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MASSIVE OPEN ONLINE COURSES (MOOCs): TRENDS AND FUTURE PERSPECTIVES

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This paper sheds light on Massive Open Online Courses (MOOCs) as a novel opportunity to learn, and presents distinct features and recent trends in MOOC enrolment and provision. It analyses the implications and main issues arising from the emergence of MOOCs from the perspective of higher education institutions, learners and the government. The paper also explores four questions regarding the future role of MOOCs in their capacity to: 1) substitute regular courses in higher education; 2) present a new model for professional development; 3) advance educational research; and 4) facilitate a more equitable access to (higher) education in OECD countries and beyond.

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TABLE OF CONTENTS

Tables

Figures

Boxes

MASSIVE OPEN ONLINE COURSES (MOOCS): TRENDS AND FUTURE PERSPECTIVES

1. Introduction

There are numerous ways through which information and communication technologies (ICTs), the internet and digital technologies can support and improve education and learning. Alongside e-learning and open educational resources, massive open online courses (MOOCs) recently emerged in the educational landscape providing additional learning opportunities for individuals, education institutions and teachers. MOOCs can be described as online distance courses that are free of charge and that can be accessed by everyone without entry requirements (see box 1). One of the distinct features of MOOCs is their 'massive' aspect: in 2015, 35 million students worldwide enrolled in a MOOC – that is the equivalent of the total number of first-year tertiary level students in all member countries of the European Union and the United States combined.

The popularity of MOOCs can be explained by the many advantages they offer to learners on the one hand and higher education institutions on the other. Learners tend to appreciate the flexibility and easy access to a wide array of courses at no cost. Higher education institutions benefit from increased international visibility, a reputation of offering presumably high-quality courses and the opportunity to experiment with new technologies. At the same time, first studies show that MOOCs work well for the most disciplined and organised learners, while others tend to drop out more quickly or do not engage much with the content. MOOCs tend to be based on rather traditional forms of content delivery and so far, higher education institutions do not seem to have exploited the emergence of MOOCs to experiment with new pedagogies and design and offer a better delivery of course content.

To ensure sustainability, the concept of MOOCs is likely to change in the future. The principal idea of MOOCs is to "provide universal access to the world's best education"[1] i.e. allowing anyone with an internet connection to enrol in a course of choice and subsequently receive a certificate of completion proving that a minimum level of understanding of the course material has been reached. Because of the very high cost of creating and maintaining a MOOC, however, providers increasingly rely on fee-based credentials. MOOCs are likely to be more integrated in face-to-face programmes in the future, with some enrolment restrictions, tutorial support and facilitation options and may require a fee for enhanced services and assessment.

In a rapidly changing technological environment, higher education institutions and MOOC platform providers are still in an experimental phase of identifying a useful, efficient and sustainable form of MOOCs. As most MOOC users are already employed, some promising trends with a successful business model could be observed in MOOCs for the purpose of professional development. At the same time, higher education institutions are starting to offer credit for MOOCs to enrolled on-campus students but progress has been limited so far.

If MOOCs are to become a more integrated element in higher education, with the possibility of systematically awarding credit or even academic degrees, this would inevitably raise questions related to the future model and role of higher education. In a sense, MOOCs could then be seen as a flexible form of online delivery mixing degree-seeking and certificate-seeking students. While MOOCs may not be a disruptive innovation, their emergence presents itself as an opportunity to improve pedagogy in higher education and induce an uptake of technologies in teaching and learning.

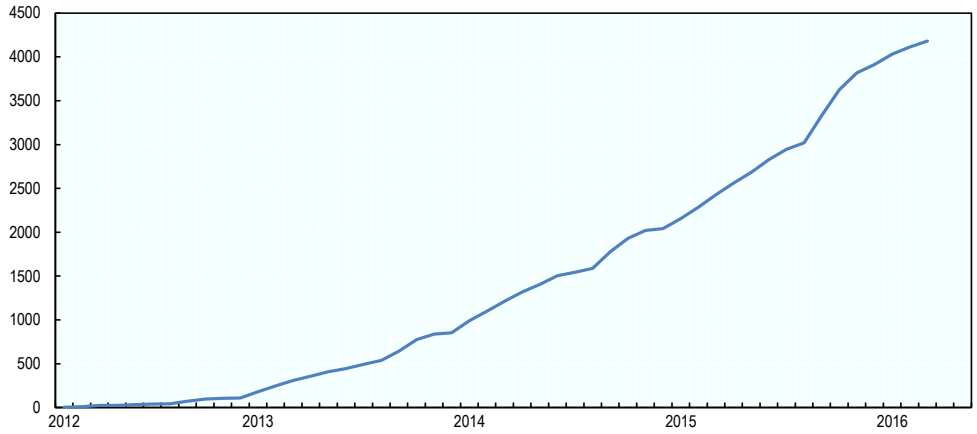
[1] www.coursera.org

This paper sheds light on the distinct features of MOOCs as a novel opportunity to learn and analyses some of the recent trends in enrolment and provision. It examines the implications arising from the emergence of MOOCs from the perspectives of higher education institutions, learners and the government and sketches a few possible scenarios for the future usage and role of MOOCs.

2. MOOCs in practice: trends in enrolments and provision

Massive Open Online Courses (MOOCs) have gained a lot of attention in recent years. Since their emergence in 2012, the number of registered users has significantly increased to 35 million students in 2015 up from an estimated 16-18 million in 2014 (Shah, 2015). In early 2016, 4200 MOOCs were available - more than the preceding three years combined (see figure 1).

Figure 1. Number of MOOCs, 2012-2016



Source: Class Central, 2016

In 2013, 7.8 percent of internet users in the European Union followed an online course against 4.7 percent in 2007 (see figure 2). This increase was generalised across countries, and shares more than doubled in some of them. On average, for the 30 OECD countries for which data are available, 9.4 percent of Internet users followed an online course in 2013. This percentage varied from 40 percent in Korea and 33 percent in Canada, to less than 4 percent in Austria, the Czech Republic, Japan and Poland (OECD, 2014).

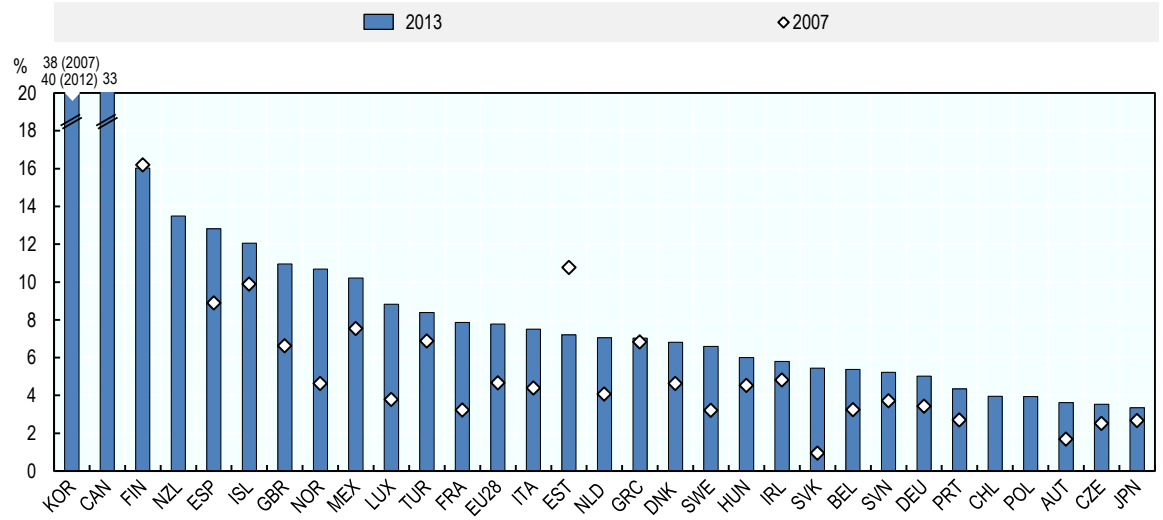
MOOCs are designed as full courses (i.e. with full learning environments) meaning that they combine content with discussion forums and assessment tools (Orr et al., 2015). Most MOOCs consist of a mix of digital teaching tools (videos, audios, graphics or slides) with subsequent quizzes and tests to ensure that the course material has been understood. MOOCs vary greatly in their level, content, and degree of demand of the learner. Some are very short and light introductory courses, in atypical university degree subjects (e.g. Ignite Your Creativity, Coursera), whereas others are essentially full university courses converted into a MOOC format (e.g. Algorithmen und Datenstrukturen, iversity).

MOOCs can be found on almost any topic: from language and coding courses, to biology and life sciences and even for personal development and the learning of musical instruments. The largest share of courses is taken in subjects related to business and management (see figure 3) while other fields of studies are relatively evenly represented. When combining subjects related to science, computer science, mathematics, engineering and programming (40 percent), they outweigh social sciences and humanities (20 percent).

MOOCs emerged as a new form of distance learning in line with other developments such as e-learning or open educational resources, which have been defined as "digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research" (OECD, 2007). Given that online distance learning has been in use for many years, what exactly distinguishes MOOCs from previous forms of online distance learning? What type of student takes MOOCs and who are the providers?

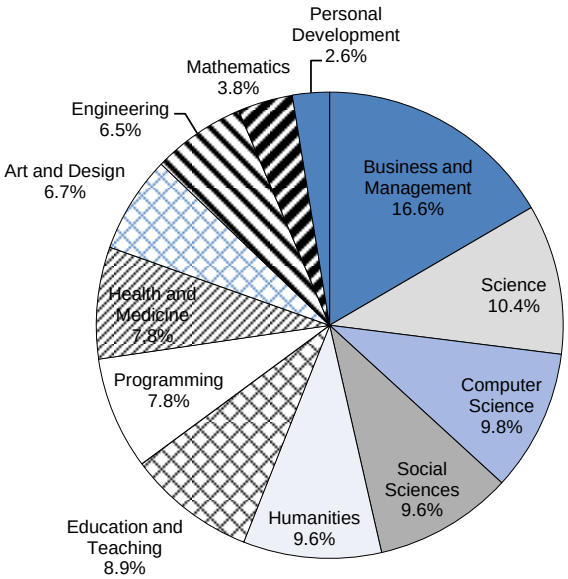
Figure 2. Individuals who attended an online course, 2007 and 2013

As a percentage of individuals who used the Internet in the last three months



Source: OECD, ICT Database and Eurostat, Information Society Statistics, May 2014.

Figure 3. MOOCs by subject, 2015



Source: Class Central, 2015

2.1 What's new?

As already mentioned above, MOOCs can be described as online distance courses without entry requirements and that can be accessed by anyone at no cost. A major difference between MOOCs and more established online learning courses is that MOOCs are equally accessible by enrolled university students and any other individual interested in the course topic and material. The terms 'massive', 'open', 'online' and 'course' are defined in more detail in box 1. As MOOCs offer similar advantages and challenges as other forms of learning, it is useful to differentiate MOOCs from other forms of online distance learning.

Box 1. Defining Massive Open Online Courses

- ***M: Massive***

MOOCs are massive, in theory at least, because they provide unlimited access to courses i.e. anyone with an Internet connection who wishes to participate in a course can do so. The pedagogical model is tailored to accommodate a large number of learners in the sense that an addition of students does not necessarily imply an increase in teachers or student support. A massive number of students is planned for at the outset and during the design of the course.

- ***O: Open***

The term 'open' is not so clearly defined. It can mean that the course 1) is free of charge, 2) accessible to anyone with adequate technology and/or 3) there are no enrolment restrictions (i.e. 'open' enrolment). In MOOCs, variations of these terms are possible, for example, when courses are offered for both credit-seeking students and anyone else who is interested.

Open can also mean open access which implies that some instructors intend for the course materials to be freely available to others to reuse and adapt. These courses and their materials tend to remain open and available after the course ends. Some MOOCs, however, specifically those offered through platforms such as Coursera and edX, are copyrighted and thus access to the course is often closed after its completion, and the materials are removed from public view. Thus there are variations among MOOCs as they relate to this concept of 'open' as well.

- ***O: Online***

MOOCs are offered online. That is, the course is delivered completely over the Internet, with no face-to-face meetings, allowing students from multiple locations to access the course. Some instructors, however, have begun to offer what they call blended or hybrid MOOCs, in which students do part of the work on-campus and other parts online.

- ***C: Course***

A MOOC is a course in the sense that it is a self-contained instructional unit with a content organised around a limited amount of information in a specified content area. A MOOC can last from a few weeks to a full semester or longer. In a MOOC there is a syllabus, and students typically engage with content and complete built-in assignments, assessments, and evaluations.

In the literature, two distinct pedagogical forms of MOOC are discussed cMOOCs and xMOOCs. The early MOOCs were 'connectivist', described as cMOOCs, due to the focus on creating mass communication and interaction. The more instructivist models have been labelled xMOOCs. These tend to employ a knowledge transmission model, through video recordings of classroom lectures or custom produced mini-lectures. These may feature famous professors from highly reputed universities. Online participants learn autonomously without (necessarily) much focus on creating social interaction.

Source: Major and Blackmon (2016)

While the different features that characterise MOOCs have already been available in previous forms of learning, it is the combination of different features that sets them apart from other forms of online distance learning and thus brings some novelty to the educational landscape (Belleflamme and Jacqmin, 2016). For example, OpenCourseWare already made educational material available online at no cost and without entry requirements (OECD, 2007) but did not provide certificates. For-profit universities and Open Universities on the other hand have already been offering certification to their students upon course completion before the emergence of MOOCs. The interaction between the learners and the platform and among the students themselves is often advertised as an added value of MOOCs. However, learning management systems such as Blackboard or Moodle have already been in use to facilitate the interaction between students and teachers and thus support more traditional courses.

MOOCs attract a very large number of students. For the most popular MOOC in 2015 "Understanding IELTS: Techniques for English Language Tests", a total number of 440.000 students signed up (Shah, 2015). The easy and flexible access free courses, in many cases offered by well-known professors in prestigious universities in the United States, partially explains the very large number of sign-ups. Also, earlier efforts involving online learning may have lacked what the advances in technology have now provided in terms of appealing presentation and design. However, it has been argued that educational programmes transmitted on TV and/or on the radio had already been available to students around the world at a low cost long before the emergence of MOOCs (Kearney and Levine, 2016).

Also, the very large number of sign-ups, however, needs to be interpreted with caution. Since registration is necessary to view the course content, many users sign up and dropout without engaging much with the course content. On the MOOC platform provider edX, about 35 percent of registered users never engage with the content (Ho et al., 2015). The terms 'enrolment' and 'completion' may thus require a novel interpretation with respect to MOOCs.

2.2 Who are the MOOC students?

Representative data on the characteristics and socio-economic background of MOOC students is scarce. MOOC platforms occasionally publish ad-hoc data on a subsample of students. Edx, for example, published data on its MOOC students enrolled in a course in 2012-2013. Based on this data, the average MOOC student is male, around 30 years old and lives in the United States or in Europe, although nearly half of all students resided in other regions (see table 1). Across all countries or regions of origin, the majority of MOOC users on the edX platform have completed at least a Bachelor degree (see Figure 4).

Since not all MOOC platform providers publish data on their users, researchers have attempted to analyse trends based on non-representative subsamples of MOOCs. Based on a literature review, Glass et al. (2015) examine MOOC student demographics and identify similar trends on age, gender, education level, employment status, socio-economic status and country of origin:

- **Age.** Most MOOC students are around 30 years old. However, the number of students enrolled in HarvardX and MITx open online courses aged 30 and older rose from 40 to 47 percent between 2012 and 2014 (Ho et al., 2015).

- **Gender.** The majority of MOOC students are male. Depending on the study the male share of students can make up to 70 percent. However, the number of female students enrolled in HarvardX and MITx open online courses rose by 15 percent between 2012 and 2014 (Ho et al., 2015). Ho et al. (2015) distinguish female participation by course category and find that: 1) 17 percent of students enrolled in Computer Science are female; 2) 23 percent in Science, Technology, Engineering, and Mathematics; 3) 45 percent in Humanities, History, Religion,

Design, and Education; and 4) 39 percent in Government, and Health and Social Sciences. Once enrolled, female students complete certificates at the same rate as male students (Ho et al., 2014).

- **Education level.** At least 60 percent of MOOC students have completed at least a Bachelor degree. The share students enrolled in MITx and HarvardX courses having completed at least a Bachelor degree rose by 10 percent between 2012 and 2014 (Ho et al., 2015).

- **Employment status.** More than half of MOOC students are employed full-time or self-employed. Ho et al. (2014) find that 40 percent of learners who take a MOOC are teachers.

- **Socio-economic status.** MOOC students live in affluent areas. The analysis of the location of HarvardX students based on zip codes by neighbourhood census block showed that students login from neighbourhoods with an average income of USD 70,646, significantly higher than the average for the general U.S. public of USD 57,642 (Hansen and Reich, 2015). Among those who did register for courses, students coming from areas with greater socioeconomic resources were more likely to earn a certificate. The educational disparity is even stronger in emerging economies. In Brazil, Russia, India, China and South Africa, 80 percent of MOOC students come from the wealthiest and most well-educated 6 percent of the population (Emanuel, 2013).

- **Country of origin.** About one third of MOOC students are from the United States and another one-third live in Europe, with increasing participation from Asia, especially China and India. The share of students from non-English speaking countries is likely to increase as MOOCs are becoming more diverse in terms of language and culture (Shah, 2015).

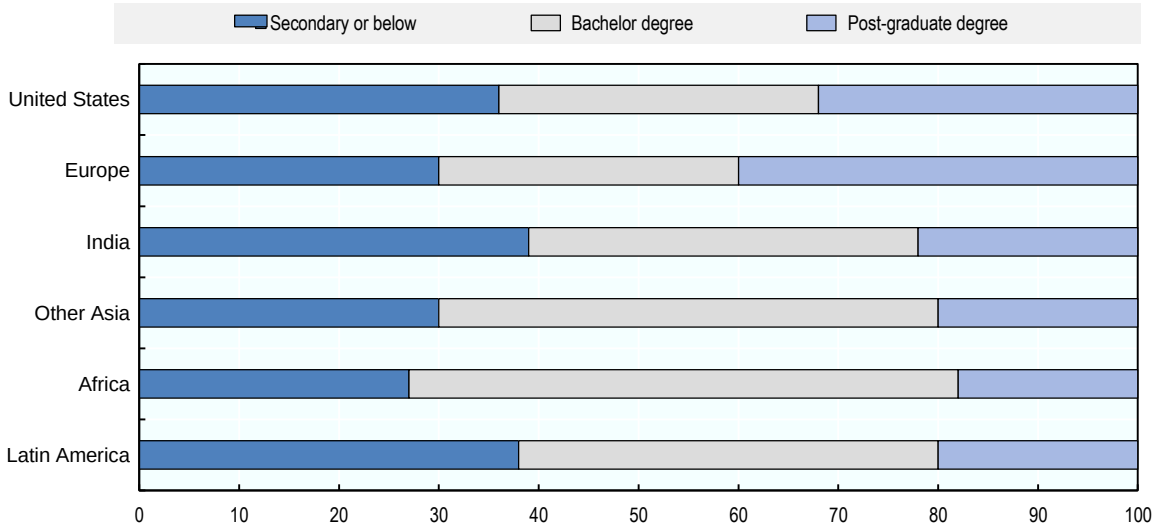
MOOCs are being increasingly offered in developing countries but there is little information on how effective these courses are in more challenging contexts. Based on 1400 MOOC users in Colombia, the Philippines and South Africa, Garrido, et al. (2016) find some surprising results. They find that completion rates are very high (49 percent of MOOC surveyed users receive certification for at least one course; the rate is even higher – 70 percent - when limited to employed respondents) independent of learners' income levels. According to this study, students come from diverse socio-economic backgrounds with varying educational levels, and women are more likely to complete a course.

Table 1. Enrolment, median age and gender in edX MOOCs, 2012-2013

Country/region of origin	Number enrolled '000 in 2012-2013	Median age	Share of women in percent
United States	138	31	35
Europe	72	28	32
India	60	23	22
Other Asia	60	25	24
Africa	33	27	20
Latin America	32	26	24
World	395	27	26

Source: MOOCs data provided by edX: Harvard University and Massachusetts Institute of Technology. Student statistics in 2012-2013 academic year.

Figure 4. edX MOOC users' education level, 2012-2013



Source: edX

The low completion rates of MOOCs have overall caused a lot of criticism. Although the overall completion rate remains very low at below 10 percent (Jordan, 2015; Zhenghao et al., 2015), the total number of students who complete a course is still substantive – about 5 of the 35 million students enrolled in 2015. The high dropout rates can be explained by several factors: learners' motivation to start a course, incentives driving completion as well as the inherent difficulties that completing a MOOC may entail (see discussion in section 3.2).

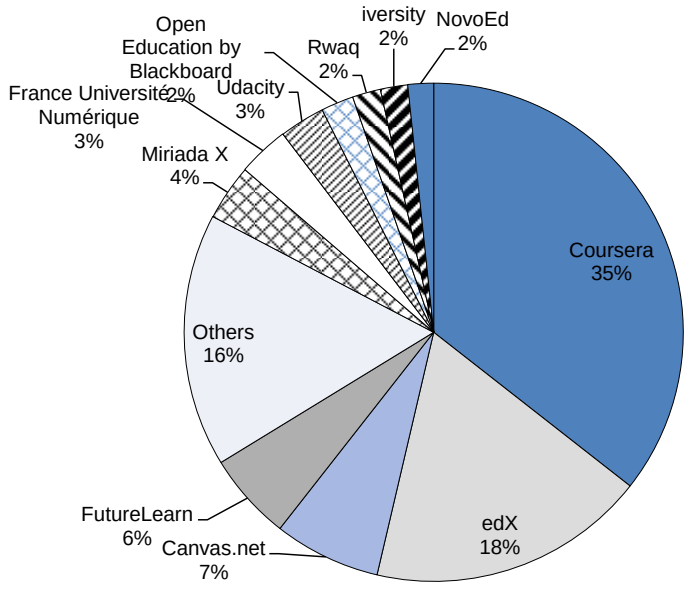
2.3 Who provides MOOCs?

In 2015, over 650 higher education institutions worldwide offered MOOCs (Shah, 2015). While initially it was mainly top US universities that created and offered MOOCs, there is an increasing number of European and Asian institutions engaging in MOOCs and the majority are internationally considered "second" and "third" tier universities. Some higher education institutions are actively developing MOOCs and may be termed "producers" or "developers", while others are using MOOCs developed by other institutions in their programs and could be termed "consumers" or "users" and a few are doing both (Hollands and Tirthali, 2014b).

In most cases, higher education institutions offer MOOCs through an established platform provider. There are over 100 MOOC platform providers offering MOOCs in co-operation with educational institutions and other organisations (examples are illustrated in box 2). While most MOOC platform providers operate as private businesses there are some examples of non-profit organisations.

The most common MOOC platform providers are based in the United States (e.g. Coursera or edx) or in Europe (e.g. FUN, futurelearn or iversity). Coursera and edx combined offer more than half of all courses offered (see figure 5). Arab States have started engaging in MOOCs through their own platforms (e.g. Rwaq) alongside Brazil (e.g. veduca) and China (e.g. XuetangX).

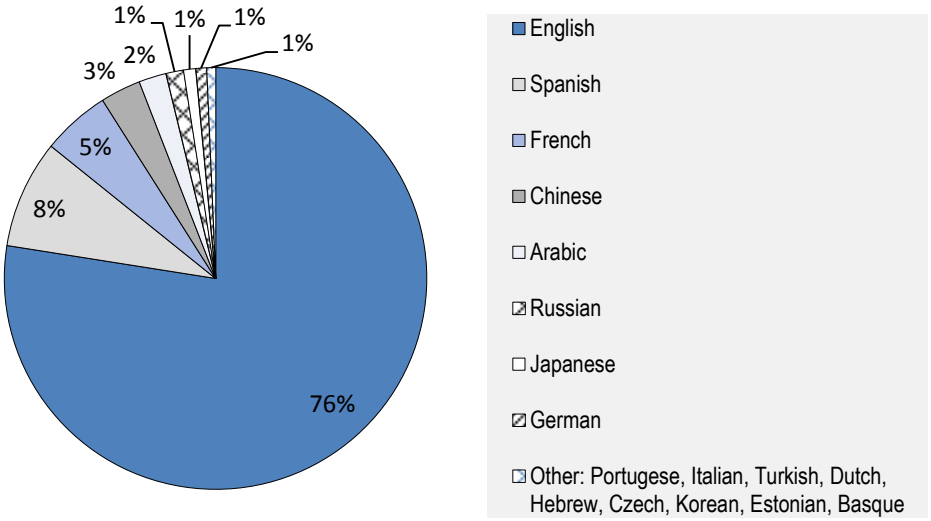
Figure 5. Course distribution by provider, 2015



Source: Class Central, 2015

The languages in which MOOCs are offered are becoming more diverse with MOOCs available in over 30 languages in 2016 (MOOClist, 2016). MOOC platforms are being created outside of the United States and established platform providers such as Coursera or edX increasingly co-operate with higher education institutions outside of the United States and Europe. Therefore, the share of courses offered in English has slightly reduced from 80 percent in 2014 to 76 percent in 2015 followed by Spanish (8 percent) and French (5 percent) (see figure 6).

Figure 6. Course distribution by language, 2015



Source: Class Central, 2016

Box 2. Examples of MOOC platform providers

- ***United States***

Coursera, a for-profit company, was founded in 2012 as a partnership between Stanford University, Princeton University, the University of Michigan, and the University of Pennsylvania. Coursera is the largest MOOC platform with over 15 million users in 2015, over 140 partners (including postsecondary institutions as well as private companies) across 28 countries. In co-operation with the University of Illinois at Urbana-Champaign, Coursera offers the opportunity to achieve a fully accredited MBA (see box 5 in section 3.1.).

edX is one of the few non-profit MOOC platform providers. It was founded in 2012 by Harvard University and the Massachusetts Institute of Technology. As of March 2016, edX has more than 7 million students and over 100 partners.

- ***Europe***

Futurelearn is the largest European MOOC platform provider in terms of course offerings. Futurelearn is a non-profit organization and it belongs to The Open University (United Kingdom) and has over 100 partners worldwide.

MiriadaX is the main Spanish-speaking MOOC platform provider. The platform is an initiative of Universia (the largest collaboration network of Latin American universities) and Telefónica Learning Services based in Spain.

France université numérique (FUN), France's MOOC platform, was launched in 2013 by the French Ministry of Higher Education and Research in the framework of a digital agenda for higher education. The platform offers mainly MOOCs in French created by higher education institutions in France.

Iversity collaborates with mostly German universities and individual professors who design their own MOOCs with technical support from iversisty. Iversity is the only MOOC platform offering courses with European Credit Transfer and Accumulation System (ECTS).

- ***Emerging economies***

Venduca was launched in March 2012 in Brazil and provides online courses aimed at Portuguese speakers. The platform features video lectures from universities such as Harvard, Stanford and Princeton and Oxford, translated into Portuguese

XuetangX, with its over five million registered students, is one of the top five MOOC providers worldwide (Shah, 2016). It was launched in October 2013 under the initiative of Tsinghua University in co-operation with other Chinese universities and it is the first Chinese MOOC platform. About 400 courses are offered on the platform and more courses are expected to be launched in 2017. Partner universities recognize 42 XuetangX courses as credential courses. The most popular course with almost 280.000 registered students is Conversational English.
XuetangX plans to launch a MicroDegree program, which will integrate university courses, industry-oriented courses developed by industry leading companies, and hands-on projects. The learners are expected to master a subject by joining the MicroDegree program, learning the specifically designed series courses and earning a professional certificate of achievement. The learners who successfully complete the program receive a job recommendation for renowned companies.

3. Perspectives on MOOCs

The emergence of MOOCs entails different opportunities and challenges for higher education institutions, learners and governments. To fully grasp the new issues arising from the emergence of MOOCs, it is worthwhile considering their different perspectives.

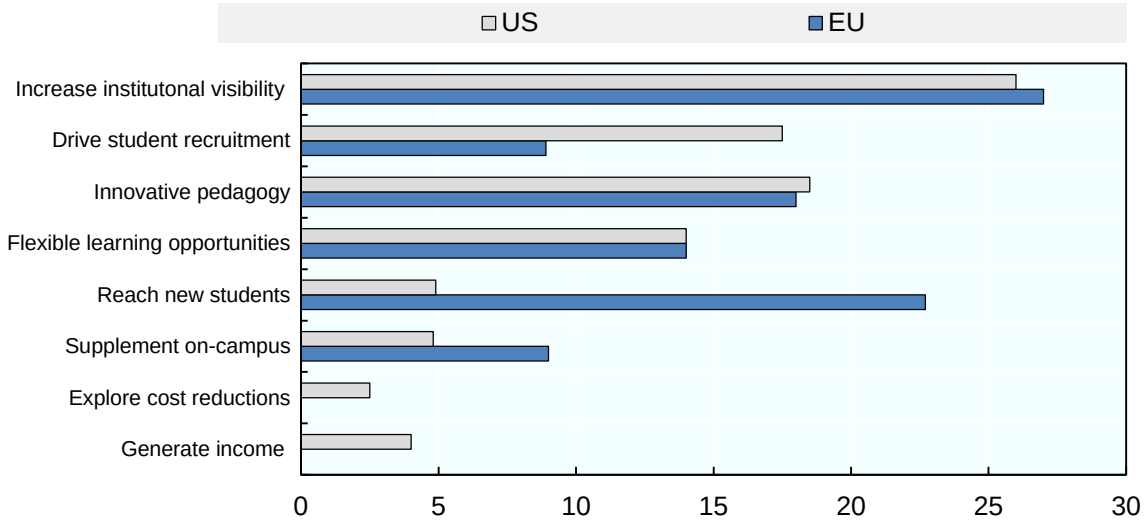
3.1 The institutional perspective

While MOOCs were initially created and offered exclusively by top US universities, in 2015 over 650 universities worldwide offered MOOCs, with an increasing number in Europe and Asia, particularly in China (Shah, 2016). What are the motivations for higher education institutions to engage in MOOCs? And once higher education institutions offer MOOCs, what are some of the new issues arising for institutions?

MOOC-offering higher education institutions report different motivations when engaging in MOOCs: extending reach and access, building and maintaining brand, improving economics by reducing costs or increasing revenues, improving educational outcomes, innovation in teaching and learning, and conducting research on teaching and learning (Hollands and Tirthali, 2014b).

Motivations differ by region (Jansen and Schuwer, 2015; examples are illustrated in see box 4). While increasing institutional visibility is a primary motivation in both the United States and in the European Union, reaching new students is much more pronounced as an objective in the European Union and supporting student recruitment is a key motivation for institutions in the United States. The motivations related to finance (explore cost reductions, generate income) of MOOCs are not seen as a primary objective in this survey (see figure 7).

Figure 7. Motivations to engage in MOOCs in the US and in the EU, 2014



Source: Jansen and Schuwer, 2015

Based on a survey of higher education institutions in the United States, 57 percent of interviewed MOOC-offering higher education institutions strongly agreed that MOOCs are an efficient mechanisms for raising the institutional profile, 50 percent and 44 percent stated that MOOCs can help improving access around the globe and in the United States, respectively. Only 19 percent agreed that MOOCs can reduce cost and 34 percent stated that MOOCs could improve pedagogy (Alliance for Higher Education and Democracy, 2014). A survey on online learning of 2800 degree-granting colleges and universities in the

United States revealed that only a small segment are experimenting with or planning MOOCs. The share of higher education institutions that currently have a MOOC increased from 2.6 percent in 2012 to 8 percent in 2015. 39 percent report they are still undecided about MOOCs while the largest group (46.5 percent) says they have no plans for a MOOC. 16.3 percent of academic leaders believe that MOOCs represent a sustainable method of offering online courses, down from 28.3 percent in 2012. While in 2013 almost half of surveyed institutions saw MOOCs as a way to learn about online pedagogy, in 2015 is only 28 percent (Allen and Seaman, 2015).

Depending on their motivation, higher education institutions have different approaches when offering MOOCs. At top universities in the United States, for example, MOOCs are usually merely an add-on and fully independent of on-campus education. In some other institutions, however, MOOCs can be selected as a substitute for a course as part of a degree. MOOCs can also be used to remove some inefficiencies in education and to find new structures to improve on-campus education. Some institutions experiment with MOOCs to prepare students for graduate programmes with the objective to ensure that admission requirements (i.e. necessary knowledge to succeed the course) are met and thus to reduce dropout rates.

If MOOCs systematically become (or are to become) a more integrated part of (higher) education, at least three issues may arise from the perspective of higher education institutions: 1) the quality of MOOCs and learning outcomes; 2) cost-effectiveness of MOOCs; and 3) intellectual property rights for course content and data usage.

Box 3. Institutional perspective: Case studies from the United States, the Netherlands and China

- ***Stanford University, United States: Big data analysis***

The arguably first MOOC was offered by Stanford University on "Introduction to Artificial Intelligence" in 2012 with 160 000 students signing up, in over 190 countries (by far most students being located in the United States). Since, over 100 faculty at Stanford University have developed close to 200 online course activities on campus and for public release.
Stanford University has heavily focused on combining course development with research on attrition, interventions to increase success, and demographics of public course participation and many research papers have been published based on data from Stanford MOOC students (Mitchell, 2014).

- ***TU Delft, Netherlands: Increase visibility and attract international students***

TU Delft has been experimenting with many forms of online learning and is actively involved in MOOCs since 2013. The university currently offers 43 MOOCs (mostly in the engineering and science field of study) with about 960 000 enrolled students worldwide and almost 30 000 issued certificates (or for about 3 percent of all enrolled students). Other campuses in India, the UK, and Germany are using MOOCs produced by TU Delft in their classes. TU Delft has an increasing share of international students applying for their programmes, especially from China, and they state that about 10 percent of their enrolled on-campus international students have previously taken a MOOC at TU Delft. They also experiment with MOOCs to improve on-campus education (e.g. flipped classroom). Their research goals are to gain insights into learner behavior and to design and implement interventions that enable adaptive learning.

- ***Tsinghua University, China: Facilitate access and reduce costs***

Tsinghua University, a top academic institution in China, partnered with EdX in 2013 to offer MOOCs in Mandarin with English subtitles. The popularity of the courses led Tsinghua University to create its own MOOC platform provider XuetangX (see section 2.3). Tsinghua University creates about a third of all MOOCs in China with over five million registered users in 2016 (Shah, 2016).

3.1.1 The quality of MOOCs and learning outcomes

The quality of a MOOC is essential for higher education institutions to successfully apply MOOCs for their different purposes. Yet there is very little empirical research on the effectiveness of MOOCs for learning outcomes, also because it is challenging to determine the quality criteria for a MOOC[2]. Expectations and profiles of MOOC students differ from students enrolled in traditional courses and therefore it is questionable whether conventional quality criteria should apply in the context of MOOCs (Weller, 2013).

Existing evidence generally suggests that the distinct features of MOOCs fail to achieve better learning outcomes. For example, the absence of an instructor or other type of support in case of questions on course material is reported to be one of the main reasons for students' dropout (Hew and Cheung, 2014). Oremus (2013) finds that MOOCs are ineffective in terms of learning outcomes as seen at San Jose State, where more than half of the students who took a (fee-based) Udacity course for credit failed their final exams. Margaryan et al. (2015) analysed the quality of instructional design of 76 MOOCs. Results show that MOOCs score poorly on most instructional design principles (i.e. problem-centred, activation, demonstration, application and integration) while they scored highly on organisation and presentation of course material. Overall, they conclude that the instructional design quality of MOOCs is low.

The question of quality is of particular importance when higher education institutions validate MOOCs for credit towards an academic degree. When offering MOOCs for credit it may be necessary to offer alternative sources of support that will guide students through the learning process and provide them with individual feedback and assistance. Student surveys reveal that learners seem to benefit from MOOCs' multimedia format (e.g., short video lectures, links to websites, and podcasts) when coupled with university-like syllabi of some classes, providing the right amount of structure and flexibility.

In some higher education institutions that offer MOOCs for credit, MOOC material is made available to students to work on independently while face-to-face instructional time is optimised by engaging in problem-solving and discussion. This form of 'blended learning' or 'flipping the classroom', a concept that significantly pre-dated MOOCs, can increase efficiency as it helps the teacher by freeing up time for more intensive supervision (Belleflamme and Jacqmin, 2016).

However, as this type of additional support is only available to on-campus or else enrolled students that met the entry requirements for the course, it may be seen as a contradiction to the 'open' feature of MOOCs whereby students could register to a course without entry requirements. The question arises whether this concept is not a specific form of online learning, without necessarily being a MOOC.

Awarding credits for MOOCs towards an academic degree is still rather an exception than the norm. Some universities experiment with allowing students to choose a MOOC instead of a regular course as an elective. However, students are often asked to take an on-site exam after 'completing' the MOOC. Also, there are a few initiatives that allow students to take a pre-determined sequence of MOOCs to obtain a degree (see examples in box 5). However, these programmes impose entry requirements and a fee, which again, is a contradiction to the initial concept of MOOCs.

Improving educational outcomes is only one of the motivations for higher educations to engage in MOOCs. Increasing institutional visibility is a much more prominent reason for higher education

[2] Some criteria are likely to be similar to those applied to a traditional course while other criteria will be specific to the open online environment. Creelman et al. (2014) mention an example related to 'choice'. Whether dropouts are as a sign of low quality of the MOOC or an expression of individual choice is an open question. Without course fees, the cost of dropping out are relatively low.

institutions to start offering MOOCs (see section 3.1). Prospective students, for example, could view MOOCs as a 'seal of quality' or reference for quality of the institution that created the course. Offering low quality MOOCs could thus poorly reflect on the institutions' reputation and therefore, it is in the interest of the higher education institution to update content and create high-quality MOOCs.

Also, higher education institutions are responsible for the quality of the qualifications they award and institutions will ultimately be held accountable to students, graduates, businesses and governments for the learning of students, regardless of the modes of delivery. While MOOCs alone may not improve learning, they present themselves as an opportunity to revive the discussion on innovative learning methods and accountability of higher education institutions to provide better learning outcomes.

Box 4. Examples of MOOC degrees

More recently, providers are moving towards offering courses that can translate directly into college credit or a more formal degree. For example, Coursera has partnered with the University of Illinois at Urbana-Champaign College of Business to create the iMBA, an online MBA program. To obtain a degree, students must apply to gain admittance into the program and complete all required courses which cost about USD 20 000 which is only a fraction of what students in the United States normally pay for an MBA.

Similarly, the Georgia Institute of Technology has partnered with the American telecommunication firm AT&T and Udacity, to offer a Master's degree in Computer Science. The degree costs about USD 7 000 while the average tuition fee for undergraduate students in the United States amounts to over USD 19 000. The first 20 students graduated from this program in December 2015. AT&T has co-designed the curriculum of the course and envisages offering up to 100 paid internships to excelling students of this degree.

Arizona State's Global Freshman Academy, a partnership between edX and Arizona State University, allows students who complete a MOOC to count these courses towards a degree. The MOOCs are offered at a discounted tuition rate and are targeted toward high school students who want to earn college credit, adults considering an online degree, and international students. edX also offers a selection of Advanced Placement and CLEP Exam prep courses, targeted toward high school students looking to earn college credit through qualifying scores on exams.

3.1.2 MOOCs: a new business model for universities?

Higher education institutions' costs are rising, owing to investments in technology, teachers' salaries and high administrative costs. At the same time, governments are no longer able to subsidise universities as generously as they used to. Therefore, higher education institutions attempt to raise more funds and aim to act in a more entrepreneurial way (OECD, 2009). Generally, online learning technologies are regarded as cost-saving with the primary channels being reduced labour costs, through larger classes and less face-to-face interaction. In the context of MOOCs, Hollands and Tirthali (2014b) list a number of possibilities that could save costs for institutions such as re-using MOOC materials multiple times and sharing MOOC materials across institutions, among others.

The business models and sustainability of MOOCs, however, are debatable and generally, because of the very high entry and maintenance cost, higher education institutions rarely see MOOCs as a way to improve cost efficiency. A survey conducted in 2013 by the UK Department of Business, Innovation and Skills shows a range of views among experts and observers regarding the value of MOOCs in both reducing costs and enhancing learning in higher education. The surveyed institutional leaders are reportedly sceptical about using MOOCs to save costs, and tend to view MOOCs as a threat to existing

institutional business models, especially for less prestigious institutions (Jansen and Schuwer, 2015). They argue that there is a risk that public universities may lose public funding if they integrate MOOCs into their syllabus.

Costs of producing a MOOC vary significantly depending on multiple factors (Gaebel et al., 2014). Costs depend on whether institutions produce in-house, low-cost video material or outsource production to external providers, with possible economies of scale depending on how many students are reached, and the initial and ongoing staff and technological costs required to maintain and upgrade a MOOC. Also, whether teaching assistance is provided to students is a key cost factor.

Also, resource requirements and cost of MOOCs differ for MOOC 'producers' and for higher education institutions 'consuming' MOOCs created by other institutions (Hollands and Tirthali, 2014b). The cost drivers for MOOC production and delivery include the number of faculty members, administrators, and instructional support personnel participating in the process; MOOC platform costs; the quality of videography; the nature of the delivery platform; technical support for participants; programming for special features such as virtual labs; and analysis of platform data. For higher education institutions 'consuming' MOOCs produced by other institutions, the cost include licensing fees to use the material, search and adaptation cost, developing material to supplement the MOOC and certification costs, among others.

The MOOC platform costs vary depending on the arrangement between the higher education institution and the MOOC platform provider. For example, the State of Tennessee was asked to pay USD 3000 per course for the use of the Coursera platform plus USD 25 per student (Hollands and Tirthali, 2014a). One community college paid Udacity a fixed sum of USD 30 000 for its role in helping to develop and deliver a MOOC and providing data on participant activity and performance. Based on four case studies, Hollands and Tirthali (2014a) estimate the total costs for creating a MOOC range from USD 39 000 to USD 325 000.

Comprehensive evidence on the cost effectiveness of MOOCs, however, is lacking. Re-runing costs are expected to be lower but there is no rigorous documentation on this question. Despite the lack of consensus on the economic value of MOOCs for institutions, it is argued that new business models are developing - including fee-based certification for courses - that could underpin the longer-term existence and sustainability of MOOCs.

3.1.3 Intellectual Property Rights

In addition to issues related to the quality of MOOCs and learning as well as a cost-effectiveness of MOOCs, the emergence of MOOCs raises questions related to intellectual property rights. Who owns the copyright for a MOOC or how can the rights be shared? Also, issues of data privacy, access, and sharing are as yet unresolved in the relatively new legal territory of MOOCs (Dillenbourg et al., 2014). For example, to whom do the platform data belong and who can have access?

MOOCs could potentially reduce the costs of higher education if they can be used by other academic institutions to eliminate the reproduction of similar courses across many campuses. If the licensing issues surrounding the sharing of materials across multiple campuses can be resolved, and if MOOCs can be re-run several times without significant adjustments at each offering, the high costs of initial MOOC development could be significantly reduced. For example, a specific MOOC course developed and taught by a professor at a particular college could be used by other colleges and universities through the MOOC platform. This raises other ownership rights questions for faculty and the institution. At the same time, this may have implications for the institutions' visibility and reputation.

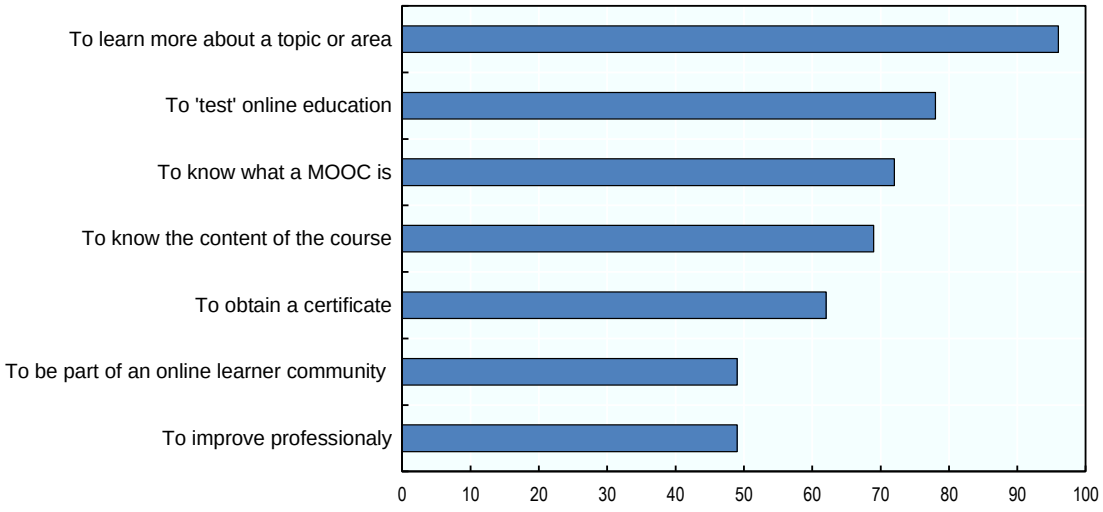
From the perspective of faculty, intellectual property is a key issue. Most faculty members develop and deliver their own courses and thus have an interest in ownership rights of their work. When preparing a MOOC, however, the institution contributes significant infrastructure and production investments. These can include instructional design, material development, videography, additional teaching assistants, etc. Because of the potentially substantial institutional investments in courses the ownership issues may be more complex. As MOOCs are often based on agreements between the institutions and the platform provider, faculty may not profit from their intellectual contribution to the course. Therefore, MOOCs may present complex copyright questions that can challenge the relationship between faculty and the institution.

3.2 The learner perspective

Why do individuals sign-up for a MOOC? MOOCs offer some distinct advantages in terms of accessibility and flexibility to students. Starting a MOOC is much easier and faster than enrolling in a traditional online course which reflects the large numbers of sign-ups for MOOCs. Students have the opportunity to only skim through the course material without the intention to complete the course. In that sense, MOOCs are useful tool to quickly get to know new topics or brush-up already learned content.

Learners taking part in MOOCs are driven by diverse motivations and incentives mostly depending on their characteristics and background. Although comprehensive survey data is not available, a few prominent reasons stand out. The first is mostly an academic or educational motivation when students seek to increase their knowledge in a given subject. The University of Edinburgh published a survey on their students' motivation to sign up for a MOOC (see figure 8) and 96 percent of surveyed students mentioned 'learning more about a topic or area' as a motivation (Fundación Telefónica, 2015). In addition, students may be curious to test this new type of learning or be motivated to gain a certificate (Young, 2013) although this is rarely mentioned as a primary objective.

Figure 8. Learners' motivation to enrol in a MOOC



Source: Fundación Telefónica based on data from the University of Edinburgh, 2015

An additional reason is to improve career opportunities by gaining job-specific skills (Zhenghao et al., 2015). This is likely to gain importance if completing a MOOC is considered as an improvement for the CV or increases the user's employability. A recent survey on Coursera students revealed that only 28 percent enrol in a MOOC to achieve an academic goal (such as gaining knowledge in their field) while 52

percent report improving their current job or finding a new job as their primary goal[3] (Zhenghao et al., 2015).

A learner's motivation to start the course explains to an extent the high dropout rates. Other factors are the incentives driving completion as well as the inherent difficulties that completing a MOOC may entail. The strongest student outcomes are achieved by those who are interested in the content or want to earn completion certificates, whereas those who enrol in MOOCs out of curiosity finish far less often (Ho et al., 2015). Participants who expected to finish a MOOC were more likely to do so than participants who did not think they would complete the course. The U.K. Department for Business Innovation and Skills noted that many users see MOOCs as an educational resource rather than as a full course which could explain the high dropout rates. Students' perceptions of the MOOC also matter: perceived reputation (influence and trust) and openness (content and attitude) have been shown to be important predictors of whether students finish a course (Jansen and Schuwer, 2015).

There is only weak evidence that completing a MOOC can have positive effects on outcomes. 26 percent of Coursera students report that they found a new job after completing a MOOC and 64 percent state that they have gained essential knowledge for their field of study (Zhenghao et al., 2015). The diversity of course choice offered by MOOCs could be helpful for students in choosing a field of study and thus potentially reduce switching of subjects and dropouts. According to the Council for Adult and Experiential Learning (CAEL), students who had completed a MOOC before enrolling in a related on-campus course were twice as likely to graduate as those who did not complete a MOOC before (Ho et al., 2014). However, this may only reflect a higher degree of discipline and capability of students that completed the MOOC.

Educational research has shown that the ability to self-regulate, which is particularly important for online courses, does not simply emerge from studying online but is a precondition for effective self-directed learning (Orr et al., 2015). For some students with less interest in using technology or those with low reflective learning styles, this type of learning environment may be intimidating and they have an increased risk of dropping out. An additional support system may be necessary to fully support students in successfully completing the course. It is often the students from the most vulnerable households who are likely to need this support system the most. Else, MOOCs may be effective only for the most motivated, disciplined learners.

Banerjee and Duflo (2014) show that students whose behaviour suggests that they are not organised (i.e. they enrol after the deadline), are significantly less likely to succeed in a MOOC, even after controlling for a number of factors that are associated with success in the course. They argue that this result is entirely driven by their failure to complete assignments on time, rather than by their performance conditional on completing them. However, results also suggest that there is scope for improving MOOC performance by providing more structure for students (e.g. suggest specific study times to students, send reminder emails etc.).

In the long run, from the perspective of learners, MOOCs will only remain attractive if they remain either free of charge or, in case they charge minimal fees, they could be used as a substitute for more expensive on-campus or online courses to obtain academic credit or other credentials that are recognised by employers.

[3] However, the questionnaire was sent to 780.000 students who had taken at least one MOOC on the Coursera platform and only 7 percent (or 52.000) responded. Although the researchers have attempted to address the response bias, the results of study need to be interpreted with caution.

3.3 The government perspective

Governments play an important role in fostering the adoption of innovative pedagogical approaches. From the government perspective, the emergence of MOOCs has implications for policies and processes related to legislation, regulation, funding, quality assurance, IT infrastructures and pedagogical support for teachers. These policies and processes generally support and promote innovation in pedagogies and greater use of technology.

Governments vary in their views on MOOC. In Norway, the government commission on MOOCs is positive towards awarding credit for them, and a specific government strategy explicitly states that MOOCs can be included in the current degree system and recommends that higher education institutions review how they would deal with MOOCs. In the UK, the quality assurance agency is more cautious and states that offering credits for MOOCs would bring them under quality assurance scrutiny, and the Netherlands, although very engaged in the MOOC debate, does not foresee MOOC accreditation under the Dutch system. In Israel, the Ministry of Education encourages the usage of MOOCs in combination with student support systems to improve course delivery.

The discussion is related to the efforts made by countries to recognize non-formal and informal learning. The Council of Europe invited all EU countries to establish validation systems that would allow individuals to obtain recognised qualifications on the basis of non-formal and informal learning. The European Standards Guidelines for Quality Assurance in the European Higher Education Area have been revised to more explicitly encourage innovation in use of technology and pedagogies. A key conclusion is that Quality Assurance agencies need to support this approach.

Generally, MOOCs seem to meet the definition of non-formal education as outlined in the ISCED2011 manual: "Like formal education (but unlike informal, incidental or random learning), non-formal education is education that is institutionalized, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an additive, alternative, and/or complement to formal education within the process of lifelong learning of individuals. It is often provided in order to guarantee the right of access to education for all. (…)"

Two quality frameworks are discussed that could be used for quality assurance in assessing a MOOC. One model is *E-xcellence*, which is advocated by the European Association of Distance Teaching Universities (EADTU). The other approach is the OpenupEd which was developed by EADTU based on *E-xcellence*. Quality indicators for MOOCs are similar to those used in ordinary quality enhancement models of e-learning and open online learning. The model relies on different features (openness to learners, learner-centered approach; quality focus etc.) and each feature has sub-indicators and benchmarks to ensure quality (Rosewell and Jansen, 2014).

Practitioners suggest that policy makers need to advocate for adjusted regulations to accommodate pathways for MOOCs to be accepted for credit. In higher education it is less clear how accreditation agencies could be persuaded to move in this direction. Establishment of an accrediting organisation for MOOCs and other non-traditional educational experiences, as suggested by MOOC advocates, would allow learners to accumulate a portfolio of credentials that serve as a viable supplement or alternative to an academic degree. Furthermore, such accreditation of individual courses or other educational experiences should confer the ability to use public funds towards the costs of these credentials.

The issue of quality is in fact decisive to the discussion of the government's support for the integration of MOOCs in the education system. The absence of pedagogical and technological standards and a lack of government expertise and reactivity on this subject make this type of investment very risky.

4. Future roles for MOOCs

What are some of the future roles for MOOCs? Hollands and Tirthali (2014b) asked over 80 higher education institutions offering MOOCs on how they see the future role of MOOCs. The majority of institutions stated that MOOCs are likely to serve as educational resources rather than as stand-alone courses, target a specific audience, for example corporate training, and offer revenue-generating services such as tutoring, face-to-face interactions, and study groups. Some interviewees expressed the view that the MOOC movement would soon fade out unless participants are able to earn meaningful credentials carrying economic value. They further stated that MOOCs may affect the economic model of higher education by allowing students to put together their own certifications. Cross-institutional collaborations are likely to improve with MOOCs.

This section sheds light on some of the relevant questions related to the future roles of MOOCs. Could MOOCs evolve to substitute on-campus courses? Are MOOCs the new model for professional development? What is the potential of data collected through MOOCs for educational research? And finally, can MOOC really facilitate equitable access to (higher) education in OECD and developing countries alike?

4.1 MOOCs as a substitute for on-campus courses?

With the hype and raised expectations related to the promise of MOOCs, a common question in the literature and among practitioners is whether MOOCs could substitute for courses offered on-campus. Courses offered on-campus, however, are not homogenous in quality and it is important to know what type of course MOOCs are compared to. Many MOOCs consist of video lectures that were prepared by professors at prestigious institutions. If these MOOCs are compared to a campus where several hundred students are lectured in classes with very little interaction, the question of substitution may indeed be justified.

MOOCs offer standardised content and assessment with limited student-instructor or student-student interaction. Therefore, MOOCs could potentially substitute for existing online and on-campus courses offered by non-selective courses (Hoxby, 2014). At highly selective institutions, Hoxby argues, MOOCs are unlikely to replace courses other than courses covering standard material, such as calculus or statistics.

So far, most practitioners agree that MOOCs are not (yet) equivalent to on-campus education (Thille et al., 2015) because they do not fully recreate some aspects inherent to an on-campus university experience. Especially courses at highly selective institutions are characterised by room for intellectual exchange and student-teacher interaction. Higher education goes beyond simple delivery of information – it is also about building learning relationships with students and professors, learning how to live independently and developing socially, intellectually and academically. In addition, there are many fields of knowledge, such as medicine and engineering, where hands-on laboratory and practical experiences are essential and a fully online delivery method is therefore perceived as less reliable.

While still in an experimental phase, there have been some initiatives to award credit for MOOCs towards an academic degree or design degrees fully based on MOOCs. If this proves successful, it may lead to the unbundling of educational services, in which the design, delivery, assessment and granting of degrees may be undertaken by different agencies. An institution designs and provides a MOOC but a different agency tutors learners through it, and yet another does the competency testing, while a university or college validates that assessment and offers an award (Jansen and Schuwer, 2015). Students may be able to take a range of MOOCs and use their certificates of completion to assemble a portfolio that reflects their learning accomplishments, giving more choice to students. Students are increasingly mobile and a system

where students have to follow a specific sequence of courses in a single institution for a number of years may become outdated.

If MOOC providers are able to offer participants credentials of economic value (e.g. college or high school credits, verified certificates of accomplishment, virtual badges to certify skills or non-cognitive traits, etc.), a system for evaluating and accrediting MOOCs would be necessary – one that is trusted by employers and educators alike. In the future, if MOOCs were seen as an alternative to on-campus courses, that is if MOOCs were systematically recognised as credits towards an academic degree, this may lead to an increased competition and thus potentially to a debate on the delivery of quality courses in higher education (Belleflamme and Jacqmin, 2016).

Their immediate impact, however, seems to be a tendency towards a more "hybrid" or "blended" model of higher education that explores how to better combine the benefits of face-to-face, on-campus education with the enormous possibilities offered by new technologies. As the face-to-face instructor is freed from lecturing and allocates more time to other teaching activities, the quality of overall instruction will increase, thereby benefiting students.

Although MOOCs have been cited by some as disruptive for higher education, it might be best to see them as one example of sustaining innovation in higher education, alongside the use of ICT, new pedagogical approaches, blended and online education and other explorations of ways to improve delivery. At least in the foreseeable future, MOOCs are unlikely to risk replacing complete courses at higher education institutions.

4.2 MOOCs as a new model for professional development?

The required skills to fully participate in and benefit from increasingly knowledge-based economies are changing rapidly. In this environment MOOCs could be seen as a welcome opportunity to respond to some of the changing labour market needs. As noted above, MOOCs seem to attract mostly already employed individuals (Ho et al., 2015). Therefore, many MOOC platform providers have started exploring MOOCs for professional development. This may also become a major objective for MOOCs. There are already some successful examples of MOOCs being integrated for professional development purposes (see box 5).

Given its distinct features, MOOCs can be used to efficiently address many shortcomings of workforce training and provide alternative routes to employment training for the unemployed. First, they are often cheaper. Second, according to Meister (2013), MOOCs are particularly well suited to corporate learning and development because MOOCs allow users to progress at their own pace, while motivating them to collaborate on common learning objectives. Albert and Sekhon (2015) argue that contextual content, dynamic and active peer-to-peer learning, and participant engagement through constant feedback are fundamental in the success of MOOCs for corporate learning. Many MOOC providers offer certification and in some cases even credit allowing employees to demonstrate the acquisition of specific skills which may further motivate employees. These credentials are valuable as a means of recognising employees' efforts at attaining newly learned skills, as well for legitimising the learning experience (Meister, 2013; Yupangco, 2014).

Radford et al. (2015) conducted a survey of Human Resource departments of over 100 businesses in North Carolina operating in a wide array of industries to analyse their perceptions and usage of MOOCs. About 7 percent had already begun using MOOCs for professional development and 71 percent could see their organisation using MOOCs for this purpose. Respondents viewed MOOCs as attractive because of their flexibility and easy access as well the availability of diverse course options. MOOCs could fill skills gaps in three areas: soft skills (particularly leadership and management) to meet the high training demand

for this type of skills, basic computer skills to reduce costs of already available training, and highly technical subject matters such as analytics, engineering design, blueprint design etc. to address the lack of expertise in offering highly specialised courses. At the same time, respondents expressed concerns regarding quality and level of participants' engagement in these courses.

The American telecommunication firm AT&T launched the first MOOC Master's degree in Computer Science in a joint initiative with Georgia Tech University and Udacity (see example in box 5 in section 3.1.1). Such initiatives often serve multiple goals (OECD, 2015). First, as the curriculum can be co-designed by the firm, employers can to some extent determine the course content and adapt it to their immediate skills needs. Second, by making the course available to students worldwide, employers enlarge their pool of potential recruits. Third, education providers experiment with new learning and teaching practices which can trigger improvements in pedagogical models and bring learning contents closer to the industry also in traditional education programmes.

Integrating MOOCs for professional development seems to offer the most promising model for the future usage of MOOCs. The training and development needs of corporations are vast and can be very specific depending on various factors. Companies can leverage the MOOCs that have been developed by higher education institutions and creatively apply them for their own specific purposes and needs. Dodson et al. (2015) outline different options how companies could integrate MOOCs in its training and development structure: 1) take advantage of existing MOOCs to supplement employees' development; 2) develop MOOCs as an opportunity to market courses to potential clients, business partners or end users; 3) implement 'MOOC-like' solutions in existing and planned corporate training.

Box 5. Corporate Open Online Courses (COOCs)

- Udacity created "Udacity for Business" which targets the corporate training market (tech-companies specifically) via its business webpage promoting "Hands-on Training. Done Online". The courses and programmes promoted are identical to Udacity's existing ones, but are packaged to appeal to company and human resource executives as a solution to meet skill gaps among employees and as a tool for succession planning.

- L'Oréal: 160 employees of the French cosmetic company completed the MOOC "Public Speaking" offered through the iversity platform in 2015. The course was developed by Homuork, a Spanish ed-tech company in collaboration with a lecturer from Universitat Pompeu Fabra (UPF). Overall 25,000 individuals participated in the MOOC. To obtain a certificate, course participants had to submit a video presentation that was peer-reviewed by fellow participants and graded by the instructors. The cost of a certificate was 99 EUR and L'Oréal covered the cost for their employees.

Examples of MOOCs being utilised to bridge the skills gap, and particularly the digital skills gap, have been identified in other regions across the globe.

- India has developed "Mobile MOOCs" to address skills shortages in finance and accounts (Association of Accounting Technicians, 2014). Other initiatives in Tanzania are also developing the use of MOOCs to provide skills in specific industries (Daniel et al., 2015). These examples of initiatives have additional corporate and non-governmental support from sponsors such as The World Bank and Coursera.

Corporate learning seeks to enable the training and development of its employees in order to fill knowledge gaps and increase productivity. MOOCs provide a potentially low-cost means for companies to educate not only their employees, but also a global audience about products, services, and the company.

The sustainability of MOOCs in the corporate learning and development space, however, will depend on its ability to measure the success and effectiveness of those MOOCs.

4.3 MOOCs for educational research?

The massive enrolment in MOOCs results in a significant amount of data being collected on students' learning habits and outcomes. While this is the case for all online learning courses, the important distinction in MOOCs is its 'big data' aspect which could be leveraged for educational research and adaptive learning. Some researchers even argue that 'learning about learning' is what the technology is really valuable for. The ability to perform research on teaching and learning was part of the justification used by Harvard and MIT to invest over USD 30 million in edX. Massive data from MOOCs could allow fundamental studies in the learning process and how students interact with content at a scale and pace not previously possible using traditional campus courses (Eichhorn and Matkin, 2016).

A potentially useful application of the big data from MOOCs is in learner analytics. These can be used to improve courses or to catalyse high quality adaptive learning and personalised educational experiences which meet the needs of a variety of learners. There are several areas that could be explored for research such as testing pedagogical strategies, student engagement and motivation, human-computer interaction, and personalised/adaptive learning, amongst others.

Also, while there is no doubt that the MOOC platforms collect masses of data, it is apparent that interpreting these data and querying them to answer useful research questions is a work in progress. Several types of data could be collected through MOOCs:

- The "clickstream" logs collected directly from the course platform through server registration of user activity. Data records the time any platform user accesses a resource from the server, for example, watches a video, stops a video, or enters quiz responses. This allows one to understand how various topics are best absorbed.

- A second data source is the summary tables made available by the platform providers. Some provide a list of tables summarising some of the most commonly requested data points. This allows the instructor to see how many participants are active in the course, how many complete each quiz, how many attempts are made, how many answered a question correctly, etc. These data are reported in the aggregate, not by individual student, and do not show relationships among variables, for example, whether participants who watch more videos perform better on quizzes.

- Thirdly, most institutions offering MOOCs create their own pre- and post-surveys which are administered via the MOOC platform, and are usually optional for participants to complete. Pre-surveys investigate items such as participant demographics, pre-existing familiarity with the course content, other MOOCs completed or in progress, how participants learned about the MOOC, reasons and goals for participation, and prior online learning experience. Post-surveys typically include questions to elicit feedback on the course design such as accessibility and usefulness of the various types of materials and activities, and how much time was spent on the course.

This valuable new side effect of MOOCs has provided researchers an ocean of data about how students learn or fail to learn, and that data can be useful in the classroom as well as online. While protecting the privacy of participants, researchers can monitor the activities of students online, seeing what approaches work, where students stumble, what grabs students' attention and what style of videos work best in various situations.

However, the insights into student learning that can be analysed from MOOC data have been limited by the type of interaction that is observable. Most of the student activities in MOOCs are either too passive (watching a lecture) or too simple (multiple choice questions) to be useful to the science of learning. This could change once MOOCs mature as they may present the complex tasks that are instrumental in collecting more detailed data on the leaners intermediate learning process.

While the potential for MOOCs to contribute significantly to the development of personalised and adaptive learning is high, the reality is far from being achieved. A great deal of co-ordination and collaboration among researchers, instructional designers, and programmers will be necessary to result in meaningful improvements to teaching and learning.

4.4 MOOCs to facilitate equal access to education?

Education systems face the challenge of widening access to high-quality opportunities to learn. There has been an immense expansion of education systems without necessarily providing equal opportunities for all. Many argue that technology will play an important role in widening access to disadvantaged learners. With their massive, international reach, MOOCs could present themselves as a welcome opportunity to 'provide universal access to the world's best education', in line with their initial idea and principle. A recent example is Kiron University, a non-profit organization based in Germany that partnered with universities to provide refugees with the opportunity of receiving a MOOC-based degree in combination with additional support (see box 6).

MOOCs represent an opportunity for developing countries as they can contribute to the Sustainable Development Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. The Education 2030 Framework for Action, adopted in Korea in May 2015, recognises lifelong learning for all as one of the underpinning principles of this new vision, stating that "all age groups, including adults, should have opportunities to learn and continue learning." It also calls on countries to "develop policies and programmes for the provision of quality distance learning in tertiary education, with appropriate financing and use of technology, including the Internet, massive open online courses (MOOCs) and other modalities that meet accepted quality standards to improve access."

Box 6. MOOCs for refugees

Kiron University, a non-profit organisation based in Germany financed by crowdsourcing, enables refugees to obtain an accredited academic degree. The degrees consist of a two year online and a one year on-campus part. For the first two years, students can select a number of existing MOOCs of their choice. Kiron University modifies these MOOCs and designs study programmes with working sessions, teamwork projects, mentoring and other student support. In the third year, students attend regular courses in a well-established partner institution such as RWTH Aachen or Applied University Heilbronn.

However, the time investment by faculty in a typical MOOC in a developing country context is almost double that for a regular, on-campus course. This requires formal recognition, along with incentives. Unlike MOOCs offered by institutions in the OECD countries, a much higher level of mentoring is expected. Whilst it is known that online pedagogy is different from classroom pedagogy, there is insufficient consideration for the importance of approaching learning as a process that can be engineered (Unesco, 2016). Learners in low-income countries may also face greater infrastructure barriers, especially in rural areas, which are much more likely than city centers to lack connectivity options, including landlines and mobile coverage, not to mention high-speed broadband internet (Liyanagunawardena et al., 2013).

If MOOCs, in their current form, are used simply to replace more traditional forms of instruction, they may be widening rather than narrowing the attainment gap. Some practitioners argue that the emergence of MOOCs will lead to double-standards in education with elite students having access to the traditional model of lectures and full student support and all other students only being able to afford the blended/online learning model.

5. Conclusion

MOOCs are still in an experimental phase and at this stage it may be too early to determine the implications of MOOCs for higher education institutions and learners. MOOCs of today still face a number of challenges: the difficulty of granting credits and degrees, the sustainability of the business models, low completion and high drop-out rates, and the pedagogical model prevalent in a lot of the courses. Involved stakeholders, however, are already addressing these issues. Especially the MOOC model for professional development seems promising and could contribute to easier access to lifelong learning.

Features that may improve the delivery and effectiveness of MOOCs, such as additional support services for (paying) learners, however, may contradict the concept of MOOCs which were designed to accommodate the largest possible number of students. The question arises whether a more sustainable, efficient and useful form of MOOCs could comply with their initial purpose of "providing universal access to the world's best education".

While MOOCs have not yet revolutionised education systems, their hype did create great interest and debate about learning and educational research and this can already be considered a success. While content has always been available, it does not automatically equal learning. The best teachers do more than teach content, and the fruitful interaction that is inherent to successful education systems has yet to be duplicated in a virtual environment. New technologies, however, may speed up this process.

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