and ARISTOTELE, COnCEPT is also focusing on other aspects (e.g. conceptual design and sketching).
Opportunities for collaboration	As the project is already complete, the COnCEPT partners will investigate the results of ARISTOTELE that are in the public domain and their applicability to COnCEPT.

Name of project	**CX - The Creative Exchange**
Website	www.thecreativeexchange.org
Aim	The creative exchange is an interdisciplinary project that seeks to explore how anyone, anywhere and at any time can access, explore and create content inside the 'digital public space'. The project seeks to enable cross-collaboration between creative professionals, businesses and academics. Using the project themes (personalisation, exploration, participation, connectivity, narrative, identity), the core team makes introductions/connections between partners. Workshops are used to develop and iterate ideas between these partners. The CX then funds the most promising projects.
Current status	Currently nearing completion (AHRC funding from 2012 - 2014)
Relation to COnCEPT	Parallels to COnCEPT: • Mix of partners: Academic partners are drawn from three design innovation labs at universities in the UK (Lancaster, Newcastle and RCA), while industry partners are both public and private, SMEs and large organisations. • Collaboration is key for this project. Similar to COnCEPT, it aims to create links between business and academia. • It is focused on digital interactions.

	• It is UK centric.
Opportunities for collaboration	• Tools: The tools used by the CX to facilitate collaboration amongst its members, is not publically available. • Continuity: Presumably there will be a further project to assess the progress of the first round of ideas. Perhaps the COnCEPT platform could be piloted amongst a relevant segment of those partnerships. • Forums/events: CX stages 'Creative Lounge' workshop sessions to bring together researchers and creatives in business (including designers, artists, technologists, creative firms). The staging of such an event could be used in the piloting/testing phase of COnCEPT. • Staging of an'interactive' conference entitled The Knowledge Exchange in 2013, again with the focus of fostering collaboration between academia and creative practice. (http://thecreativeexchange.org/tkex) • Dynamic website, and excellent use of social media

The following projects might be of interest, for example to later deploy and evaluate the COnCEPT platform:

Fablabs	Fabrication workshops in Belgium Ongoing, UHasselt is involved, and thus providing means for easy collaboration. A possible test bed for the COnCEPT platform with Fablab-researchers.
SCATE	Smart Computer-aided Translation Environment Ongoing, UHasselt is involved. Focus is on workflow modeling and personalization of the UI for professional translators.

6 CONCLUSION

In this document, analytical information is provided regarding existing technologies and tools used by professionals in the areas of creativity/innovation in design, collaborative design platforms, creative brainstorming and innovative problem solving. Focus is given on how these technologies in their current disconnected form assist the professional designer during the creative stages of the design process.

Initially, the design process that is going to be followed within COnCEPT is presented and analysed. The steps and functionalities supported in each phase are detailed along with the role of the key COnCEPT stakeholders. COnCEPT is going to provide tools for realising the first two phases of the design process, namely the discovery and definition phase, and part of the third phase, namely the development phase. During the discovery phase, the initial brief of the project will be produced along with the realisation of a set of research and inspiration activities and the formulation of the overall design problem. During the definition phase, the project idea and concept will be produced and presented along with a series of evaluations in different milestones within the phase. During the development phase, the selected concept will be evolved and finalized taking into account the input collected from the various project stakeholders.

Following, the candidates for the realization of individual COnCEPT tools are presented and shortly evaluated based on their type of license, the provided functionalities, the user-friendliness, the interoperability with existing CMS and the capacity for extensions. A set of tools is provided for project management functionalities, social media interaction, collaborative editing, mindmapping and brainstorming tecnhiques, moodboards and storyboards creation, sketching functionalities, annotations management and addition and context modeling mechanisms. Based on the evaluation results, the most prominent candidates for being adopted within COnCEPT are identified. Part of them is going to be easily integrated with existing CMS, another part is going to be properly extended while in some cases custom development of the overall components will be required.

Taking into account the input provided in sections two and three, in section four, the COnCEPT collaborative toolset is presented. The toolset is based on the individual tools presented in section three and takes into account the need for interaction and exchange of material within the various stages of the examined design phases. The functionalities that have to be supported per type of tool per design phase are documented as well as the interconnection among the tools is identified. It is important to note that the toolset is going to be implemented upon the design and the instantiation of the COnCEPT architecture in WP4.

Finally, in section five, an overview of research projects whose activities are related to the research being undertaken for COnCEPT are presented. The current status of each relevant project and the opportunities for establishment of collaboration with COnCEPT are described in detail.

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