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# Kapittel 5
# Concept and Prototype Design of Massive Open Online Network for Innovation and Knowledge Sharing

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SAMMENDRAG Små teknologibedrifter kan ha en fordel når det gjelder tilgang til forskning relevant for den type industri de opererer i. Vi har utviklet et «massivt åpent nettverk på nett» ved å implementere en prototype som har til hensikt å dele kunnskap mellom personer, grupper og organisasjoner. Vår nye utforming og prototype kan brukes til å støtte samarbeid og innovasjon.

ABSTRACT Small businesses in high-tech industries can be at a disadvantage when it comes to accessing research to compete within their own industries. Using a Design Science Research approach, we develop the concept of a Massive Open Online Network and implement a prototype that aims to support knowledge sharing among formal and informal persons, groups and organisations. We contribute novel knowledge in design principles and prototype that can be applied to support co-creation and innovation.

NØKKELORD Massivt åpent nettverk | kunnskapsdeling | dokumentdeling | ny prototype | på nett | samarbeid | innovasjon

## NOTES

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## INTRODUCTION

Small businesses face competitive challenges of distinguishing themselves via excellence from their larger competitors. In comparison, small businesses may not have resources to develop industry specific ideas in house. Seeking knowledge or expertise among external groups is essential and therefore activities such as contacting others with special knowledge, sharing and collaboration with them, can be seen as a necessary starting point for innovation.

Although the open distance and educational resources movement (OER) started in the late 1990s, and that by 2002 MIT had established the OpenCourseWare project, the term Massive Open Online Courses (MOOC) as a term was not coined until 2008 (Cormier, 2008; Fini, 2009). The concept of MOOC is hailed as new pedagogic approach that revolutionises education. Such platforms allow students, at all levels of academic readiness, of various backgrounds, and essentially from all over the world to follow courses taught by experts, e.g. at a highly ranked university. However, the ideals of OER are not always part of educational infrastructures that make use of MOOC platforms (Hylén, 2007). Those outside of academia often do not have access to closed course content (e.g. of copyrighted materials) and may not have institutional access to MOOC platforms, and therefore lack the ability to set-up «digital classrooms» for sharing knowledge. While MOOC platforms provide online learning opportunities that serve certain underserved groups of learners; in this paper we introduce a new conceptual design that can help small businesses achieve knowledge sharing objectives.

Specifically, in this paper, we take a Design Science Research (DSR) approach to design a novel concept of a Massive Open Online Network (MOON) for connecting and collaborating among persons, groups or organisations that may address innovation needs of small businesses. In particular, we discuss the conceptual design and prototyping of an implementation of a MOON that we call CC-MOON (accessible at https://www.CC-MOON.net). The concept of MOON is distinguishable from that of a MOOC based on several criteria that are described further in this paper. The most obvious difference as already mentioned is that the targeted users of the MOON are not seeking to take a course in the formal or informal sense. Rather, they are seeking knowledge within their domain of practice. Additionally, some groups may be spontaneously formed, and may have intermittent active periods. They may need to share resources outside of the timeframes of scheduled courses.

The output of our design process is to develop the concept of the MOON that will address the problem to allow targeted groups to create and share knowledge through a platform that supports connecting and collaborating. The CC-MOON

prototype more specifically is an instantiation of the concept that materially allows for local generation of knowledge artefacts (documents, video, etc.) through users' own selected applications (e.g. OneDrive, YouTube, etc.) and at the same time it allows for seamless sharing of these artefacts through a simple common interface (the web portal). The concept of a MOON is a further evolution of MOOC for innovation and co-creation in business partnerships. A portal such as a MOON integrates the sharing affordances of an xMOOC for exchange and communication affordances of cMOOC via hooks to social media such as Facebook, LinkedIn, etc. In the sections that follow we describe how the prototype CC-MOON combines many of the features of xMOOC and cMOOC. Additionally, a MOON can be used by persons, groups and organisations in business. As such the CC-MOON may be used by those that have no conceptual tie to courses or educational programs. In brief, CC-MOON is a content sharing portal that may be used by any type of collaborative working group.

## LITERATURE REVIEW

The concept of content sharing information systems has roots in educational institutions, and was first implemented around 1999. Notably, the University of Tübingen in Germany started offering courses and course materials online as hosted by their Tübinger Internet Multimedia Server (Carson, 2013). Also in 1999, Rice University started Connexions (later named OpenStax CNX); an open source platform to share educational content repository and management system free of charge and presently shared materials can be made available under Creative Common licenses. Connexions was one of the first Open Educational Resources (OER) initiatives (CNX, 2017). The openness concept was next incorporated in 2002 when Massachusetts Institute of Technology and Carnegie Mellon University launched OpenCourseWare and Open Learning Initiative respectively (OLI, 2015).

The concept of Massive Open Online Course (MOOC) developed out of the OER-movement and the first use of the acronym MOOC was by Dave Cormier in 2008, in a course called «Connectivism and Connective Knowledge» (CCK08). The course had 25 paying students, and all course materials were available to the general public using a combination of tools and platforms including: blog posts, Moodle discussions, and Second Life meetings (Cormier, 2008). Since that time, various MOOCs have been developed and successfully implemented including the Stanford MOOC (2011), and platforms Udacity and MIT edX (2012).

The evolution of MOOCs is classified in two types, specifically xMOOC and cMOOC (Yuan, 2015). According to Bozkurt et al. (2017), the «c» means connec-

tivist and the «x» is for extended or extension. Courses taught with xMOOC follow a pedagogic approach that places the teacher or expert at the centre, disseminating the information or knowledge. The xMOOCs can be characterized by specially designed platforms that provide facilities for storing, management and streaming of digital content. Typical content shared are for example video lectures. Tools may be available for marking assignments, or tracking use. And in xMOOCs the support of discussion moderation may be moderate, or not supported in the features.

More recently, cMOOC evolved. These applications of MOOC focus on communication and emphasise greater use of social media. The cMOOC is characterized such that the pedagogic expert is no longer at the centre, but rather all students or participants are contributors to the learning experience. Sometimes the identification of a cMOOC can be more associated with practice or how the MOOC is used rather than built in technical features of the MOOC. A cMOOC might for example be implemented as one general registration system with hooks to social media tools (e.g. Facebook, Moodle, Twitter, LinkedIn). The cMOOC may support apps that allow users to make contributions (create content) in their own social media tools.

Several literature review studies of MOOCs have confirmed that there is ambiguity in the definition of MOOC types (Liyanagunawardena, Adams & Williams, 2013; Veletsianos & Shepherdson, 2016). These reviews express that there is a need to define MOOC types more explicitly and to explain emerging pedagogies. They also point out there has been little research on cMOOC in the period 2008–2015.

Others report that 2008–2011 was dominated by cMOOC articles, while xMOOC articles dominated in 2012–2013 shortly after the name distinction of the concept of xMOOC in 2011 (Ebben & Murphy, 2014). Alternatively, Veletsianos & Shepherdson (2015) suggest that xMOOCs have had dominance in both the literature and in practice. They point out that xMOOCs have been the default type in use in mainstream education because the pedagogic approaches used in xMOOCs are well known to academics. Alternatively online learning practices of cMOOCs are less known and mainstream education may be hesitant to use them. Bozkurt, Akgün-Özbek & Zawacki-Richter (2017) suggests that the inherent diversity of MOOCs creates a problematic situation in MOOC research, and that this problem demands more in-depth research on methodology and design. He states, «..there are a great many loosely written papers in MOOC research without a specific methodological focus. Such obscurity in methodological frameworks and opacity in the definition of MOOC types could be construed as precluding MOOCs from being both a ripe research realm and a promising educational prac-

tice» (Bozkurt, et al., 2017, p. 7). The presence of little research on MOOCs is perhaps a circumstance that has also led us to be aware of the problems of MOOCs in practice for several target groups outside of academia. Further, with recognition of the problem, this leads us to explore the design of a novel form of MOOC for non-educational purposes and for informal groups, namely to introduce the concept of a MOON for co-creation and innovation.

Innovation is often defined as a new idea, product or method that creates new value for a target group of users. In the organisational context, Peter Drucker defines innovation as follows:

> «Innovation is the specific function of entrepreneurship, whether in an existing business, a public service institution, or a new venture started by a lone individual in the family kitchen. It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth.» (Drucker, 2002, p. 149)

More recently a Forbes commentary stated that «innovation is never one event, but a process of discovery, engineering and transformation» (Satell, 2015, p. 1). Further they referenced recent innovations (e.g. batteries in the auto industry) and suggested that the ecosystems in which innovations exist are likely to be very complex and include a complexity of technologies. They argue that nobody can do it alone and so organisations need to find the missing pieces elsewhere (2015). Other marketing research also indicates that central to creating customer value are collaboration and co-creation. Further stating that, «open innovation thinking, where companies collaborate with suppliers, distributors, and customers to co-create unique value, is fast replacing traditional thinking that viewed innovation as a proprietary activity and marketing as a static, one-way broadcast» (Bhalla, 2016, p. 1).

## DESIGN METHODOLOGY

As stated in the introduction, this research takes a Design Science Research (DSR) approach. According to Vaishnavi & Kuechler (2015), DSR «involves the creation of new knowledge through design of novel or innovative artifacts (things or processes) and analysis of the use and/or performance of such artifacts along with reflection and abstraction» (2015, p.1). They also characterize DSR as learning through building or artefact creation. In DSR, the process of design is used as a research method. There are different phases of the design process, and we apply

the DSR Process Model as introduced by Takeda et al. (1990) and further developed by Vaishnavi & Keuchler (2004).

Our applied adaption of the Vaishnavi and Keuchler model is depicted in Figure 5.1

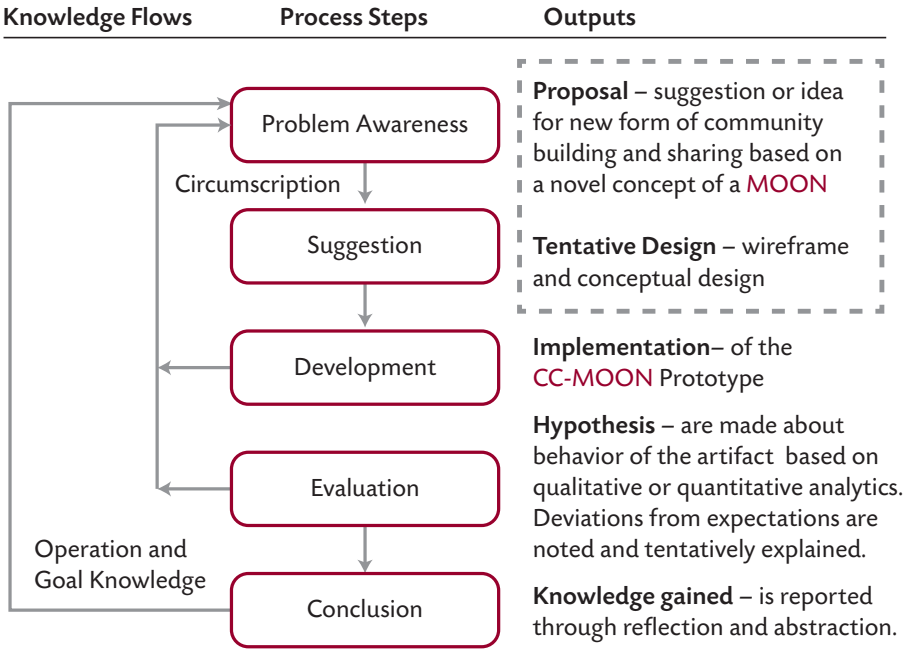


**FIGURE 5.1:** Design Science Research Process Model applied to MOON concept and prototype development. Adapted from (Vaishnavi & Keuchler, 2004).

The DSR process is a knowledge building process. In this project, we began with gaining awareness of the problem prior to submitting the proposal to VRI. As one of the co-authors has been central in the development of a MOOC concept and platform for Molde University College, his experience has been the foundation of the problem definition. That is there was an awareness of certain limitation of a MOOC for various types of group communication and sharing. The output of the first process awareness step can be a proposal, formal or informal for a new research effort. Our awareness of the problem led to the VRI-research proposal.

The project exercised two cycles of the DSR process model. The first cycle was from January 2017 to attendance at a local conference in June 2017, and the second cycle began following that conference until the end of the project period in November 2017.

The second step, suggestion, is supposed to be a creative phase. Here we envisioned the new conceptual model of a MOON and functionality for an IS platform that would support such model. In the first cycle of the tentative design phase, the project team established several versions of wireframes and blueprints for the suggested prototype. We also worked with several graphic designers to develop a logo and with team members to develop a dissemination plan.

In the third DSR process step, the artefact or implementation of CC-MOON was developed. In DSR it is pointed out that the prototype does not need to embody state-of-the-art implementation. That is the novelty or new contribution is in the «design» and not in the construction of the artefact or prototype (Vaishnavi & Keuchler, 2015).

In the fourth step, evaluation, the project team evaluated the prototype according to the problem-awareness criteria that were described in the proposal. Content was added to the portal by several users, including the industry partner, the project team, and several external users. Also, feedback was gathered at the June conference. The purpose of the feedback step is for circumscription to take place. That is, the output of this step is to create explanatory hypotheses to explain deviations from expectations in users' behaviours in their use of the prototype. The explanatory hypotheses developed from cycle 1, were used as feedback to improve the design in cycle 2.

The fifth step, conclusion, at the end of the first research cycle produced a presentation about the MOON prototype for the June conference. The conclusion of the second cycle is this research paper that reports on the research effort. Here we clarify the type of knowledge gained and explain to what extent that we think it is generalizable.

March & Smith (1995) point out the DSR knowledge contributions can take various forms, being abstract artefacts (e.g. models and methods) or material artefacts (e.g. instantiations or prototypes). Rossi & Sein (2003) and Purao (2002) identify several kinds of outputs that can be shown as a knowledge hierarchy. We depict the Design Science Knowledge Hierarchy adapted from Purao (2002) as applied to this research in Figure 2. In Vaishnavi & Kuechler (2015), it is pointed out that the creation of design science knowledge in an area usually begins at the lowest level of abstraction and generalization. It is only from standpoints developed through larger communities that broader knowledge is developed. At higher levels of abstraction, there is a contribution of more general knowledge in an area. In this research project we have contributed to some design principles in the development of the MOON concept. At a lower level, we have contributed to an instantiation of a prototype CC-MOON.

The value of the lowest level of an expository instantiation of the artefact is that the prototype can be used for further testing of the higher level constructs and for eventual development of well-developed designs and theories (Gregor & Jones, 2007).

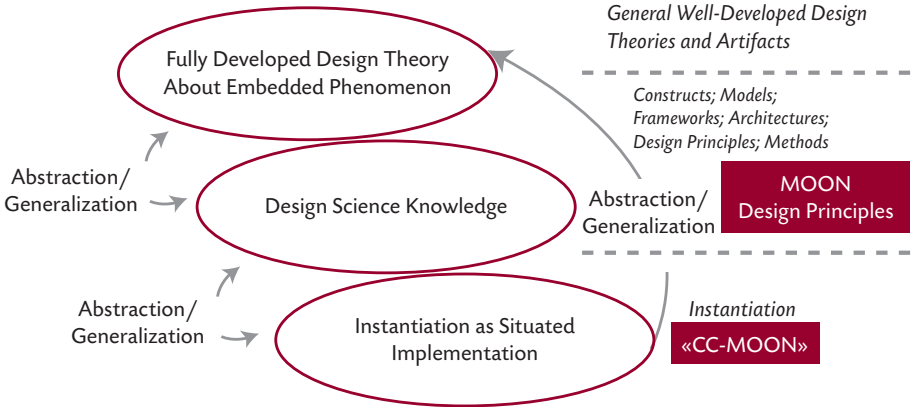


**FIGURE 5.2:** Design Science Knowledge Hierarchy and the knowledge output of the VRI-project as based on Purao, (2002).

In the next section we discuss the output of the DSR problem awareness step and suggestion step by presenting the design elements of a MOON. We discuss how a MOON differs from a MOOC and we outline the features that support innovation and co-creation.

## PROBLEM AWARENESS AND SUGGESTED DESIGN ELEMENTS FOR A MOON

Academic supported MOOCs are generally available for educational institutions and for support of courses. Researchers with knowledge sharing needs outside of courses may not have access to these systems. In addition, alternative solutions such as social media applications like ResearchGate and LinkedIn, do not address these research sharing needs. Those applications are generally used for presenting individuals' professional profiles and support communication via text exchange.

We recognised a problem, or an unmet need for a MOOC-like platform that could address the innovation and entrepreneurship needs of small or medium sized businesses. In some organisations, small and dynamic teams may have responsibilities to further research agendas. Small organisations such as SMBs can benefit from tools that allow them to reach out to connect with remote expertise and share content. Unlike educational institutions, the need for such collaborations (e.g. expert teams) may be ad-hoc, form and dissolve, be active or inactive at the will of the participants.

Our research team in the VRI proposal suggested a need for MOONs and proposed to develop a prototype of a MOON. In brief, Table 5.1 we outline the characteristics of the MOON that address user needs and how they compare with MOOCs. We highlight in bold the features that can support co-creation and innovation.

**TABLE 5.1** Comparison of the features of MOOC and MOON

| xMOOC | MOON |
|---|---|
| – Objective of a MOOC is to support the pedagogic goals of a course in a formal or informal implementation of a course | – Objective of a MOON is to share knowledge resources among groups or individuals in a user selected domain of practice |
| – Content Provision – Provide facilities for storing and streaming of digital content;<br>– The administrator of the MOOC maintains the digital content | – **(1) Content Provision** – Does not centrally store digital content, but allows sharing of resources through a simple common access interface<br>– **(2) Content is self-maintained –** on the repository chosen by those creating the content |
| – Automate assessment (marking assignments, peer assessment) | – No assessment procedures needed. |
| – Student tracking facilities | – Tracking of access and use of shared group resources may be a desired feature. |
| – May offer discussion space | – Discussion may be supported through social media |
| | – **(3) Supports Discovery of Individuals/ Groups** – discover new contacts through keyword search of registered users based on: individual, group, organisation or project name |
| **cMOOC implementation** | |
| – **Support communication** through access to social media via hooks or apps from a central administration point, peer feedback may be shared via social media | – **(4) Support communication** through access to social media via hooks or apps from a central administration point, peer feedback may be shared through social media (e.g. Facebook and LinkedIn) |
| – Autonomy – users control their social media profiles, but privacy settings are different on each social media | – **(5) Autonomous control over content creation** – registered users will have personal control over self-created content that can be publically shared or made private through the common MOON interface; |

In Table 5.1, we claim that the features of MOON highlighted in bold would support innovation through (1) sharing of content, (2) users select and maintain their own data content repositories, (3) discovery of new contacts, (4) various ways to communicate and (5) encourages co-creation of content through the protection of the creators' rights. We suggest that the five design principles of a MOON in Table 1, if implemented, would support knowledge sharing needs for SMBs and other informal groups that could be a basis for co-creation and innovation.

## SUGGESTED DESIGN OF THE PROTOTYPE

1. The project was established in **January 2017** and is supported and led by Axbit AS and is a VRI Møre og Romsdal financed project. Two researchers and a programmer from Molde University College are contributing to the MOON prototype design and testing. The VRI project proposal had the following primary objective:
2. Create a portal (*CC-MOON.net)* where both academics and industry stakeholders can present their projects with associated opportunities for collaboration, sharing and exchange information. Specifically, the CC-MOON prototype should have a low threshold so that Axbit AS and others can contact and collaborate with external research groups and others for the open sharing of knowledge and innovation.

That CC-MOON prototype should support the possibility for collaboration and sharing for researchers, not only in Norway but also beyond the borders of the country, such that it can support innovation and entrepreneurship in SMBs.

In **February**, potential user groups and suggested uses of the prototype CC-MOON were identified as follows:

- single person projects
- large or small group projects
- academia or business
- study group
- promote your idea to the world
- share our documents with colleagues
- collect our links in one common place
- research groups
- access your own documents from anywhere

- open or closed digital content
- add members to your project
- collect link to Dropbox, Google Drive, OneDrive, Facebook-groups, YouTube, Mediasite etc. in one common interface

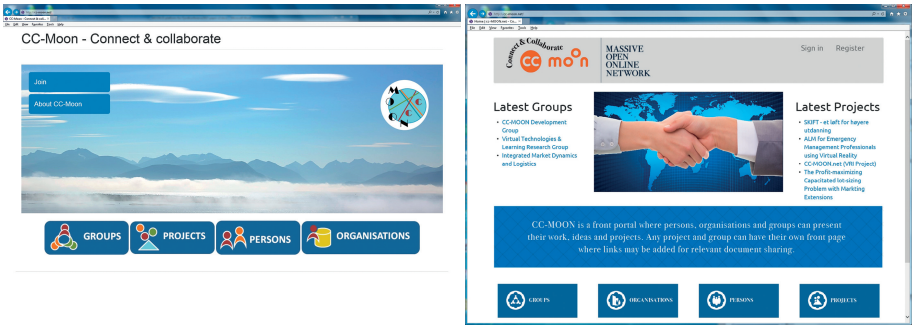


**FIGURE 5.3:** CC-MOON.net prototype of front page in April and June 2017

In **March**, there were group meetings to discuss wire framing of the portal for possible layout functionality. For example, there were many revisions regarding which search tools should be available and where the access to those elements should be placed, e.g. on the front page as in Figure 3. The portals design both in aesthetics and functionality went through numerous changes in the initial implementation of the prototype. The main implementation outcomes are highlighted chronologically here.

In **April**, the site was coded to support basic functionality. Several use cases were added. The prototype trialled use cases from Axbit AS and from Molde University College. In **May**, an initial logo for CC-MOON was designed by Linda Thinn (local artist and graphic designer), and was presented at a conference in June.

## CYCLE 1- IMPLEMENTATION AND INITIAL FEEDBACK

The implementation of the functional elements of the MOON was a gradual process. The first cycle of implementation took place mostly within April and May. We were able to present a prototype of the website to several users throughout the summer and received important evaluation feedback on the functionality and design. The prototype was first demonstrated and reported to diverse groups in **June** at the «Fjordkonferansen» 2017, 20th–21st June, Loen, Norway. The initial feedback from the conference participants indicated that there was confusion regarding the intended target group of the portal. It was hypothesized that a succinct statement was needed on the front page of CC-MOON to explain what a MOON is. We also

hypothesized that as more users and the database of projects grew that it would become more apparent as to what the affordances of the portal are.

The project attempted to attract new users outside of the project teams' close acquaintance groups. One user had added a project page, and then immediately wanted to take it down based on a critic of the aesthetics. She reported that she did not like the boxy-ness of the pages, the segmentation and small images. She wanted a big image to go across the whole page, and wanted to be able to individualise her project page so that it would look different from others. We hypothesized that users want a page that looks more like a WordPress site and that allows individualism of their content. This would result in a redesign the front page to have one larger image and the project pages to allow individual looks.

A second potential user described a problem with the functionality of the project page. He suggested that it was not possible to easily see which resources were opened or closed to those outside of the group. We hypothesized that there was a need to relabel several buttons. The project team also realised that there were no instructions or support to help new users to add projects or other page content to CC-MOON. This was something that would need to be addressed. We concluded at the end of cycle 1 that a revision to the appearance and functionality of the initial design was needed. The presentation at the June conference we consider to be the report of CC-MOON indicating the end of the first DSR cycle.

## CYCLE 2- IMPLEMENTATION, EVALUATION AND REPORT OF CC-MOON

The initial feedback had highlighted several design problems with CC-MOON. In **August**, Vebjørn Heggdal became more actively involved in the redesign of the website, in both its functionality and look. He proposed a new logo design process that involved some of his internal personnel. The VRI project team eventually adopted the current version of the logo that can be seen on the website.

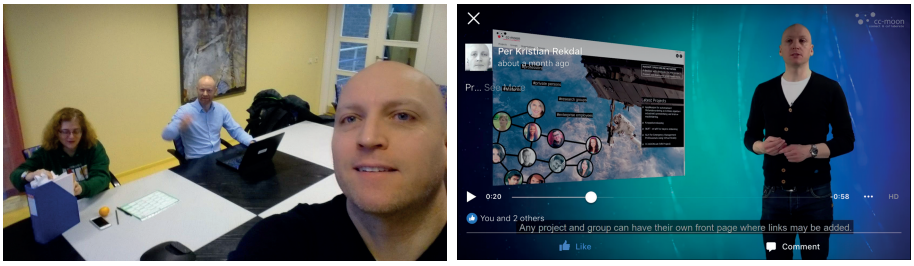


**FIGURE 5.4:** The project team and development of a promotional video

In the autumn of 2017, we have worked with the development step of cycle 2 of the DSR process. The front page layout changed in **September** 2017. It eventually became as it is shown in Figure 5. In **October** there have been several improvements to the user interface as seen from a phone or tablet. In addition, Per Kristian Rekdal recorded a promotional video (Figure 5.4). A site-footer was added, and the «About CC-MOON» page was created.

In **November**, we have added a «Contact Us» form. A placeholder was added in the site-footer for a «Getting Started» instruction page that still needs to be written. The page is intended to give support for new users who would like to add content to the CC-MOON portal. We hope to improve the instructions available for new users, so that it is easier for new persons to get started and add their own projects or groups.

One of the last actions in November under the VRI funding has been to port the prototype over to a faster server. CC-MOON is built upon Drupal 8, which is a free, open source, content managing system (CMS). Drupal is based on PHP and Twig, and uses a MySQL database to store the web sites content. One can see more about Drupal on Drupal.org<http://Drupal.org>. CC-MOON's theme is custom made from a Bootstrap<https://www.drupal.org/project/bootstrap> child theme. The page is located on a Turnkey Linux server, set up with Apache and MySQL.

While the VRI funding of the project is at an end, the project team wishes to continue to improve the design and promote the use of CC-MOON in their personal time. The porting over to a new server had introduced certain downtime of the prototype. So, although new users have joined in the autumn, these are yet to be evaluated. Nevertheless at the end of cycle 2, the project team is able to evaluate and report based on 8 projects and related persons and groups who are using the portal.

We report and describe what the CC-MOON prototype implementation is at the end of its Cycle 2 of the DSR development. We think that it addresses its two main objectives to support target groups: 1. To Connect – that is to set up new connections to contacts or to find like interested collaboration partners and; 2. To Collaborate – that is the ability to share content.

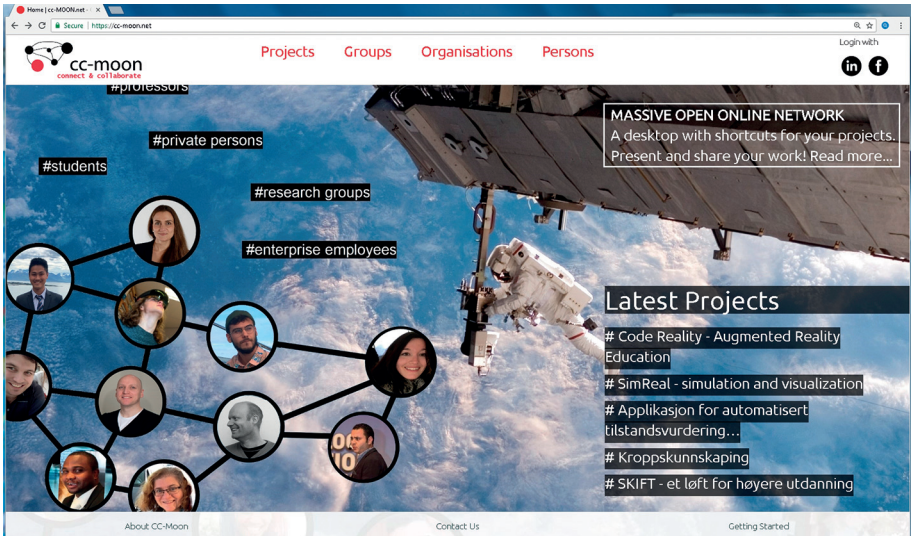


**FIGURE 5.5:** CC-MOON front page in November; Login available through Facebook or LinkedIn

As the design has intended, CC-MOON contains little digital content, but is rather a search engine and interface. The prototype supports the administration tasks of «joining» or registering an account, and then the ability to «sign-in» and edit one's own profile. Sign-in can be done with accounts through Facebook or LinkedIn as seen in Figure 5.5. Those who are signed-in may control the groups or individuals that they connect to, and they may make changes to the connection pages for the groups that they manage. Managers of content can select to have materials «open» or «closed» depending on their preference and setting in the profile.

Figures 5.6 demonstrate that it is possible to search on classifications of Projects. An example of a target page is also shown in these figures. Equivalent search pages are also created so that it is possible to search on Organisations and Persons as well. The four search options, Projects, Groups, Organisations and Persons, are main menu choices that are shown in the header of all CC-MOON pages. In August a feature was added to offer «shared files». Each registered project is given storage space for files up to 120 MB. This is depicted in Figure 5.7. This gives interested groups another option for sharing documents. In brief, the use of CC-MOON as described in this paper is free. Anyone can register an account and add groups or projects at no charge. We think that the no cost and open access to CC-MOON is a good starting point for innovation and co-created value.

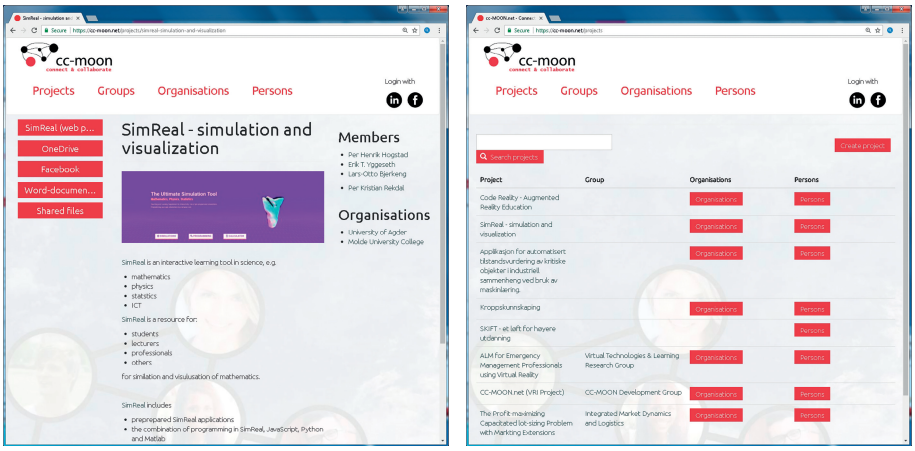


**FIGURE 5.6:** Target and Search page for Projects

As the prototype is implemented, CC-MOON has little digital content – there are only short descriptions on landing pages of the registered projects. It is a portal where all relevant links are collected in one common interface. Through CC-MOON a home-page is therefore offered for anyone involved in a project – small or large project, and that content can be shared with users who are internal as well as external to the user's own organisation. In addition, anyone can access the public part of the description of any persons, groups or organisations, not only internal members of these entities. Content creators have autonomous control, in that each group can decide if the links to their documents and videos are open or closed for those external to the entity.

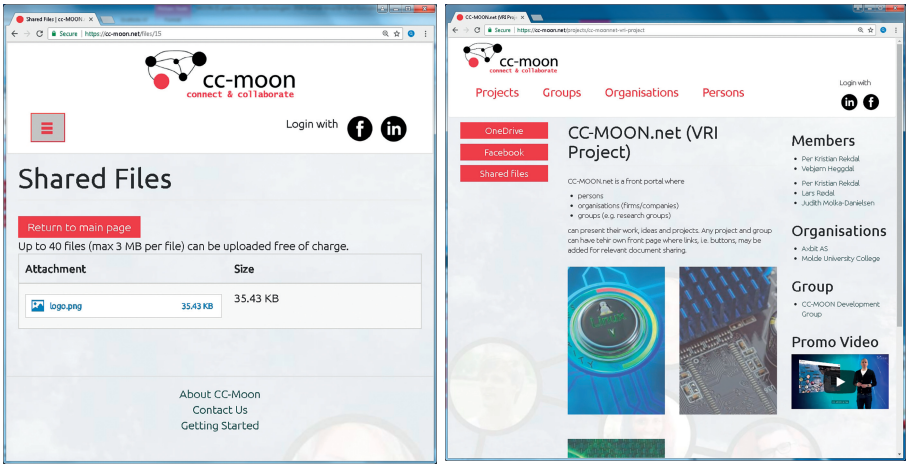


**FIGURE 5.7:** Shared files space is offered on CC-MOON. Up to 40 files (max 3 MB per file) can be uploaded free of charge.

## REFLECTIONS AND KNOWLEDGE GAINED

One of the main objectives for the VRI project has been to support the innovation and co-creation needs of SMBs. With recent development and availability of social media applications on Internet it is often assumed that innovation and co-created value are easily produced through simple use of those general purpose applications. However, research indicates that functionality in collaborative systems needs to be developed to address specifically co-creation challenges that are to: (1) provide support for identity representation within the community; (2) protect the creative and collaborative intellectual rights of the individual contributors; and (3) provide support and functionality to allow communities to grow (DiGangi, 2010; Molka-Danielsen, 2011). In our literature review we have pointed out the functionality of various MOOC models and find a lack of support for SMBs for innovation and co-creation objectives under these models. We proposed the MOON design concept and implementation of prototype to address this gap.

Reflecting on the material implementation of CC-MOON, we have learned that it does what it was intended to do, functionally. That is, the developed prototype CC-MOON allows for easy discovery and sharing with collaborative partners by collecting relevant shortcuts. The portal does not have very complex functionality. To some extent, one may say that it is only a front-page with short group descriptions/presentations and some links to the real content that is maintained by the partners in the collaboration and on their own systems. As such, prototype as implemented addresses the needs for collaborative system support. That is, CC-MOON supports (1) the collaborative communicative relationship between the individuals, groups and organisations of interest by allowing users to search and connect on any of these entity levels; (2) it supports protection of the creative rights of its members by allowing members to choose the materials that are open to the public or closed to the group; and (3) it provides a simple login (e.g. through Facebook or LinkedIn) and a simple content contribution interface that will support growth of membership, through easy additions of new individuals, groups, projects and organisation information.

We have also learned that good design does not alone guarantee adoption of the tool. At the end of Cycle 2, the design principles of a MOON that are outlined in Table 1 are built into the prototype CC-MOON. However, while some users have implemented the features that support sharing content (e.g. adding buttons to shared drives), others users have yet to do anything more than have a simple organisation entry on the portal. Clearly, additional user support and help materials are needed to help users make use of the key design principles of a MOON.

As a result of the two cycles of DSR process development, we hypothesise that the lack of complexity of the CC-MOON should contribute to a low threshold for entry of new registrations of individuals, groups, organisations or projects. Although there are not many users at present, a larger user base will eventually make the system more useful as a tool for finding relevant other like-interested groups for collaboration and sharing digital content. But, even before there are many adopters of CC-MOON, the tool itself can be useful for members within groups to share digital content. With newly added sharing features CC-MOON has the necessary collaborative system elements that can make it a useful tool for co-creation and innovation.

In summary, through our DSR process development approach, we have gained generalizable knowledge and insights on essential design criteria for a MOON. In particular we have trialled features on a prototype implementation and have learned from user feedback about preferences for search page functionality and site layout. And in general, the VRI project has contributed to the body of knowledge regarding the need for and how to create digital tools that will support Massive Open Online Networks, such that individuals and groups who have no affiliation with courses may also find mechanisms to connect and collaborate on their work.

## CONCLUDING REMARKS

This paper introduced the concept of Massive Open Online Network (MOON) and discussed the conceptual design differences of MOON versus MOOC. In our introduction and literature review we explain that MOOC platforms provide online learning opportunities that can serve certain underserved groups of learners. Similarly, small businesses can face challenges to access specialised knowledge and to connect with the right knowledge partners achieve business objectives of creating new value. In particular, research supports that innovation is not a solitary activity, and that collaboration and co-creation is the norm for the creation of new business value. Motivated by these needs, the project group led by Axbit AS and with research team from Molde University College sought funding for the current project. The VRI M&R project was funded to design and test a prototype for a Massive Open Online Network (MOON) IS-platform that would allow self-registering research individuals and groups to connect and share documents and video through the common portal. We have through a DSR approach introduced the novel concept design of a MOON and developed a prototype implementation. The project group aims to further develop instructional material to help new users

join CC-MOON.net. The portal is already being used by the IT-innovator Axbit AS. We are hopeful that CC-MOON will prove useful as a tool for formal or informal collaborative working groups and that it will support knowledge sharing, co-creation and innovation.

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