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Innovating and Disrupting Higher Education: The Evolution of Massive Open Online Courses

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***Abstract*—**A great deal has been written on Massive Open Online Courses (MOOCs) since 2012 (considered by some as the year of the MOOCs). The emergence of MOOCs caused a great deal of interest amongst academics and technology experts as well as ordinary people. Some of the authors who wrote on MOOCs perceived it as the next big thing that will disrupt education. Other authors saw it as another fad that will go away once it ran its course (as most fads often do). But MOOCs did not turn out to be a fad and it is still around. Most importantly, they evolved into something that is beginning to look like a viable business model. This paper explores this phenomenon within the theoretical frameworks of disruptive innovations and jobs to be done as developed by Clayton Christensen and his colleagues and its implications for the future of higher education (HE).

***Keywords*—**MOOCs, disruptive innovations, higher education, jobs theory.

I. Introduction and Methodology

DIGITAL technology is impacting on many aspects of our personal and professional lives. This impact is continuously evolving as new developments in technology emerge. Like other industries, education is has been impacted by digital innovations. Personal computers, the Internet and wearable technology have transformed learning and teaching at schools, colleges and universities. One consequence of this transformation is MOOCs. MOOCs are courses that are being provided for free and are being made available to an unlimited number of people. At least, this is how they were being sold to people since 2012. This model differs from the online educational model that existed before. Online education had been (and continues to be) used by educational institutes throughout the world as a tool that complements their classroom-based curriculum delivery. The MOOCs model therefore has great implications for educational institutes, especially, higher education (HE). They raise many issues that impact on several important aspects of traditional education in terms of income, quality, student experience, employability and acceptability. Most importantly, they raise a big question mark on the future of education (especially HE).

In this article, MOOCs is examined within the theoretical frameworks of disruptive innovations and jobs to be done (developed by Clayton Christensen and his colleagues). This approach is helpful as it will shed some light on the process, implications and future direction of this innovation with relation to education. These theories are the product of many years of research into the failures and successes of various innovations and organizations and its insightful and convincing interpretations of historical and current events are widely acknowledged by many executives, directors and authors throughout the world [1]. This approach will be preceded by an introduction of the MOOCs phenomenon and its recent origins.

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II. Background

A. MOOCs

The history of MOOCs is traced back to early efforts that sought to provide free online education to the masses. One such effort began with the establishment of the Khan Academy – a non-profit organization – in 2006 by Salman Khan (an American of an Asian origin). The Khan Academy is a portal that contains thousands of free educational resources on different subjects (some made available through YouTube) translated into different languages. In 2008, two Canadians, George Siemens (an educator Professor at the Center for Distance Education) and Stephen Downes (an online learning designer and researcher), offered a free online learning course entitled "Connectivism and Connective Knowledge 2008 (CCK08)". The course was offered formally through the University of Manitoba and informally through open enrolment (at no cost) to anybody in the world [2]. Some initiatives aimed at providing free university education have emerged since then. One of those was initiated by the University of the People (UoPeople). UoPeople was founded in 2009 by educational entrepreneur Shai Reshef and is affiliated with the United Nations GAID, the Clinton Global Initiative, and Yale Law School ISP. Courses provided by UoPeople are free but students are required to pay a one-time application processing fee of US$60 and subsequent examination processing fee of US$100 -200 levied per course. UoPeople offers undergraduate and postgraduate programs in business administration and computer science and has more than 9000 students from 194 countries. However, what is very interesting about new developments in free online education is a surge of interest in MOOCs by leading US universities who seemed keen to deliver their own online courses for "free". Since 2011, MOOCs began to attract a great deal of interest, especially from highly prestigious US universities. Examples include Harvard, Stanford, Michigan, Pennsylvania, Princeton and MIT (to name but a few). Several start-up companies (for-profit and non-profit) emerged since then and developed partnerships with universities and professors to offer MOOC's. By 2015, companies such as Coursera, Udacity and edX became the biggest in terms of registered students. There are now many MOOC initiatives emerging throughout worldwide.

Despite the universal use of the term "MOOCs", some analysts (with some justification) claim that there are mainly two types of MOOCs: xMOOCs and cMOOCs. According to these views, xMOOCs relate to platforms that employ courses delivered by institutions to subscribers (a kind of traditional one-to-many instructor-students model). xMOOCs employ a cognitive-behaviorist or instructivist pedagogical approach which relies on content-based training delivered at scale through a one-to-many learning environment [3]. Many existing MOOCs (e.g., edX, Coursera, Udacity) fall into this category. The origin of the letter "X" comes from "eXtended" or "eXtension" to indicate that the offering is an extension of the core curriculum. cMOOCs, on the other hand, relate to platforms where the subscribers can also be instructors who deliver content and take part in the discussions and learning (a kind of many-to-many model of learning). The C in cMOOCs is borrowed from the early open course Canadian initiative that began with the aforementioned course "Connectivism and Connective Knowledge" [4]. cMOOcs follow the pedagogic principles of connectivism through which learning is viewed as residing in the connections that exist between people and digital artifacts within a ubiquitous network [5]. Examples of cMOOCs include Change 11, Personal Learning Environments Networks and Knowledge (PLENK 2010), Connectivism and Connected Knowledge 2011 (CCK11).

III. Theoretical Frameworks

B. Disruptive Innovations

The concept of disruptive innovations was first proposed by Christensen and his colleagues and developed into a theory known as the "theory of disruptive innovations" [6]-[8]. According to this theory, there are two types of innovations: sustaining innovations and disruptive innovations. Sustaining innovations, according to these authors, are often innovations that occur frequently and are implemented by established large incumbent companies in order to improve the performance of some of their existing products or services that have strong market shares. Disruptive innovations, on the other hand, occur less frequently and tend initially to have performance problems. Furthermore, there are two main types of disruptive innovations: new market and low-end disruptions. Disruptive innovations that create new markets, according to this theory, can occur when characteristics of existing products and services limit the number of potential consumers (defined in the theory as "non-consumers") or force consumption to take place in inconvenient or centralized settings. Moreover, such innovations tend to be of lower quality than the well-established ones and often take a long time before they overcome such limitations. The Personal Computer (PC) is one example of a new market disruptive innovation. Prior to using PCs, gaining access to software and hardware for business and personal tasks could only be provided by gaining access to a terminal connected to a mainframe or minicomputer. Minicomputers and mainframe computers were very expensive to buy and rent and using their services often required a great deal of effort and expertise (e.g., requiring authorization, travel to gain access to a building that houses the terminal, technical skills). Moreover, when PCs emerged, they had many limitations (e.g., limited memory, storage and processing power and limited screen resolution), but were able eventually to overcome those limitations and disrupt the mainframe and minicomputers and create a new market in PCs.

Low-end disruptions affect the low-end of the original business or mainstream value network by attracting customers (who are often over served) at this level of the business. One example of this type of disruption was the Korean automakers' entry into the US market. The Korean automakers did not create a new market; they simply attracted the "least attractive" customers (those who cannot afford the big cars) of the targeted businesses. A hybrid of the two types (new market and low-end) of disruption can also be found. The American low cost Southwest Airlines is one example of a hybrid disruption. It initially targeted people who were not flying (the non-consumers of air travel who used cars or buses) but later pulled customers out of the low-end of the major airlines' value network as well. Faced with this type of disruption, managers (often those who successfully built their companies) tend to ignore or dismiss the potential of these innovations. The classical example is William Orton (President of Western Union in 1876) who called Alexander Graham Bell's telephone invention an "electrical toy". Western Union then had a monopoly on the telegraph which at the time was the world's most advanced communication technology [7]. Christensen does not fault these executives because he argues that these people are essentially following what is taught at business schools as being two principles of good management. These are: 1) you should always listen to and respond to the needs of your best customers; 2) you should focus investments on those innovations that promise the highest returns. What often happens (according to Christensen) is that these two principles actually sow the seeds of every successful company's ultimate demise. He calls it the innovator's dilemma because doing the right thing is the wrong thing [6].

The theory of disruptive innovations came under attack recently due to the emergence of disruptive innovations (e.g., Uber, Airbnb, Google Maps) that did not have to go through the usual path of being products that suffer from performance issues in the initial stages of their development. The discussion of this critique is beyond the scope of this article. However, in a recent Web article, Michael Raynor (one of Clayton Christensen's colleagues) argues that the disruption theory, like any good theory, has remained a work in progress and that it has matured into a core set of concepts without slipping into an ossified orthodoxy. As such, disruptive innovations need not start with cheap and poor quality products which less resourceful (and unattractive) customers can afford. Rather, disruptive innovations can also get their start in entirely new markets, quite independent of the characteristics of the customers or markets in question [8].

C. Jobs to Be Done

In his recent writings, Christensen describes the theory of

disruptive innovations as essentially a theory of competitive response to an innovation [9]. He claims that the theory explains and predicts the behavior of companies in danger of being disrupted and provides insights into the mistakes that incumbent leaders make in response to what initially seem to be minuscule threats. However, according to him, the theory does not tell you where to look for new opportunities and it does not predict or explain how companies should innovate to undermine established leaders or where to create new markets and it does not tell you how to create products and services that customers will want to buy and predict which new products will succeed. However, he claims in his thought-provoking book, "Competing against Luck: The Story of Innovation and Customer Choice" that the theory of Jobs to be Done (his new theory) can do all of that.

The theory of Jobs to be Done (according to Christensen) is built through inductive research and is the result of two decades of research trying to find out what motivates customers to buy products and services. The theory is based on the premise that the customer is not the right unit of analysis; but rather, the job that a customer is trying to do is. What causes people to buy products and services (according to Christensen) is the "stuff" that happens to all of us every day. He contends that we all have jobs that we need to do which arise in our day-to-day lives and that we buy or "hire" products and services to get these jobs done. He argues that this is what causes people to buy these products and services: to get a job done. He further explains that not everything we do is a job. For example, the need to eat is not a job to be done and neither is the need to feel healthy. The job to be done (according to Christensen) is different from the traditional marketing concept of "needs" because it entails a much higher degree of specificity of what one tries to achieve. As such, a job to be done is progress that an individual seeks to achieve in a given circumstance. The circumstance is fundamental to defining the job (and finding a solution for it) because the nature of the desired progress will always be influenced (according to Christensen) by the circumstance.

Christensen provides the case of "milkshake" in his book as the first example of what motivates people to buy and prefer one product to another. He narrates the story of a US fast food restaurant trying to find out how to increase sales of its milkshake. Having conducted a series of interviews with customers and improved its products based on those interviews, the sale of milkshakes did not grow. When the restaurant managers finally approached a team of consultants to look into this matter further, the team looked at the problem from a different perspective. Following several observations inside the restaurant, it became clear that most sales of milkshakes were taking place very early in the morning (before 9.00 am). When customers - who bought the milkshake – were interviewed as they came out of the restaurant's door, it transpired that these customers (mostly commuting to work) had one job to be done: staying full when mid-morning hunger strikes. Other competitor products did not seem to do the job so well. While driving, customers would suck the milkshake (from a straw) on their way to work. Using (or hiring) other products (e.g., bagels, doughnuts) did not do the job so well. Bagels were often dry and tasteless. Doughnuts can be crumbly and leave customers' fingers sticky. The research team learned (following this experience) that what these buyers had in common had nothing to do with individual demographics or product characteristics. Rather, they all shared a common job they needed to get done in the morning.

IV. Disrupting Education

Christensen, Horn and Johnson see great potential for online education to have a disruptive impact on traditional classroom-based teaching [10]. This is because there are significant areas of non-consumption (often one of the main targets of disruptive innovations) that online education can meet. The authors see online learning as a classic example of a new market disrupting or substituting an existing business model (i.e., class-based education). They argue:

> "This substitution is happening because of the technological and economic advantages of computer-based learning, compared to the monolithic school model. Online technology provides accessibility for those who previously would not have been able to take the course. It provides convenience for a student to fit the course into his or her schedule at the time and place that is most desirable. To varying degrees, it is simpler because it offers comparatively greater flexibility in the pace and learning path. And when it is software-based, it can scale with ease" [12].

The high cost of Western HE is also likely to create non-consumption among many students who are unable (or unwilling to be in debt) to meet the rising costs of degree qualifications. Degree courses delivered fully through online education are relatively inexpensive when compared with traditional college or university degrees [11]. This is especially true in many Western countries. In the UK, for example, a university home student can pay a total of up to £27,000 in fees for a three year undergraduate degree. In the US, the annual degree fees charged by some universities can exceed US$ 40,000 [12]. Online learning is enabling people to gain access to education at far less cost. It also removes many of the inconveniences associated with a traditional education, e.g., registering at certain times of the year, commuting, attending classes, finding a seat in a crowded classroom.

Given the aforementioned "rationale" of the theory of disruptive innovation, the MOOCs phenomenon represents an interesting case of a disruptive innovation. It is not a sustaining innovation because, according to the theory disruptive innovations, sustaining innovations often target demanding, high-end users with better performance than what was previously available For example, MOOCs are not an improvement to the online degrees that are currently being offered by many educational institutes throughout the world. By contrast, disruptive innovations do not attempt to bring better products to existing markets. Rather, they disrupt (as is the case with MOOCs) by introducing products or services that are less expensive to use, simple and convenient that

appeal to new or less-demanding customers [7]. Indeed, the MOOCs phenomenon is a very interesting case of a disruptive innovation. This is due to the fact that the existing incumbents (e.g. universities) are driving the innovation; contrary to historical evidence which suggests that existing incumbent organizations cannot naturally disrupt themselves [12].

The MOOCs phenomenon is unlikely (at least not in the short or medium run) to radically impact existing educational practices and force many traditional education providers (as disruptive innovations often do) out of business. In a rare Web article, Horn and Christensen acknowledge that most of the universities that currently try to embrace MOOCs do so out of fear of being left behind and because "disruption theory is finally widely enough understood that astute leaders know how to identify and chase opportunities early" [13]. However, a great deal of the future of MOOCs will depend on the extent to which employers will be willing to recognize MOOC qualifications.

Recent announcements and activities by MOOC providers have created a great deal of debate on the future of MOOCs. In November 2013, Udacity (to the delight of MOOC skeptics) announced a radical change of its business model. Its co-founder (Sebastian Thrun) called it a "great pivot". Since then it began to concentrate on providing courses that are vocational in nature (and partnering with employers) with the purpose of helping learners find employment or improve their career prospects and also helping companies find candidates with the right skills. For example, Coursera partnered with Snapdeal, Shazam and Instagram, Edx partnered with Microsoft, Udacity partnered with Google, Facebook, Amazon, GitHub and AT&T [14].

What is significant about these partnerships is the emergence of nanodegrees, which are small programs aimed at addressing specific skills (often technical) such as, for example, front-end web developing, iOS, Android programming, machine learning), and cost less than US$1000. Students pay US$ 200 per month for the course and can take as little or as much time as they need to finish. Those who finish within 12 months receive half their tuition back, thus keeping the cost of tuition below US$1,000 for most students. Upon completion, students receive a nanodegree. This credential may not mean much to traditional academia but is increasingly recognized by Udacity's partner technology companies looking for programmers and other skilled workers. AT&T, for instance, has pledged to reserve 100 paid internships for Udacity's nanodegree program graduates, and Google has invited top nanodegree graduates to visit its Silicon Valley campus. Furthermore, in an effort to further legitimize its nanodegrees, the company began by attaching a job-placement guarantee onto some of its degrees. Though a bit more costly at US$299 per month, Udacity's "nanodegree plus" programs come with a commitment from the MOOC provider to place graduates in jobs related to their coursework within six months of graduation or the company will refund 100% of the tuition cost.

To provide an example of the potential of this development, Udacity has enrolled more than 11,000 students in its nanodegree programs and graduated 3,000 of those. In 2015, Udacity's revenue, according to Thrun (one of its main founders), was growing nearly 30% month-over-month, thus pushing the company into profit and its valuation to about US$1.1 billion [15].

When MOOCs began in 2011 they lacked a real business model. They began by offering courses to everyone in the world for free (they still do). They had vague ideas of how to make money and began to struggle. However, developments since 2014 and 2015 saw a number of MOOC providers partnering with companies to offer short courses and degrees based on skills that are in demand by these companies. These developments suggest that MOOC providers might have finally managed to carve a business model that will ensure their survival. Weise [16] contends that such moves appeared to map well to employer needs and what can be described as areas of non-consumption (which disruptive innovations often target). He argues that in their turn away from career-oriented training, colleges and universities have unwittingly left unattended a niche of low-end consumers who are over-served by traditional forms of higher education, underprepared for the workforce, and seeking lifelong learning pathways [18]. Winning the trust and confidence of employers could be a turning point for the future of MOOCs and the disruption this might cause to HE.

Education technology companies and alternative learning providers — such as MOOCs — are finding disruptive footholds, according to Christensen and Weise [17], by targeting these non-consumers and also graduates from well-regarded colleges who are struggling to launch their careers, make it into the workforce, or transition between jobs. This is further echoed by Horn (one of Christensen's co-authors of the theory of disruptive innovations) who contends that the real disruption in U.S. higher education was never going to come from "slapping" traditional courses online for free. The real disruption in higher education, according to him, was always going to come from a new system that looks quite different from the current one that begins by serving non-consumers of traditional higher education and linking the learning with employer needs to help students make progress in their lives [18].

The thought of MOOCs potentially replacing brick-and-mortar educational establishments is probably difficult to predict. Some MOOC providers (at one point) were over-optimistic. Thrun (the founder of Udacity) once predicted that in 50 years' time (thanks to MOOCs) there will only be 10 universities left around the world [19]. He listed these as:

1. Oxford
2. Cambridge
3. Harvard
4. MIT
5. Stanford
6. Princeton
7. The University of Pearson (acquires Coursera, 2016)
8. The University of Google (acquires Udacity, 2014)
9. The University of Walmart (acquires University of Phoenix, 2017)

10. Brigham Young University

This doom scenario for traditional higher education is probably still far away from reality and may not even happen. For example, it is unlikely that MOOCs will do to universities what the PC did to minicomputers and what minicomputers did to mainframe computers. This is because there will always be many consumers of brick-and-mortar educational establishments. These will be the people who seek more than just the skills and the knowledge that are provided by these entities but also the social and emotional experience. Moreover, there are bound to be subject areas that cannot be fully replaced by MOOCs. Medicine, for example, is no doubt one of them. Nevertheless, MOOCs could impact the future growth of HE institutes and their income. This brings to mind the rationale proposed by the theory of Jobs to be Done (introduced above). There will always be possibilities to "hire" brick-and-mortar HE institutes by some consumers, not just for the social or emotional experience they provide, but maybe also for the type of degree and the future aspirations of those consumers (dictated by their own circumstances) in order to get a job done. The same thing can also be said about MOOCs. Some consumers of HE could hire certain MOOCs to do or accomplish some job or progress such as getting a job, for example, or gaining a special skill that will enhance their career (a job to be done) but does not require years of training and high expenses. Indeed, research suggests that many of the registered students with MOOCs already own some kind of degrees. For example, a study revealed that 83% of MOOC students have a postsecondary degree, 79.4% of students have a Bachelor's degree or higher and 44.2% indicated a level of education beyond a Bachelor degree [20]. These students do not necessarily require another degree that lasts several years to complete. These types of students would normally turn to HE institutes for continuous professional development (and employer-recognized) courses in order to upgrade their skills or gain new knowledge for career or employment purposes.

In an interesting and extended blog article hailing the potential merits of MOOCs, Shirky (a keen advocate of MOOCs) echoes this thought. He comments:

> "...anything that could replace the traditional college experience would have to work like one, and the institutions best at working like a college are already colleges. The possibility MOOCs hold out is that the educational parts of education can be unbundled. MOOCs expand the audience for education to people ill-served or completely shut out from the current system, in the same way phonographs expanded the audience for symphonies to people who couldn't get to a concert hall, and PCs expanded the users of computing power to people who didn't work in big companies" [21].

V. Conclusion

The MOOCs phenomenon, as demonstrated in this article, has exhibited characteristics of a disruptive innovation: both low-end and new market. It has the potential (as evidenced from the provided examples) to attract low-end consumers (those who are overserved by traditional higher education offerings that shunned job-oriented training) and also to attract non-consumers (those who do not have the means to go to a higher education college or university). What is interesting about this potentially disruptive phenomenon is that it emanated from the providers of HE, contrary to conventional wisdom, which suggests that incumbent organizations cannot naturally disrupt themselves. However, MOOCs are evolving and it is early days to suggest that MOOCs will disrupt HE in the way the PCs disrupted minicomputers or the way that minicomputers disrupted mainframe computers. To replace the traditional college or university experience, MOOCs will have to work like one and there is no strong evidence to suggest that this is what MOOC providers intend to do. Indeed, some MOOC providers seem to have acknowledged this fact and adopted a business model that seems to be paying dividends. Partnerships with businesses to provide students with sought after skills and jobs (a vocational business model) is what some major MOOC providers are currently bent on concentrating their resources and this direction seems to be working.

Research indicates that many of the students who subscribe to MOOCs often have college and university degrees. This suggests that MOOC providers could be providing some of their consumers with opportunities to "hire" courses or short duration degrees to enable them to do a job that they need to do such as improving their careers or employment prospects. Focusing on the jobs to be done, MOOC providers have the potential to attract huge numbers of consumers who would want to pull some MOOC courses or degrees into their lives.

In the final analysis, MOOCs have the potential to compete with HE institutes by disrupting them from three directions: 1) new market disruption by competing with them on quality and employability; 2) low market disruption by attracting the least desired or well-off students; and 3) by attracting huge numbers of students who would traditionally approach HE institutes for continuous professional development courses or postgraduate programs in order to upgrade their skills or gain new knowledge for employment and career purposes. What is certain, however, is that MOOCs are evolving and those who portrayed this phenomenon in the past as a passing fad might be disappointed.

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