LUISS BUSINESS CASES

To Cloud or not to Cloud

Strategic choices and IT governance in the digital transformation of a University

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One late evening on 21st March 2015, Francesca – Head of Research and Teaching office at The University – ran the meeting and was hoping that the information and insights collected enabled her to make the right decision. She initiated the meeting by telling the story that few days ago on 15th March, during the presentation of a new digital solution for universities by MG company, she realized how different can be the instructors' practices in managing teaching materials and interacting with students. She gave examples of tools and functions used by University instructors such as personal webpages, blogs, Moodle, Dropbox, Google Drive, iTunes, WordPress, Facebook groups, Blackboard, etc. Francesca knew how important innovation is in a competitive higher education market. Therefore, Francesca has always been supportive on teaching experiments made by instructors. For instance, in 2007, she encouraged the Information Systems (IS) research group at University in adopting Moodle as a Learning Management System (LMS) for their IS courses. In 2014, the positive feedback collected from both students and instructors who used Moodle, led Francesca to pilot the system at University level. Simone, a member of the IS group, was in charge of the implementation and received full support from the IT Office. After one year, the new learning platform was available for any instructor interested in experimenting the Moodle functionalities. However, during the last exam session, the learning platform was down for few hours. Not only students were unable to access the teaching materials to prepare for the exams, but also professors were unable to assess students works!

"Why not having one platform to support all our teaching practices? One channel to interact with our students" she said. She asked for inputs and insights from a team of experts before making a decision. Francesca's idea was to have a single Learning Management System (LMS) supporting more than 60 programs in the four University departments. Now the problem was to select a proper technological solution, fitting with the needs of both students and instructors, and also reducing the risk of downtime. Especially knowing that many instructors will not be happy to standardize their practices, she wondered how to convince them to use the new system.

The University Profile

The University –located in Italy – was one of the leading universities in Europe. With the history back to 1966, the University had more than 7000 students enrolled in four departments; Department of Business and Management, Economics, Political Science, and Law. The University has developed and offered international bachelor programs, master programs (one-year and two-year), doctoral programs, executive programs, and customized programs in social sciences. The vision was to be among the leading universities that prepare future change makers by offering a combination of problem solving, critical thinking and entrepreneurial skills. The University equipped all its campuses with latest multimedia technologies and facilities to enhance students' learning experience. The University was well recognized for its high quality in education and research and its continuous efforts in providing innovative solutions and new educational technologies. It employs a variety of different teaching methods such as lectures, case studies, business games, group projects, videos, massive open online course (MOOC).

Digital Transformation in education

During last two decades, information technologies along with the development of computing, communication and connectivity technologies have transformed the concepts of products, services, process, as well as the way knowledge is created and transferred. Evidence in many industrial sectors shows significant transformation as an effect of digital innovation. For example, digitalization has reshaped the media industry where customers access to various services from anywhere in the world, at any time. Automotive, banking & finance, health care, agriculture and retailing sectors are some examples of industries that have shifted the way they create, capture and deliver value.
Digital technologies continuously offer organizations the possibility to rethink their products, services, corporate strategies, organizational structure and business processes to meet the changing behavior and demand of customers. But what about the higher education sector? And how educational institutions rethink their services? Educational institutions have always leveraged information and communication technologies (ICT) in order to align teaching style with demands and expectations of students[1].The use of videogames, business simulations, forums and Skype are examples of innovative approaches to deliver content and improve the learning experience.
In the digital era, a paradigm shift is challenging the traditional pedagogy approach in higher education. Digital natives and digital immigrants know how to use digital technologies to socialize, learn and play. In 2015, 2.14 billion users around the globe were communicating and sharing content in social media, with an estimation of growth up to 2.77 billion by 2019[2]. Constant connectivity to

1. Proserpio, L. and Gioia, D.A., "Teaching the virtual generation". *Academy of Management Learning & Education*, 2007, 6(1), pp.69-80.
2. https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/

digital world and social media has changed the needs and behavior of students, and consequently their learning style. The abundant data sources eliminate any spatial and temporal boundaries for them to learn. Moreover, the pervasiveness of digital technologies and the multiplicity of knowledge sources are enhancing students' competences like digital fluency and collaboration skills[3]. For instance, recent studies show that players of online games are able to manage challenging situations[4]. Therefore, online games are a new means for developing skills and their benefits go beyond entertainment aspects.

From the perspective of higher education institution, the challenge is not limited to technology selection, but to the effective use of technology in order to enhance students' learning experience. The true learning experience is possible when ICT support both learning processes; conveyance – when students access to learning sources, and convergent processes –when students interact, create and exchange knowledge[5].

Therefore, many educational institutions around the world have adopted LMS as a software application. Learning management systems allow instructors to create and distribute teaching materials with students, as well as to engage students in content creation. Additional features facilitate collaboration among students and with instructors and aid the learning by doing approach[6].

Therefore, LMS supports both learning processes and student engagement by effectively supporting knowledge sharing and collaboration. Learning platforms have become an attractive model for many universities thanks to the digitization of teaching materials (e.g. books, academic articles, project reports, case studies, technical reports, multimedia), as well as to the wireless connectivity of mobile devices that allow students to access the Internet anytime and everywhere. Moreover, e-learning platforms effectively support the interactions between students, instructors and administrative staff. LMS is also a versatile tool and can be used in different ways for different teaching needs. For example, it can be used as a tool to store and distribute teaching materials and contents. Therefore, it can be used to support blended learning activities (e.g. project work, blogs and wikis) or to fully support online courses. The physical learning experience of students is thus boundless in both time and space.

LMS have reshaped the way students search for information about course schedule, classroom, exam sessions; use different sources of information (e.g. text, audio, video); communicate with peers; share materials with them; where and when access to course materials; plan and do group work or assignment with peers. With a look at how digital technologies offer opportunities to communicate, collect, process and analyze information, the University noticed many educational institutions around the world have adopted LMS to enhance education delivery.

3. Colbert, A., Yee, N. and George, G., "The digital workforce and the workplace of the future", 2016.
4. Yee N., "The Proteus paradox: How online games and virtual worlds change us—and how they don't", *New Haven, CT: Yale University Press*, 2014.
5. North-Samardzic, A., Braccini, A.M., Spagnoletti, P. and Za, S., "Applying media synchronicity theory to distance learning in virtual worlds: a design science approach", *International Journal of Innovation and Learning*, 2014,15(3), pp.328-346.
6. More information on aligning teaching style with learning style can be found: Proserpio, L. and Gioia, D.A., "Teaching the virtual generation", *Academy of Management Learning & Education*, 2007, 6(1), pp.69-80.

Considering the differences in interests and learning style of students, the University has decided to offer new forms of course delivery and interactions, as well as to facilitate learning at anywhere and anytime. Hence, the Research and Teaching office at the University has encouraged and facilitated instructors to adopt new digital solutions (e.g. LMS) to manage and deliver courses, or any tool set to enhance students' engagement.

Digital transformation of the University

Francesca, as the Head of Research and Teaching office at the University, was responsible of creating the conditions for University's excellence in the quality of offered programs. Traditionally, the instructor to student ratio at University was very high (i.e. 1:7) and this has always been a distinctive indicator of the attention posed by the University to the quality of the learning experience. Since the University was growing internationally, it was important to maintain the same quality of teaching and learning experience without losing efficiency. Francesca was constantly receiving news and demonstrations on educational good practices and tools from service providers and software vendors. She played a pivotal role in sharing this information with instructors by involving few of them in some of these meetings. At the same time, she was always open and supportive towards instructors that experimented new methods and tools.

For example, the University has launched its iTunes channel in 2011. The channel included audio and video files of lectures and seminars recorded in class by more than 30 instructors and 40 events. In this way students could access course materials in different formats. Materials were accessible through different devices like personal computer, iPhone, iPod or iPad. This enabled the University to create a new communication channel to share with student's news and videos of any event organized by the University. Another example was the adoption of the best of breed LMS product in the market (i.e. Black Learn) made available to the Business School students. In 2007 the School adopted LMS to enhance the learning experience for its Master, Executive and MBA programs. The solution was sourced through a service contract with the local branch of the multinational company. The pricing model for the service was calculated on the basis of the number of students using the system. The solution was quite expensive, but the Business School managed to cover the costs with tuition fees.

A much cheaper initiative was undertaken by the IS research group at the University in 2007. At that time the Research Center was already involved in national and European projects aimed at building and experimenting knowledge management solutions in different sectors (e.g. e-health, securities, etc.). The role of the IS research team in these projects was to analyze the knowledge requirements and to validate the solutions implemented by technical partners. During these projects, as a spillover of these research activities, the IS group members experimented two open source solutions to support their teaching activities. The first solution was Spaghetti Learning and was replaced after a couple of years by Moodle that was emerging as the best open source platform for

higher education purposes. In both cases the software was hosted on external servers, remotely operated by Simone, a PhD student and member of the IS group. Both systems allowed IS instructors to effectively manage the interactions with students and also to transfer course materials over time with teaching assistants. This experience was informally shared with colleagues from other areas and some instructors asked to adopt the LMS in their courses.

In January 2014, Piero, the head of the IS Research Center, proposed to Francesca to open the system to the whole university. To inform this decision Piero prepared a detailed report on the experience with Moodle – see Exhibit 1. The positive feedback collected from both students and instructors who used Moodle and the reliability of the LMS operated by the IS group for more than six years, convinced Federica to pilot the system at University level. Simone was in charge of the implementation and received full support from the IT Office. After one year, a new version of the LMS was made available to everyone, and instructors from all Departments were invited to experiment the Moodle functionalities. The IT Office decided to install and operate Moodle in house to ensure better performances and fully control the system.

Francesca sent a communication via email to all instructors informing them on the availability of the new LMS. Moreover, she circulated some hands-on tips to access the system and a description of the basic platform's features. To access the platform, instructors were required to fill in a form and provide some basic information on their course. After having this input, Simone was able to create the course section. To simplify the access to their courses, a single-sign-on feature was implemented by the IT Office and students were automatically enrolled in courses included in their study plan. In this way each student was able to access the system with the same username and password used for other services (e.g. Wi-Fi, email, etc.). This automation made the interface of students with platform easier and required less effort from instructors in configuration and control. However, the LMS did not work for a critical period of exam sessions, leaving both students and professors unable to access course contents or assignments. The IT Office during that day received massive amount of emails from users requesting support and sharing screenshots of the error massage "Database connection failed". The IT Office replied to all requests indicating that "We are aware that the LMS is having some trouble. We are working on this issue to resolve it as soon as possible". Following a downtime of about 10 hours, the IT Office resolved the problem thanks to the help of an online community of software developers.

In 2015, the University has refined its strategy to better address the environmental challenges and the digital transformation. According with the new vision, the University must be well-known internationally and nationally for higher quality of teaching and research – see Exhibit 2. Although Francesca has been always supporting the development of innovative practices and the implementation of educational technologies, she now had a bigger concern– see Figure 1. During the presentation of MG Company on 15th March, she realized how the University is far from creating a unique learning journey for its students. With increasing number of digital tools and solutions, it was difficult for students to keep track of updates from different channels. Many digital solutions in use at the University were not even operated by the University staff. This was a challenge also to gain con-

trol over the teaching material and the data generated by students using the system. At the same time, she was concerned about resistance of instructors in standardizing their teaching practices.

To create a seamless experience for students, it was clear that a necessary condition was adopting a unique Learning Management Systems. An official University LMS was a way promote interactive teaching and to rethink the interactions among students, instructors, and administrative staff. However, there were an excessive number of providers and solutions in learning management market. Solutions range from tools for sharing course content, information and updates about course calendar, office hours and exam sessions; collaborative tools such as wiki and blogs for group work; students' performance evaluation; communication tools (e.g. instant messaging), to more recent services such as online modules and integration with massive open online course (MOOCs) for distance learning. The main priority of Research and Teaching Office was to bring innovation into teaching and engage students for effective learning.

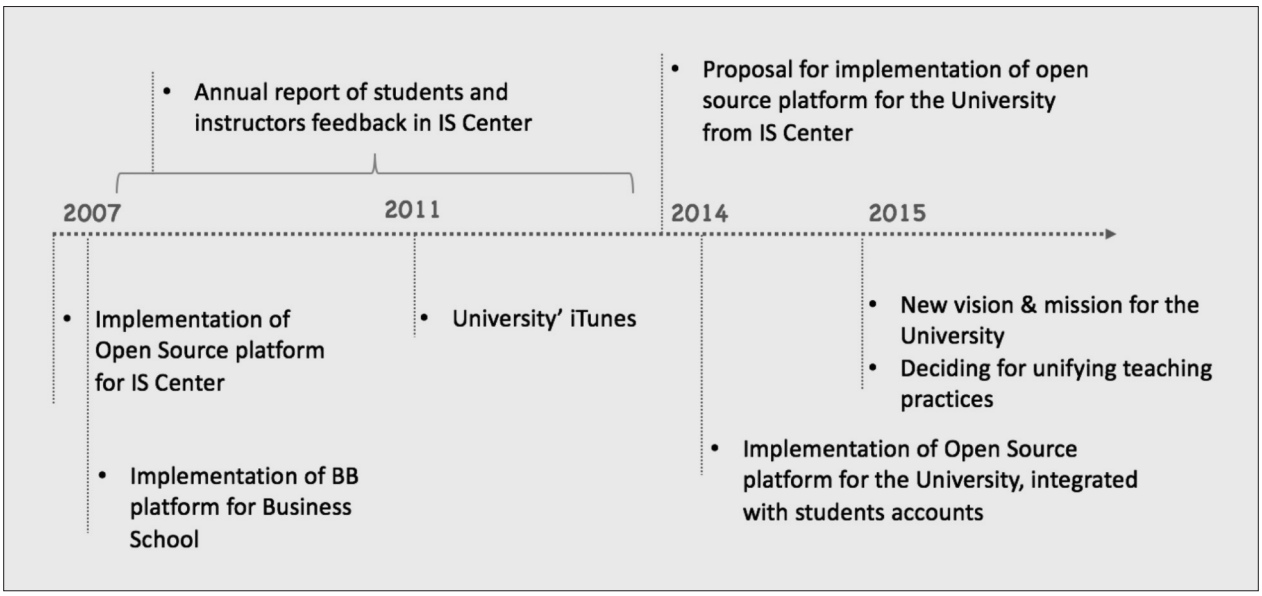


Figure 2 The innovative practices and digital technologies at the University over time

So far, Francesca has not made any decision to unifying the communication channel with students and standardize teaching practices, especially with the growing number of digital solutions in the market. However, she had some struggling questions in her mind. She knew that autonomy in selecting tools and teaching methods based on previous experiences of instructors enable them to better perform in course delivery. But this scattered use of digital solutions has raised many legal and governance issues. First, the University did not have full control over the content of the material shared with students on different channels. Especially when the University has increased the number of visiting, adjunct professors, and practitioners from industries to bring professional experience and expertise to the classroom, it became more difficult to manage and control the dis-

tribution of course material. Some instructors, for instance, openly shared copyrighted versions of course materials. Second, both teachers and administrative staff did not have a complete and easy-to-access representation of students' activities during each course. Third, there was also a privacy issue. What about if an instructor upload or share students' performance like exam results in public accessible sites? To answer these questions, on 21st March 2015, Francesca set a meeting with Carlo, Researcher on Marketing Communication; Piero, Professor of digital innovation; Lorenzo, head of IT Office and Simone, researcher and e-learning expert – see Figure 2. Detailed profile of participants in the meeting is provided in Exhibit 3. Francesca was hoping that the information and insights from them due to their expertise and experience guided her to the right decision.

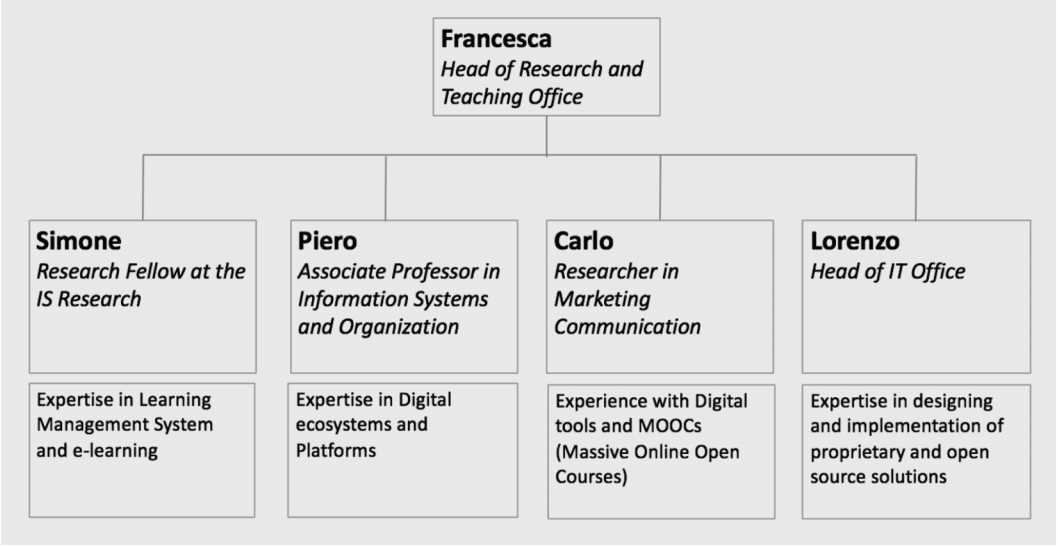


Figure 2 The Team

She initiated the meeting by telling the story that few days ago, on 15th March, during the presentation of a new digital solution for universities by MG company, she realized how different can be the instructors' practices for managing teaching materials and interacting with students. She then highlighted the importance of innovation in teaching methods, especially considering the new mission and vision statements of the University; she explained how unifying all digital practices in one platform would enhance the quality of learning experience for students – see Figure 3. She highlighted the tensions between flexibility, standardization and sustainability of different solutions. She also shared with the team some of her legal and governance concerns.

Figure 4 Unifying teaching practices

Setting the Scene: insights from the Team

Simone, Piero, Carlo and Lorenzo contributed to the discussion regarding the Learning Management System. First, Lorenzo provided the brief summary of the University's IT architecture – see Figure 4. He explained the data layer includes data of students, faculty and administrative staff, as well as teaching materials (textbook, slides, case studies, academic articles, reports, whitepapers, etc.). At application layer, there are email and administrative services to access the Student Secretariat data on registration and installment payments, to book and monitor exam sessions, to apply for the graduation session, and to issue certificates. Lorenzo provided also a picture of IT outsourcing at the University: The University has outsourced some of its non-core IT components to cloud providers (e.g. email system) and has implemented in-house an integrated solution developed by a consortium of universities to support the Student Secretariat. Considering different components in IT architecture, Lorenzo gave a brief description of his role at the IT Office. He explained his role as designing and developing of IT standards to extend the IT architecture with new IT components.

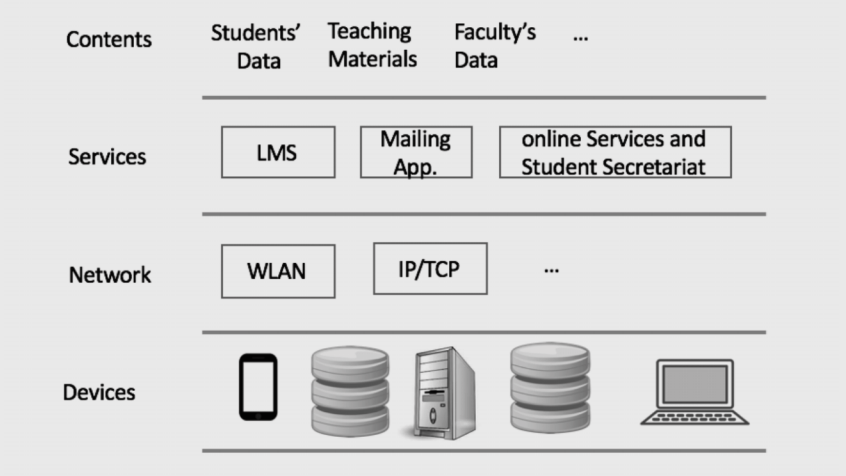


Figure 4 The University IT architecture

Then, Simone introduced four well-known LMS educational solutions considered as benchmarks in Europe and America[7]. Simone illustrated some services and features offered by each LMS solution, and added some comments based on his own experience. A brief description of the four LMS solutions is provided here:

Black Learn

Black learn was one of the leaders in providing of LMS to three sectors; K-12 schools, higher education, corporate and government clients. The experience in education went back to 1997, as the main

7. For more information, see exhibit 4.

business activities of Black Learn. It provided wide range of services to almost 77% of top universities and training organizations (based on the Top 100 of the Times Higher Education World Ranking 2014). It supported more than 1900 institutions, and more than 30 Million users around the world. Black learn offered also a mobile LMS solution for higher education. The mobile LMS was a cloud-based solution accessible via smartphone, tablet and desk PC by students, instructors and administration. The cloud-based solution enhanced the quality of the service by no downtime updates, scalability and flexibility as claimed by Black Learn. Here are the company highlights for the Mobile LMS in higher education:

- For students: accessing course materials remotely, receiving notifications and updates, remote participation to lessons, accessing recorded lessons in format of audio or video, Instant message, online campus visit, etc.
- For Instructors: uploading course materials, previewing content and evaluation of assignments, recording lessons, etc.
- For Staff: sharing the University's news, events and workshops, updating information and calendar, services guide and communication, etc.

Dynamic Learn

Dynamic Learn was born as an e-learning service based on an open source project. The solution has been widely adopted in public and private organizations to manage distance learning processes. However, the company has shifted from free, to pay-per-use pricing model. Thanks to the origin of project, the solution had a community of 200 developers supporting the implementation. Nevertheless, the company offered support services to more than 1300 clients located in 80 countries around the world and operating in 40 languages. The solution allowed to build the didactic contents of the lessons starting from files with the most widespread formats (Word documents, PowerPoint slide, PDF, movies, etc.). It supported managing users in groups and categories. The solution had an advanced reporting system and precise statistics for every user enrolled in a course. It provided different features like SCORM, and communication tools like videoconferencing[8].

Pure Learn

This solution was not a complete LMS but a customized support system of the autonomous creation of didactic materials that integrates functionalities to support the processes of distance education. Pure Learn was provided as a service by a leading publisher and it offered the possibility to include books from the company's catalogs (only in English) and to integrate material produced by the client university[9]. Here is a list of the main features of the system:

- an editorial system able to aggregate educational contents of various sources and nature (texts, multimedia materials, interactive materials);
- a system of disbursement of the educational contents, personalized by the teacher, both in paper form (custom publishing) and in digital form (e-learning);

8. For more information, see exhibit 5.

- a virtual class (assignment, assessment, gradebook) for exercises and checks;
- a scalable project: disciplines and users.

Moodle

Moodle was a free open source LMS with many possibilities of customization. The first version of Moodle (Moodle 1.0) was released in 2002. The growth in number of users, partners and developers collaborating to support the open source project, made Moodle to become a leading LMS platform with more than 69 million users, in 2014[10]. Moodle is a flexible tool that supports teaching activities for many purposes; it can scale up or down to any size, from few to millions of students. The download of the software was free of charge and two options are supported: to operate the software internally by hosting it in the in-house web server of an organization or to install the software in the cloud. The modification, improvement and redistribution of the source code was allowed to any user. Its modular design enabled the integration of plugin and add-on applications even with external ones. It was easy to personalize and configure the Moodle platform based on needs of instructors and students. Moodle was supported by an open and international community of developers. The community forum and virtual collaborative tools enabled developers and users to share knowledge and experience about the platform. This allowed the community to contribute in features development and improvement of Moodle. The community forum enabled, for instance, users and developers to point out issues in security or user privacy and to share experience and potential solutions. Moodle resources included instructions and a collaboration environment to learn how to setup, how to manage and deliver courses in more than 120 languages. Moreover, there were parties offering Moodle as software-as-a-service. Some of the key benefits of Moodle were as follows:

- Cost Saving: Moodle is available for free. However, there are some cost associated with Moodle mainly for implement and support.
- Usability: Moodle is one of the leading open source software in education sector and adopted by many well-reputed higher education institutions around the world. Moreover, the international community engage to improve usability of Moodle by reporting and solving system failures and bugs.
- Level of customization and control: As users can access and modify source code the level of customization and control is higher than in outsourcing.

For educational institutions with limited resources, Moodle offered commercial services through Moodle Partners that support institutions for seamless implementation of Moodle. Simone shared with the team a fact sheet of Moodle – see Exhibit 7.

9. For more information, see exhibit 6.
10. For Moodle's vision and mission statement see exhibit 8.

Solution selection

At this point, Simone emphasized the importance of leveraging on internal competences in IT and -learning for adopting Moodle at University. The team in charge of developing the new LMS, needed special skills not only to implement and maintain the open source software, but also to customize the platform based on the emerging needs of instructors. He shared with the team his experience of creating and configuring the e-learning platform based on Moodle for 90 courses since Feb 2014. Besides, he mentioned the importance of support before and after implementation phase. With a group of IT experts, Simone has designed and formed guidelines and run training sessions for instructors, staff, administrator as well as for the computer support center – see exhibit 9. Having implemented Moodle for the IS Research Center and then for the whole university, Simone reinforces his competences and skills in troubleshooting and solving issues, especially interacting with the online community of users and developers. However, the problem with Moodle during the last exam session was critical. Simone recalled that Moodle has had some bugs before. He knew that Moodle relies heavily on the support of both an IT office (24/7) and an online community. This is particularly important now that Moodle supports more than 60 programs in all departments.

However, Moodle's issues are not limited to software bugs but also to the exposure to large-scale cyber-attacks. That is why Simone shared with Francesca the last report of Moodle's security in 2011, including denial of service and authentication vulnerabilities.

To adopt one single platform, as proposed by Francesca, Simone reframed all mentioned solutions based on two questions; whether the solution is managed internally or externally, and whether the solution is licensed as an open source[11] or proprietary software. He highlighted the first dimension is about sourcing model of LMS (to insource or outsource). Either the University should develop the solution and manage it internally or outsource the LMS platform (i.e. subscribe cloud services rather than develop its own IT resources). Simone provided the team with a comparison of the four e-learning platforms (Table 1).

11. More information on Open Source can be found in exhibit 10

	COST	INFRASTRUCTURE FLEXIBILITY	OWNERSHIP OF THE GENERATED DATA ON PLATFORM	INTERNAL IT COMPETENCES	CONTINUOUS MODIFICATION
BLACK LEARN	COST OF THE SERVICE (INCLUDING LICENSING AND SYSTEM SUPPORT)	POSSIBLE THROUGH SERVICE LEVEL AGREEMENT	POSSIBILITY OF DATA USAGE BY BLACK LEARN	NOT NECESSARY	SUPPORTED BY BLACK LEARN
DYNAMIC LEARN	COST OF THE SERVICE	POSSIBLE THROUGH SERVICE LEVEL AGREEMENT	POSSIBILITY OF DATA USAGE BY DYNAMIC LEARN	NOT NECESSARY	SUPPORTED BY TECHNICAL COMMUNITY AND DYNAMIC LEARN
PURE LEARN	COST OF THE SERVICE	POSSIBLE THROUGH SERVICE LEVEL AGREEMENT	POSSIBILITY OF DATA USAGE BY PURE LEARN	NOT NECESSARY	SUPPORTED BY PURE LEARN
MOODLE	INTERNAL RESOURCES (STAFF) TO BE ALLOCATED TO THE PROJECT	POSSIBLE THROUGH INFRASTRUCTURE CHOICES AND SOURCE CODE MODIFICATION	UNIVERSITY CAN MANAGE INTERNALLY DATA THROUGH AGREEMENT WITH USERS	NECESSARY	SUPPORTED BY GLOBAL COMMUNITY OF DEVELOPERS AND USERS

Table 1 Comparison of four e-learning platforms

While commenting the global LMS providers, Piero highlighted that IT strategy and business strategy should be continuously aligned due to the dynamic, fast changing environment of digital innovations. Moreover, he mentioned that teaching materials and students' data are important assets for University. Therefore, there was a need to choose a proper sourcing practice for the IT infrastructural components (i.e. LMS). In order to align IT and business strategies, he recommended the team to carefully reflect on the two dimensions presented by Simone. Who is going to manage the solution? The University IT Office or an external company? Which license would be preferable? An open source or a proprietary software? Moreover, Piero highlighted that Black Learn, Dynamic Learn and Pure Learn offered cloud-based LMS. Cloud-based services allowed the University to access on-demand services and IT resources via network (see Exhibit 11 for more information on cloud computing). He flipped his presentation and pointed out some pros and cons of outsourcing e-platform to cloud providers in one slide (Table 2).

PROS	CONS
• HAVING MORE TIME TO FOCUS ON CORE COMPETENCIES, AND NOT BEING CONCERNED ABOUT OUTSOURCED ACTIVITIES • ACCESS TO A GREATER KNOWLEDGE BASE AND SKILLED RESOURCES FOR BETTER INNOVATION IN SHORTER TIME • LOWER COST FOR MAINTENANCE • ENHANCE AGILITY AND QUALITY OF DELIVERY OF OUTSOURCED ACTIVITIES • REDUCES CASH OUTFLOW AND OPTIMIZES RESOURCE UTILIZATION • LESSEN SERVICE OUTAGE RISK	• POSSIBLE LOSS OF CONTROL OVER OUTSOURCED PROCESSES • POSSIBLE BUSINESS DISCONTINUING DUE TO LACK OF VENDOR COMPETENCES (DEPENDING ON SLA) • POSSIBLE SHORTCOMINGS IN PERFORMANCE, BENEFITS REALIZATION, RESULTS AND UNEXPECTED COSTS VS EXPECTATIONS • SECURITY, COMPLIANCE AND TRUST ISSUES (OUTSOURCER VS. INTERNAL RESPONSIBILITIES) • VENDOR LOCK-IN

Table 2 Pros and Cons of Cloud Services

Therefore, the team shared inputs with Francesca in particular focusing on cloud sourcing, and prepared answers for the following questions: What are the advantages of outsourcing a service to cloud solution provider? what are the associated risks? How formal contracts and informal relationships with provider influence delivery of cloud-based solutions and facilitate an organization to meet its objectives of outsourcing?

The advantages of outsourcing a service to cloud solution

For the University, the main reasons for outsourcing IT were cost reduction and accessing special expertise and/or resources. Therefore, the University could focus more on its core activities; Teaching and Research. During the meeting, the four alternatives for LMS selection and sourcing were put on the table for an in-depth examination of their implications. For the cloud based LMS offered by Black Learn, Dynamic Learn and Pure Learn, the pricing model was based on fees for specific periods of time. The licensing price offered by Black Learn included support and maintenance activities 24/7. On the contrary, there was no license cost for downloading and using Moodle. However, adopting Moodle the University must carefully take into consideration the costs of implementation, development, support, maintenance and management of the LMS. By adopting cloud-based solutions, the University could better focus on teaching and research activities while students, instructors and administrators enjoy unique experience using various services provided by the service provider.

The risks associated with outsourcing services to cloud providers

The first risk was associated with the level of customization and flexibility of the system. Based on Simone's experience, an open source software is flexible enough to be customized and integrated with other systems being possible to access and modify the source code. While outsourced services are standardized to accommodate the common needs of multiple clients. Moreover, Black Learn, Dynamic Learn and Pure Learn solutions, provide a limited control over data generated by system users. For example, with fast pace of new technologies, what if the University decides to integrate gamification and new collaborative tools, or any multimedia? Moreover, Simone stated that outsourcing LMS to a cloud provider may reduce the internal innovation capabilities.

The second concern was related to security and data breach. By adopting Moodle as LMS, the University needed to protect information security internally. Even if an LMS seldom handles sensitive information, the integrity of exam data and the availability of services are key requirements for such systems. In case of cloud solutions, the service provider is liable for security, maintenance, and updates. Since data from multiple clients are managed by the same system, cloud service providers represent an attractive target for cyber-crime; centralization of data in fact increases the frequency of cyberattacks and increase the overall risks. Therefore, it is important to know the maturity level of cloud service providers in preventing data breaches, reacting to cyberattacks and ensuring disaster recovery and business continuity. The latter is in fact a key concern, especially during exam sessions. What happens if students' project works are not accessible for assessment at the end of the semester? The team noted how delivery and performance of cloud providers depend on clauses, terms and conditions in service level agreements (SLAs).

Last but not least, in long-term, it was important for the University to avoid any lock-in situation with a cloud provider.

The governance modes and outsourcing a service to cloud solution providers
Another important element was to understand how the agreement between the University and the cloud provider influences the performance of LMS, and whether and how it could be defined and negotiated. Service level agreements (SLAs) include key performance indicators (KPI) for the quality of service including the reliability ensured by the cloud provider. In case the University wanted to outsource the LMS to a cloud provider, it was important to understand how much flexible the terms of the SLA are. The team knew for instance that for mitigating the risk of being damaged by a cyberattack, a proper set of KPI and penalties should be negotiated in the SLA definition. What are acceptable terms and conditions for the SLA? Is it possible to customize the standard template of the SLA issued by the cloud service provider? if yes, how much impact this customization has on the cost of the service?
At the end, Francesca needed to make a critical choice with many important implications for the future of the University. Should the University outsource or insource the LMS? is it better to choose an open source or proprietary solution? What benefits and outcomes are associated with each choice? What organizational factors influence this choice? Which solution has the more transformative power and ensure long-term returns in terms of learning experience and innovation?

Conclusions

Different digital solutions promise to enhance the learning experience at the University. Francesca knew that two contrasting requirements were important: a flexible tool to follow the evolution of learning experience requirements and a reliable system to efficiently support a core set of standard practices.
After the first year of Moodle pilot, only a small number of instructors adopted the LMS in their courses. Both Simone and the IT Office were ready to devote additional efforts in promoting the system at University level. However, Francesca was attracted by the proposal of some of the leading companies that offer also assistance and support adoption of the cloud services.
Should the LMS be outsourced or not? Is an open source solution advantageous or not in the long-term? Should the University develop internal capabilities for managing and developing an internal LMS? Which are the implications of such choices? And last but not least, how instructors can be encouraged in adopting a unified system?

Exhibit 1 The proposal and Report of IS center

Subject The proposal and Report of IS research center
From IS research center
To Research and Teaching Office
Date January 2014

Introduction

The digital technologies introduced new learning opportunities such as simulation games, and collaboration tool that foster learning by doing approach. The main research areas of IS research center focus on the role of information and communication technologies (ICT) in different fields, especially in organizational learning, platform strategy, digital innovation, and on the emerging practices of open, distributed and community-based learning. Specially the center has conducted research and experiment on Learning Management System (LMS) as a e-platform supporting teaching and learning processes. The following report is based on experience of implementing Moodle open source system at the IS center since 2007.

Report of IS Center on Open Source learning platform

IS research center has adopted open source system platform to foster innovation in teaching. Studies reveals that the appropriate ICT solution (software and hardware) depends on how and in which context technology is used. ICT solution has to create a learning environment to facilitate the way knowledge is created and circulated, and to support interactions and knowledge exchange. The level of flexibility of technology facilitating the both enhances learning experience[I] .
Before 2007, the IS Center had implemented Spaghetti Learning, as an open source system. However, the feedback from instructors and students were not positive. They mentioned that the platform was difficult to use. Therefore, the IS Center has shifted to Moodle for supporting teaching activities from 2007 (Figure 5). Members of the center have used Moodle for distribution of teaching materials and/or for blended learning. In implementation phase, Moodle provided the complete installation demo and allowed to view the platform from different roles; instructors, students and administrative staff. Based on experience of IS Center, improvement of Moodle relies heavily on community including software developers, certified Moodle partners, and users. Moodle is supported by open collaboration globally (120 languages). Moreover, the layout configuration of platform easily can be

I. North-Samardzic, A., Braccini, A.M., Spagnoletti, P. and Za, S., "Applying media synchronicity theory to distance learning in virtual worlds: a design science approach", *International Journal of Innovation and Learning*, 2014,15(3), pp.328-346.

personalized. Moreover, IS center supported some faculty members to use the e-learning platform, for instance courses on statistics courses at the Department of Political Sciences, online courses by the University Test Center and training activities related to research projects. During this period, IS center support instructors to access and utilize platform features. The IS center experience Moodle platform for 600 courses and provided services for 7000 students – see Figure 6.

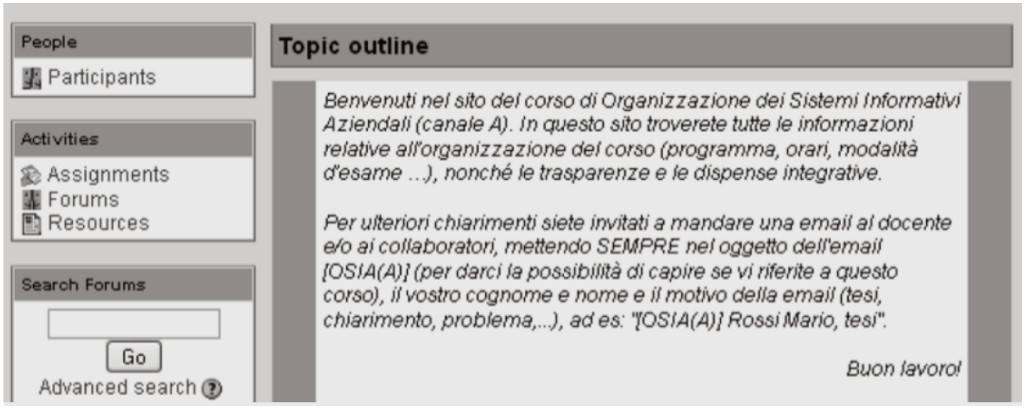


Figure 5 Moodle Platform adopted by IS Center

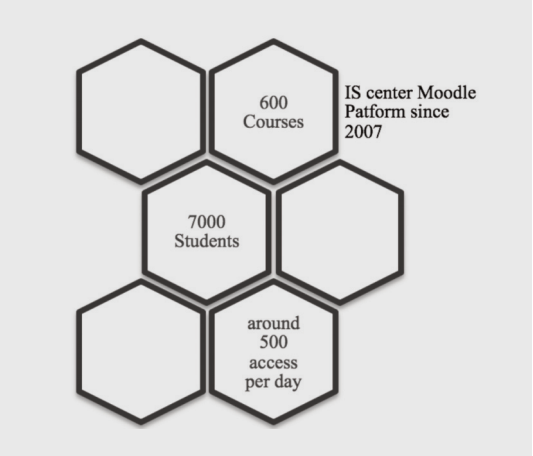


Figure 6 IS Center Moodle Platform at glance

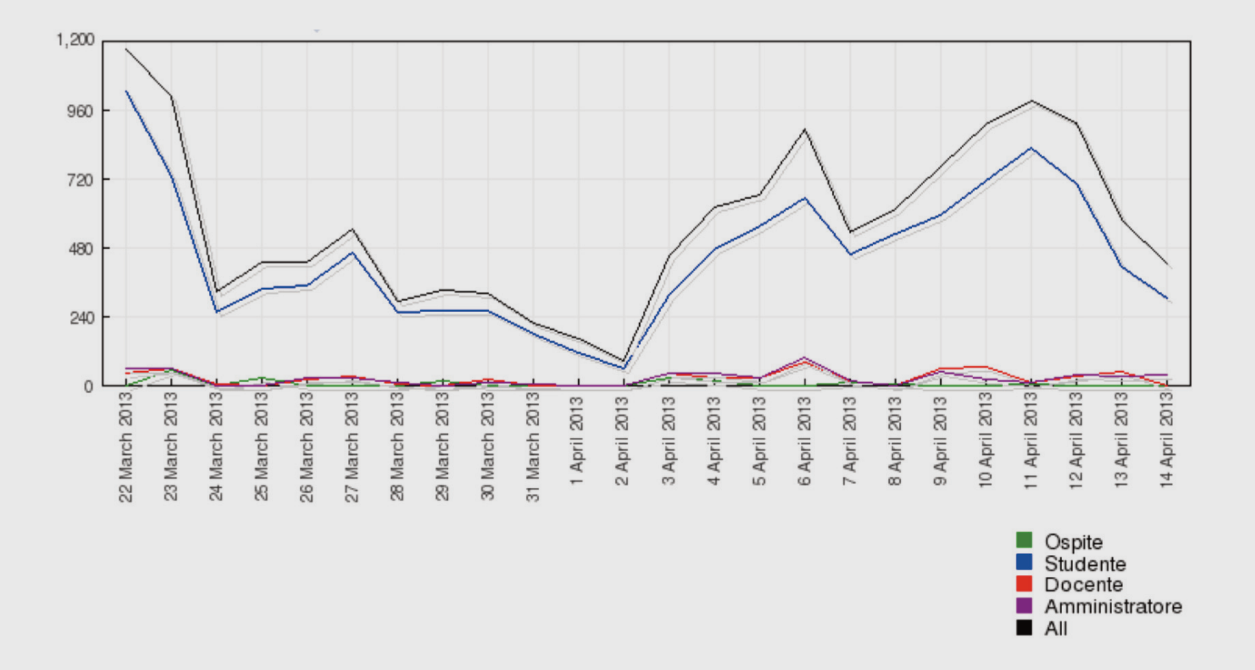


Figure 7 The number of access by students to Moodle platform (IS center)

The proposal from IS center for Moodle

Due to characteristics of open source system, the functionality of Moodle platform relies on several technical capabilities and skills. To mention some:

- basic ICT skills (EUCIP Core certification or equivalent)
- basic system skills (ITAF certification or equivalent)
- installation and customization of the Moodle layout
- user management, roles and training groups on Moodle
- methodological support for teachers on new teaching methods
- technical support for traditional training
- technical support for training provided exclusively through the platform
- support for the creation, acquisition and configuration of Sharable Content Object Reference Model (SCORM)
- creation of activities, exams, feedback of satisfaction and elaboration of the relative results
- production and analysis of reports

Based on experience of the center, implementation and governance are important for successful adoption of learning management system.

For **implementation phase**, the following steps should be taken:

1. Identifying the technical system requirements
The first step was to identify the necessary technical requirements for the installation of the Platform. All technical requirements have been documented by Moodle on the University's server. Considering the experience of IS Center for 600 courses, it was important that the platform support high workloads by introducing new courses. Based on workload and requirement analysis for the system, required infrastructure were determined. The installation environment had to be compatible or adaptable to the requirements of the chosen version of Moodle and expected workload.
A content backup system must be set up. Therefore, the involvement of IT office was essential to ensure that project choices are in line with the University's IT governance policies.

2. Set up Platform
To identify the name of the platform and domain;
To integrate the system with plugs-in applications like;
- Tracking of activities,
- Online checks,
- Conditional activities: objects managed on the basis of the previous actions of the student (completion of activities, achievement of a certain score, etc.)
- Access to external repositories: files on Dropbox, Amazon S3, Google Drive, etc. without the need for loading on the server. Also, the new file selector called *File picker* allows the search and access to files on YouTube, Wikimedia Commons, Flickr, etc.
- Support for Web services: the platform is able to communicate with external services present on the Internet using standard protocols.

3. Platform Layout Configuration
At this stage the graphic configuration can be customized. The representatives of web and communication services is responsible to define and implement platform layout. For seamless experience for students, the alignment of platform layout with institutional websites is important. The graphic layout in details explains the position of logos, type and size of fonts, type of menu etc. It is also possible to activate different modules (news from the platform, news from the LUISS, form for the login, information about courses) and how to place them (in the central body of the page or in the menus lateral).

For governance, the following steps should be taken:

1. Administrative requirements
This phase concerns the definition of the administrative and legal aspects of the platform:
- Copyright policies for content,
- The form of declarations for the privacy and processing of personal data,
- How to enroll and authenticate students in agreement with the secretariat students.

2. E-learning Model

This phase will include all the activities for the definition of the mode and of the use policies of the platform by the instructors. The courses will be categorized and organized based on approved by coordinators of degree programs and academic year. Available features and tools in platform will be identified. Moodle is equipped with two main types of instruments: the resources and the activities. Both make technological support and online action possible for a wide range of school activities. These activities belong to two large families:

- Organizational-logistical support for educational activities to develop the virtual environment of their class and / or their discipline
- Teaching support to carry out functional activities.

Regarding the logistic support, the teacher can:

- Organize educational materials developed in digital format such as texts and handouts, activities and exercises
- Distribute educational content
- Organize the evaluations
- Manage the class also in sub-groups
- Plan educational activities

3. Training

For the introduction to the use of the platform, the following services will be prepared for the teachers:

- Frontal and online training interventions for groups of teachers
- Availability of guidelines for the preparation of educational material
- Individual meetings with teachers for clarification and on-the-job training
- Presentation of courses realized by other teachers of the same area in order to show in practice how the available tools can be used
- Support in the preparation of multimedia material
- Creation of a network of teachers through a discussion forum on e-learning teaching
- Activation of a feedback collection channel for students to manage the
- and any need to extend the scope of experimentation to other teachings.

Following the training period, the teachers, depending on the type of approach, will be able to choose to use Moodle to support:

- Traditional lessons
- Collaborative teaching activities
- Evaluation of student tests
- The development of distance lessons (on-line).

4. Tutoring
After the introduction phase the use of the platform will be accompanied by services tutoring to support teachers during the entire duration of the project. Some service:
- Help Desk mail
- Implementation of a course to support teachers as a communications environment, discussions, requests for clarifications and answers to frequently asked questions
- Documentation on e-learning and on Moodle
- Examples of use of the platform
- Links to Moodle.org forums

Cost Structure

The choice of free and open source Moodle solution as a technology platform allows to reduce the initial costs of acquiring the software tool and allocate resources to cover the costs necessary for carrying out the experimentation. In the following are the main cost items of the project:
- Working group
- Project team
- Infrastructure and IT systems

The costs for the involvement of the working group will depend on the profiles of the referents involved and from the workload agreed with them during the kick-off meeting. These costs are considered as a flat-rate share of indirect costs of the project, being fully paid by the University.
The main cost item of the project concerns the cost of personnel involved in the coordination of activities and support for experimentation (project team). Below is provides an estimate of commitment, divided by work package of the three profiles involved. Daily costs are calculated approximately with refer to the University cost for a researcher (coordinator scientific), a research fellow (e-learning consultant) and a project collaborator (e-learning manager).

Risorsa	WP0	WP1	WP2	WP3	WP4	WP5	WP6	WP7	TOT GG	COSTO GG	TOTALE €
Coordinatore Scientifico	16	2	2	2	2	2	2		28	250	**7000**
Consulente e-learning		10	15	10	5	15	5		60	90	**5400**
e-learning Manager	30	15	20	20	20	25	30	40	200	84	**16800**
Totale									**288**		**29200**

It is a field of expertise that falls within the research interests of the scientific coordinator and e-learning consultant identified, it will be possible to eliminate almost completely these cost items making them fit into the normal service activity performed from the figures involved. In general, it is possible to estimate a reduction on this item of equal cost at around 40%, bringing the total cost of the resources involved in the project team to € 18k.

Finally, from the infrastructural point of view the costs will depend on the choices made in the phase of analysis of system requirements (e.g. hosted domain, cloud services, etc.) and are estimated at € 2k also including any other costs associated with the project (e.g. production of educational material, etc.).

Exhibit 2 The University Mission & Strategy

The School's Overall Mission

The School's mission is to support the growth and transformation of its corporate and institutional partners by providing talents and competencies through its education and research activities, thereby allowing these partners to face present and future economic and social challenges. This approach is unique through an entrepreneurial perspective combined with problem solving; vision nourished by creativity and critical thinking; focus on the importance of sustainability, social impact, and diversity; and understanding of the opportunities provided by digital transformation. The following are defined as key areas and attributes of the School:

Academic and Applied Research
- The School's research is unconstrained by the boundaries of academic disciplines and is grounded in deep and wide knowledge of business practices and environments.
- The School develops and promotes research with a focus on strategy and corporate transformation, corporate governance and performance measurement, and innovation and organizational design.
- The School is committed to pursuing research in ethics, responsibility, and sustainability as a way to engage students and lead the transformation of the business world.
- In the area of applied research, the School cooperates closely with its corporate partners on managerial issues through a wide range of consulting projects (developed upon corporate request).

Leading-Edge Player in Management Education
- The School strives to be a leading institution of higher education and a leading business school in Italy,
- To deliver sound theoretical knowledge as well as soft skills and competencies based on experiential activities and personal leadership.
- To build a bridge between the needs of corporate and institutional partners and the academic world,
- The School trains talented individuals and prepares them for the job market.
- The School is a leader in national rankings in the areas of research, teaching methods, and placement.

Multidimensional Approach to Teaching and Learning
- The School designs its curricula in order to develop students' soft skills, theoretical knowledge, and capacity to relate to other individuals, as well as to learn from experience and determine their own vision for the future.
- The School promotes learning-centric methodologies and undertakes ongoing improvements to pedagogical approaches that combine analytical thinking and relevant digital resources in a blended learning model. These multichannel methods, combined with a *can-do* attitude, nurture our students as innovative leaders.

- Online tools facilitate teamwork, communication, and project management while enriching the educational
- experience at the School.

Linking the Academic and Corporate Worlds
- The School serves as an interface between the academic and business worlds through its long-term partnership with Confindustria.
- Key partners from the corporate, non-profit, and public sectors are directly engaged in the co-creation of specific programmes that advance knowledge of management practices.
- The School encourages an entrepreneurial perspective that understands the international context and role of companies in society while respecting and fostering diversity and intellectual freedom, as well as helping to develop the relevant competencies and skills demanded by the marketplace.

International Focus
- The School develops graduates that are able to see their work through an international lens.
- The School provides a unique international experience to its students, faculty, researchers, and administrative staff through a strong international network that fully supports the School's goals in the internationalization of business and management education.
- Networking activities with top business schools in different parts of the world include programmes for student, faculty, and staff mobility as well as strategic partnerships, including double-degree programmes and joint research.

Ethics, Responsibility, and Sustainability
- The School requires and promotes ethical behavior from all students, faculty, and administrative staff. Integrity, merit, and personal competencies are prerequisites for the School's educational models, selection processes, and intellectual freedom. Diversity in gender, culture, traditions, and beliefs is critical for productive debate that leads to professional and personal development.
- Responsibility is encompassed in the School's goal of anticipating social and economic developments and serving the common good. The School's culture regards students, faculty, administrative staff, and business professionals as agents of change. It promotes interconnections, organized but horizontal networking, and direct actions towards a more responsible business model.
- The School's principle of sustainability inspires its development of teaching, learning, and research.

Location and Facilities
- The School benefits from both independent and university-wide resources to meet the needs of its educational, research, and administrative activities.
- Two beautiful campuses within the city of Rome feature historic architecture and a broad range of dedicated facilities: teaching classrooms, meeting spaces, career services, health services, aca-

demic publishing, a library, and a creative center. Situated in one of the most remarkable and artistic parts of the city, the School mirrors its atmosphere and beauty, and history and culture provide students with a unique environment, employment opportunities, and memorable life experience.

Exhibit 3 Profile of team members

FRANCESCA	POSITION: HEAD OF RESEARCH AND TEACHING OFFICE BACKGROUND: HAS BEEN THE HEAD OF RESEARCH AND TEACHING OFFICE FOR YEARS. REPORTING TO RECTOR AND GENERAL MANAGER OF THE UNIVERSITY.
SIMONE	POSITION: RESEARCH FELLOW AT THE IS RESEARCH CENTER. BACKGROUND: CONDUCTED RESEARCH ON ORGANIZATIONAL LEARNING, BUSINESS PROCESS MANAGEMENT, SOCIAL NETWORK ANALYSIS, SIMULATIONS, E-LEARNING ADJUNCT PROFESSOR IN IS, MEMBER OF PROGRAM COMMITTEES AND REVIEWER FOR NATIONAL AND INTERNATIONAL CONFERENCES IN THE DOMAINS OF INFORMATION SYSTEMS, PHD IN INFORMATION SYSTEMS AND DEGREE IN COMPUTER SCIENCE.
PIERO	POSITION: ASSOCIATE PROFESSOR IN INFORMATION SYSTEMS AND ORGANIZATION AT THE DEPARTMENT OF BUSINESS AND MANAGEMENT BACKGROUND: CONDUCTED RESEARCH ON ARCHITECTURAL AND EMERGENT ASPECTS OF DIGITAL INNOVATION WITH A SPECIAL FOCUS ON CYBERSECURITY, COLLABORATION AND IS DESIGN. ENGAGED RESEARCH ON DIGITAL PLATFORMS PUBLISHED IN TOP IS JOURNALS. PHD IN INFORMATION SYSTEMS, MASTER IN BUSINESS ENGINEERING, MSC IN ELECTRONIC ENGINEERING.
CARLO	POSITION: RESEARCHER IN MARKETING COMMUNICATION BACKGROUND: RESEARCH BACKGROUND MAINLY ON SEMIOTICS, MARKETING COMMUNICATION & CONSUMER CULTURE. EXPERIENCE WITH MOOCS (MASSIVE ONLINE OPEN COURSES) PROJECTS PHD IN COMMUNICATION SCIENCES, DEGREE IN COMMUNICATION SCIENCES
LORENZO	POSITION: HEAD OF IT OFFICE AT THE UNIVERSITY BACKGROUND: COMPUTER SCIENCE ENGINEER WITH 15-YEAR EXPERIENCE IN OPERATING COMPLEX IT INFRASTRUCTURES INCLUDING THE DESIGN AND IMPLEMENTATION OF PROPRIETARY AND OPEN SOURCE SOLUTIONS WITH START-UPS AND ENTERPRISES

Exhibit 4 LMS Market

To innovate teaching and learning experience, many educational institutions adopt LMS. There are various solutions and types of LMS have been introduced in last years (see Figure 8).
Adopting LMS in educational institutions leads to better sharing and accessing learning content, unifying learning resources, managing assignment and feedback to students.

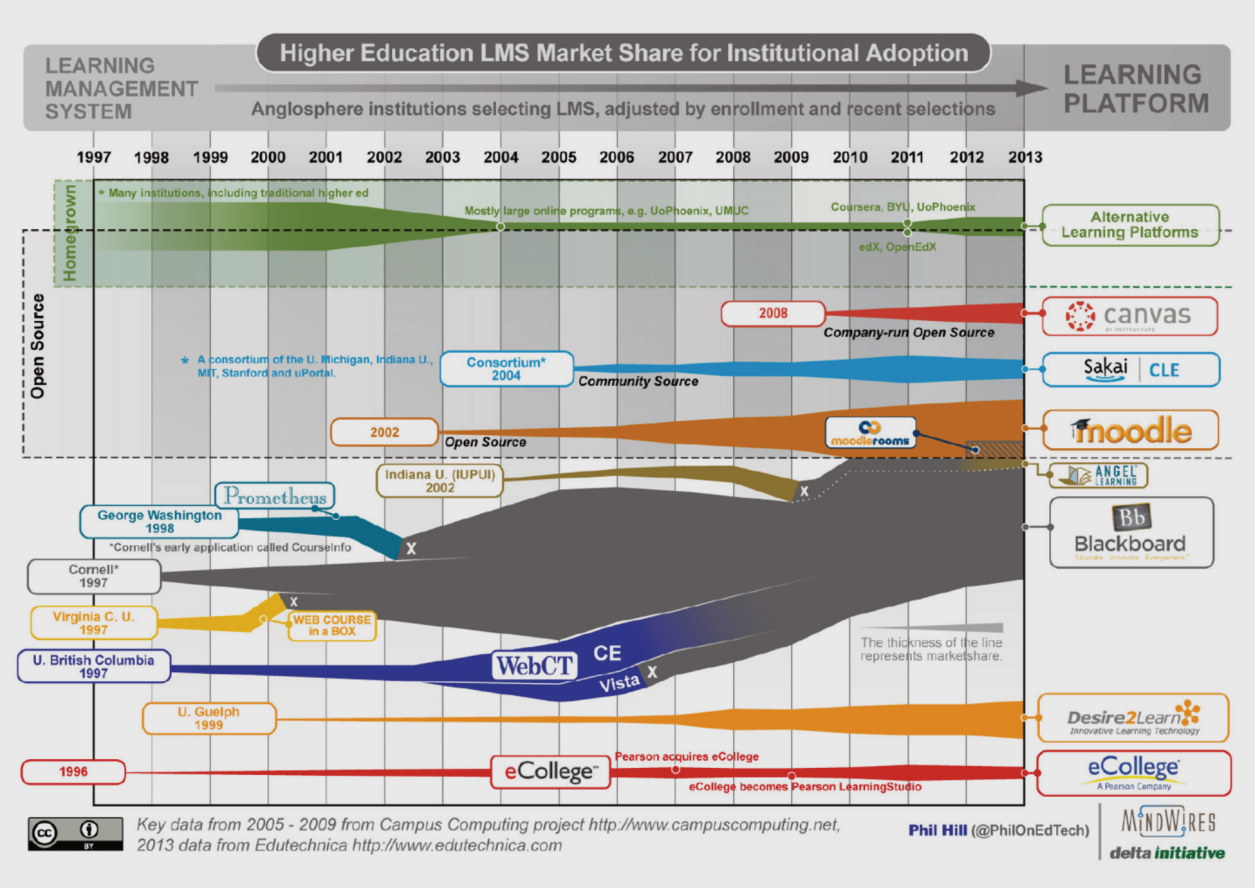


Figure 8 LMS Market over years

Instructors highlight the following reasons to use LMS features;
- Sharing content
- Receiving, Monitoring and Managing assignments
- Engaging and interacting with students

Students list the number of reasons to use LMS features as follows;
- Accessing course content
- Submitting and managing course assignments reliably

- Checking course progress
- Receiving feedback on course assignments
- Accessing information and news
- Engaging and interacting with instructors
- Engaging and interacting with other students
- Collaborating on projects in groups

To meet the need for students, the LMS providers have undergone continues improvement to provide personalized LMS by adopting new technologies: more user-friendly interface; access to different resources; consolidated interface; communication tools (social group discussions and forums to communicate with other students); access to multimedia, Mobile access (see Figure 9 and 10), etc. Due to changing demands of students, thus, long-term contracts with providers is not preferable for educational institutions. They opt adopt LMS with lower switch cost and lock-in risks in order to meet the changing needs of students.

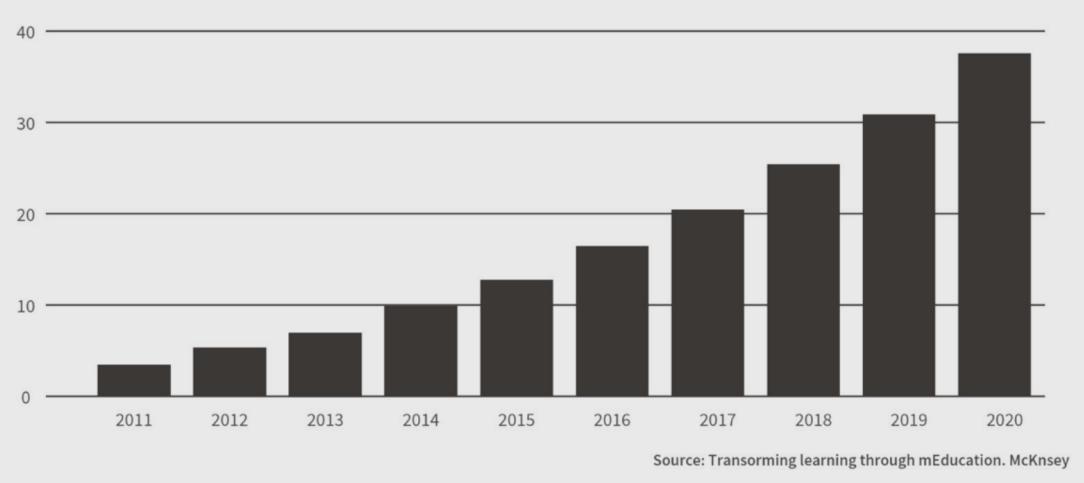


Figure 9 Mobile learning trend by 2020

Figure 10 Millennials use of smartphones

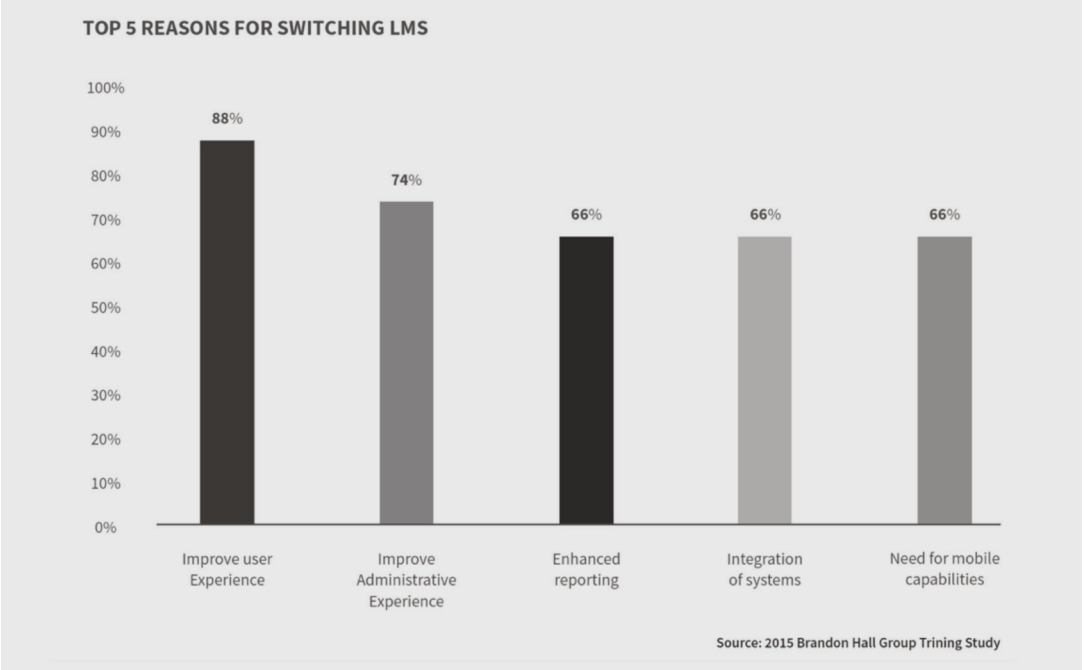


Figure 11 Top reasons that educational institutions switch to another LMS

Exhibit 5 Dynamic Learn

Dynamic Learn

Established in 2005, Dynamic Learn offers LMS to improve learning experience. The LMS is based on Software as a Service (SaaS) which offers high scalability and unlimited storage for courses and bandwidth with no extra fees. The LMS allows institutions to organize, track and distribute courses formally, and enhance informal learning by interactive and collaborative tools. The primary customers of Dynamic Learn are midsized enterprises (around 1,400 enterprises globally), however, the system can be used for Large and Small enterprises.
Custom branding is feasible: institutions can add their logos, color scheme, domain and customized layout.
The use of artificial intelligence allows users to personalize the learning experience. Moreover, adoption of automation tools reduces significantly the administration time. The system is compatible with the most international standard (e.g. SCORM).
Some other benefits:
User friendly
Accessibility (mobile learning scenarios)

- Flexible pricing plans
- Smart reports of user performance
- Enable institutions to provide digital training certificates
- Easy add-on applications like social networks, Content Management System websites, Google Apps and Google Analytics.

Exhibit 6 Pure Learn

Pure Learn

Although the core business of Pure Learn is mainly on publishing and creating contents (i.e. books), the company has embraced technologies such as artificial intelligence and algorithms to enhance learning outcomes. The Pure Learn provides students with an adaptive learning experience that can be tailored based on the students' needs. The teaching materials are accessible from multiple devices. For instructors, Pure Learn allows to enhance interaction with students. It allows students to read contents using the eBook format, so they can highlight and make comments. Moreover, the platform supports rich media content like video, text, audio files. It provides students with feedback on their individual performance. The system suggests students' resources and give feedback on each question for more accurate assessment.
Finally, Pure Learn offers training and support to instructors and it can be easily integrated with other LMS.

Some facts about Pure Learn:

- Students Marks increased by 15%
- Student Performance increased by 94%
- Student Learning Rate increased by 15%
- Partnered institutions1, 1500+

Exhibit 7 Moodle 2014 Fact sheets (Source: Moodle.com)

Table 3 Moodle Statistics 2014

REGISTERED SITES	53,074
COUNTRIES & TERRITORIES	229
COURSES	7,533,753
USERS	69,559,411
NEW DISCUSSION ON MOODLE.ORG FORUMS	21,089
QUIZ QUESTIONS	272,793,476

Table 4 Moodle Plugins in 2014

PLUGINS REACHED IN TOTAL	964
NEW PLUGINS IN 2014	239
PLUGIN DEVELOPERS REACHED IN TOTAL	652
MILLION DOWNLOADS OF PLUGINS IN 2014	3.9 MILLION

Table 5 Moodle Development in 2014

ISSUES WORKED ON	2067
SECURITY ISSUES	52
COMMITS FROM 155 OTHER DEVELOPERS	955

Exhibit 8 Moodle's Mission and Vision

Moodle' Mission Statement[II]

Our Mission
The mission of the Moodle project (including Moodle HQ and all Moodle software) is:
Empowering educators to improve our world.

Our Vision
Our goals for the future are simple:
To give the world the most effective platform for learning.

Our Values
These are the values that we encourage each other to uphold, for the good of the educators we serve and each other:

- Education: education is the foundation of making the world a better place. We, our teachers and our students all need to be always learning and looking for ways to improve how we learn.
- Respect: we treat everyone with respect and sensitivity, recognizing the importance of their contributions: team members, customers, partners, suppliers and competitors.
- Integrity: we employ the highest ethical standards, demonstrating honesty and fairness in every action that we take.
- Openness: our goals, our tools, our processes and our results shall be open as much as is practical. Our team members are encouraged to speak openly and communicate freely both internally and externally.
- Innovation: we encourage a culture of experimentation and research, where entrepreneurship and prudent risk-taking are encouraged, rewarded and incorporated.

II. Source: Moodle.org

Exhibit 9 Activities carried out in Pilot implementation of Moodle

Subject	Activities carried by IS center From February 2014 till September 2015
From	IS research center
To	Research and Teaching Office
Date	Sept 2015

- Platform configuration, creation of categories and sub-categories containing the various courses.
- Creation of over 120 users for teachers (teachers and assistants) and over 90 courses, in response to the communication made at the beginning of the second half of 2014 regarding the possibility offered to all teachers to experiment with the Moodle platform.
- Creation of an introduction to Moodle course, continuously updated
- Support to some teachers for the creation and configuration of the course and for the loading of contents
- Creation of a first version of the document containing the guidelines on the use of specific features of Moodle.
- Analysis of the requirements and functionalities available on Moodle (including any plugins to be installed) for the creation and configuration of ad-hoc questionnaires (with related textual and graphic reports)
- Generic support for platform administration needs (evaluation of specific plugins, activation of advanced features, updates, etc.)
- Supporting the Linguistic Center at the University for the creation of an experimental course in which the SCORM test modules created.
- Personal training for Linguistic Center to be autonomous in the management of sub-categories and courses
- Two half-day courses for Linguistic Center teachers on the use of the platform, course configuration and content management.
- Configuration and management of email accounts
- Creation of the e-Skills course, loading and configuration of SCORM content, and its integration with the other courses
- Interaction with the University computer support to solve problems of a mainly technical nature (e.g. student authentication malfunction)

Exhibit 10 Open Source Software

Open-source software (OSS)

The concept of Open Source was coined in 1997 – see Box 1 for more information on Open Source – as opposite to proprietary software (PS). In Open Source software (OSS), source code is released under a license allow the users to access the source code and the rights to change, improve, enhance functionality and redistributed the codes (see some examples of Open Sources in Table 6).

WEB BROWSER	MOZILLA FIREFOX
WEB SERVER	APACHE
APPLICATION SERVER	JBOSS, APACHE TOMCAT
E-MAIL/ COLLABORATION	XIMIAN EVOLUTION
DATABASE	MYSQL, POSTGRESQL

Table 6 Source: Ravi Sen, 2007, Journal of Management Information Systems

The availability of the source code for free allows contribution from software developers, independent contributors, and public users resulting in adoption by multi users around the world. Open Source software is a form of collaborative innovation that allows software developer and other users to modify, correct any bugs and use it according to their needs. This open collaboration facilitates innovation.

But what are the motivation of different groups of programmers and users that spend hours and efforts, and reveal source code? The study of Bonaccorsi & Rossi (2003)[12] lists some of the non-pecuniary motivations of users contributing in open source project:

- In collaborative project, individuals demonstrate their capabilities and skills, therefore, they gain recognition in the community
- The complexity of open source project enhances the competences of developers and creativity.

Moreover, Andersen-Gott et al. (2011)[13] illustrate the proclivity of companies in open source projects (see Table 7).

12. Bonaccorsi, A. and Rossi, C., "Why open source software can succeed", *Research policy*, 2003, 32(7), pp.1243-1258.
13. Andersen-Gott, M., Ghinea, G. and Bygstad, B.,"Why do commercial companies contribute to open source software?", *International journal of information management*, 2012, 32(2), pp.106-117.

Motivational factors for companies contributing to FOSS.

Motivational factor	References	Competitive advantage
Building greater innovative capability	von Krogh (2003), Dahlander and Wallin (2006), von Hippel and von Krogh (2003); Bonaccorsi and Rossi (2006), Chesbrough (2003), Kline (2003), von Hippel (2001) and Ebert (2007)	Being able to offer new products, better or faster than competitors
Selling complimentary services	Watson et al. (2005), Dahlander (2005), Dahlander and Magnusson (2005), Dahlander and Magnusson (2008), Pykäläinen (2007), Watson et al. (2008) and Lerner and Tirole (2002)	Specializing in a market niche, to sell services to companies that use FOSS products
Cost reduction	Ågerfalk and Fitzgerald (2008), Hawkins (2004), Cook (2008), Pisano and Verganti (2008), Tapscott and Williams (2008) and Howe (2008)	Using FOSS to lower development and maintenance costs

Table 7 Motivation for companies in OSS (Source: Andersen-Gott et al., 2011, International Journal of Information Management)

Box 1 The Open Source Definition[III]

Introduction
Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:

1. Free Redistribution: The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code: The program must include source code and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost, preferably downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

3. Derived Works: The license must allow modifications and derived works and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code: The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups: The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavor: The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License: The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product: The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

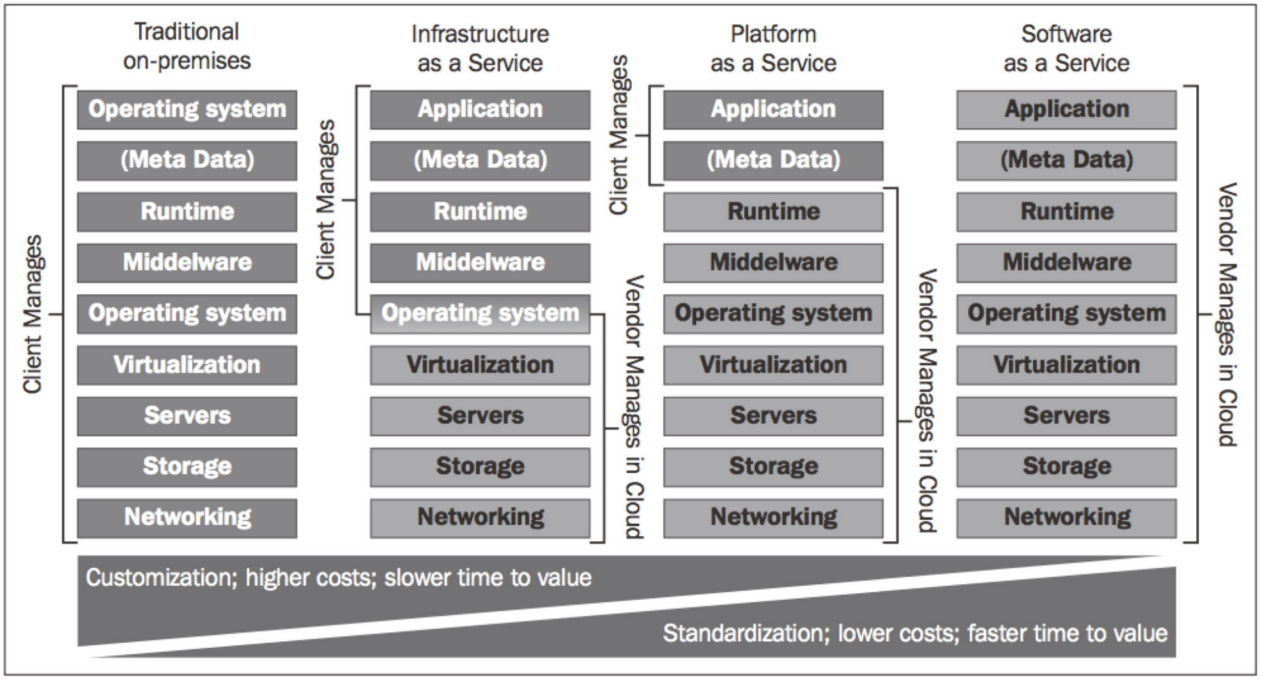
9. License Must Not Restrict Other Software: The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

10. License Must Be Technology-Neutral: No provision of the license may be predicated on any individual technology or style of interface.

III. Source: https://opensource.org/

Exhibit 11 Cloud computing and service level models

Cloud commuting as new outsourcing model enables accessing to computing resources as a software solution via internet, based on pay-per-use model (Mell & Grance, 2011)[14] . Cloud computing enables corporate to have remote access and share information while not relies on huge physical infrastructure.



Source: IBM

Cloud computing service level models are:
Infrastructure as a Service (IaaS): At IaaS level, providers of cloud computing offer infrastructure and enable the corporate to manage applications and programs by its own. The cloud provider manages and controls infrastructure while the control of operation system, storage and applications are in hand of the consumer like Amazon's S3 as storage service
Platform as a Service (PaaS): At PaaS level, providers of cloud computing offer infrastructure and platform where the user can develop and manage applications without the need to build the infrastructure around it by enabling integration of different application components. The cloud provider manages and controls infrastructure and operating system while the consumer is responsible for application mainly. The consumers are able to control and manage software through internet like Microsoft's Azure services platform or Google App Engine.
Software as a Service (SaaS): At SaaS level, providers of cloud computing control and manage the infrastructure, platform and application, where applications can be accessed from various

14. Mell, P. and Grance, T., "A NIST definition of cloud computing", 2011.

devices using a thin interface like Google Apps. Moving from IaaS to SaaS cloud solutions, an organization gain benefits of lower implementation cost while lose control on its data. SaaS is a new form of application service provision (ASP) and business service provision (BSP). SaaS model is becoming attractive for organizations specially for SMEs due to lower cost and ease of deployment. The report from Gartner shows SaaS would continue to grow and reach $32.8 billion in 2016[15].

Cloud deployment models are (Mell & Grance, 2011):

- Public: Public cloud is based on shared service environment neither or low level of control over data.
- Hybrid: In hybrid cloud consumer can use public cloud for scalability and cost convenience as well as private cloud for storing sensitive data.
- Private: Private cloud is provided based on contract with higher level of control over data by cloud client.

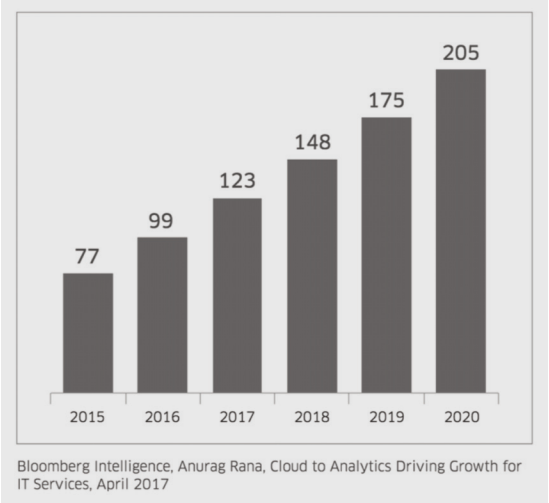


Figure 12 Public IT Cloud Spending ($Billions)

	2016	2017	2018	2019	2020
Cloud Business Process Services (BPaaS)	40,812	43,772	47,556	51,652	56,176
Cloud Application Infrastructure Services (PaaS)	7,169	8,851	10,616	12,580	14,798
Cloud Application Services (SaaS)	38,567	46,331	55,143	64,870	75,734
Cloud Management and Security Services	7,150	8,768	10,427	12,159	14,004
Cloud System Infrastructure Services (IaaS)	25,290	34,603	45,559	57,897	71,552
Cloud Advertising	90,257	104,516	118,520	133,566	151,091
Total Market	209,244	246,841	287,820	332,723	383,355

Source: Gartner (February 2017)

Table 8 Worldwide Public Cloud Services Forecast (Millions of Dollars)

15. Columbus, L. 2013. "Gartner Predicts Infrastructure Services Will Accelerate Cloud Computing Growth," *Forbes*, February 19.