DIFFUSION THEORY AS AN INSTRUMENT FOR RESEARCHING THE ADOPTION OF MOOCS IN ACADEMIC SYSTEMS

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Abstract

The goal of our research was to create a stable model and find a profound theory to quantify, analyze, and describe this eruptive process to enable us to compare MOOC adoption in different academic systems. We therefore set up a research scheme measuring overall course provision, market diversification, market concentration, and product pricing. The newness of the research model did not just require the application of a tailored model, but also demanded the provision of a suitable theoretical background that served as a basis for analysis. We decided to apply the most prominent innovation theory to our test study, Everett M. Rogers theory of Diffusion of Innovations (IDT).

To test our model we elevated and compared data about MOOC provision in the academic systems of Austria, Germany, and the USA. While the test showed that Germany and Austria seriously lag behind in almost any aspect of academic MOOC provision, we found that IDT provided useful approaches through its definition of adopter categories and adoption elements in large part. However, the IDT concept of adoption stages was not capable of describing the adoption process of organisations of the size of a national academic system (which we consider systems of systems). We therefore decided to suggest the term adoption span, an extension of the existing theoretical concept. The adoption span can cover not just one stage, but a whole range of adoption stages. With this independent extension of IDT we were able to cover all stages of adoption the national academic systems were in. Thus, we did not just provide an applicable research model for worldwide comparison of MOOC adoption in national academic systems, but also suggested a new term for the description of adoption processes in systems of systems that we hope will soon be discussed among scholars.

Keywords: IDT, Diffusion of Innovations, MOOC, Massive Open Online Courses, adoption span.

1. INTRODUCTION

Massive Open Online Courses (MOOCs) are a rapidly growing phenomenon of our time that may be considered an important vehicle carrying academic education into the age of industry 4.0. Embraced by journalists and academics as a means by which the intellectual potential of new social stratums can be reached and unlocked (Friedman, 2013), MOOCs have experienced a period of disenchantment within the

last two or three years. Practice has not only shown that the big majority of MOOC students are already educated to degree level, MOOCs also turned out to have tremendous drop-out rates and were widely criticized for depersonalizing, homogenizing, and centralizing education. Nevertheless, both MOOC enrolment and MOOC provision have grown almost exponentially within the last four years. With about 200 MOOCs online by January 2013, MOOC provision has grown by more than 271% per year ending up at 4200 courses at the end of 2015 (Shah, 2015). If the MOOC market continues to grow at this pace, there will be more than 4.5 million MOOCs online in December 2022. However, academic MOOC production is everything but equally spread throughout the world, as only few countries and universities exhibit dynamics in the emerging domain.

We wanted to have a closer look on the way MOOCs spread within national academic systems. The newness of the phenomenon demanded us to first find a stable model and a profound theory enabling us to quantify, describe, and compare MOOC adoption in different academic systems. As MOOC research has not provided a tailored model up to this day, we decided to create our own research model based on the most renowned adoption theory, Everett M. Rogers *Theory of Diffusion of Innovations* and to test it in a study comparing MOOC adoption in the academic systems of Austria, Germany, and the USA.

2. LITERATURE ON MOOC ADOPTION

Up to the present day, only a small amount of research has been conducted on MOOC provision and MOOC adoption, most of which saw Massive Open Online Courses within the broader field of online education or focused on the attitudes of academic staff towards Massive Open Online Courses. Helge Fischer (2013) was first using Diffusion Theory for the analysis of adoption behavior of scholars and academic teachers concerning all means of E-learning (not just MOOCs). Hussain et al. (2013) also took a wider view when integrating MOOC adoption in their analysis of academia`s attitude towards OER (Open Educational Resources) in Pakistan. An EADTU report from 2015 on institutional motivations and strategies on MOOCs compared the motives for MOOC provision in international academia, finding substantial differences between the European Union and the USA. While increasing the visibility of the University prevailed everywhere, driving student recruitment was much more important to US institutions than to European ones (Jansen & Schuwer, 2015). Hollands & Tirthali (2014) took a series of interviews with academic staff finding that most of them saw MOOCs as cost-ineffective and the data derived from MOOCs was not used to improve courses. Interesting data on MOOC provision is not just provided by academic researchers, but also by specialized websites like Class Central (Shah, 2015), which gathers and publishes data about the overall numbers of MOOC provision. However, although they provide interesting details about the distribution of courses by providers and subjects, Class Central does not have data about the countries the courses originate from.

3. THEORY OF DIFFUSION OF INNOVATIONS AND MOOCS

Everett M. Rogers Theory of Diffusion of Innovations (IDT) has widely been applied in the fields of marketing, management, sociology, and communication on subjects as innovativeness of members of a social system, diffusion networks, and adoption rates of innovations in different social systems. Rogers defines diffusion as a process in which an innovation is communicated through certain channels over time among the members of a social system. It is a process of convergence or divergence about the meaning the participants give to certain events or phenomena, which are perceived as new by possible adopters. The result of a successful diffusion of an innovation is individual or social change (Rogers, 2003). Up to now, a rather narrow view was taken on the adopting entities, which were only seen as either individuals or institutions. Bigger systems or systems of systems were more or less ignored. Rogers defined five stages of adoption on which diffusion researchers, including us, almost collectively agree (Rogers, 2003). However, we have a more elastic interpretation of the system.

The knowledge stage: When an individual or other decision making unit first gets to know about the existence of an innovation and acquires some understanding of its nature (Rogers, 2003).

The stage of persuasion: The persuasion stage is when an individual forms a favorable or unfavorable opinion or attitude towards an idea or innovation (Rogers, 2003).

The decision stage: When an individual sets actions that involve a choice about the rejection or adoption of an innovation, the innovation-decision process has reached the decision stage (Rogers, 2003).

The implementation stage: When the innovation is put to use by the individual or adopting unit, we are in the stage of implementation (Rogers, 2003).

The stage of confirmation: In the last stadium the adopter searches confirmation and reinforcement. If

conflicting messages are obtained, the decision to adopt may still be reversed (Rogers, 2003).

4. SUGGESTING A NEW TERM: THE ADOPTION SPAN

The focus of our model did not lie on the adoption process of single professors or universities, but on the academic system of a whole nation. These systems have different consistencies, but they all include the universities of the country, parts of the government, and different cross- and supra-institutional organizations. Although single universities may be pinpointed at a certain stage of adoption, we have realized that the system as a whole cannot be categorized in just one stage, but almost always crosses borders. As parts of the system advance quickly, others stay behind. This does not mean that systems of systems occupy all stages of adoption, but they can be located at different fields or spans. Thus, IDT provided us with an excellent grid for our study, but we were missing a more comprehensive terminology for entities occupying more than one stage.

Therefore, we decided to suggest the term adoption span as a new category and define it as follows: The adoption span reaches from the lowest to the highest stage of adoption of a system of systems. Thus, only complex systems can have an adoption span, single units of adoption can only be in a stage of adoption. Fig. 1 illustrates the suggested differentiation between an stage of adoption and an adoption span.

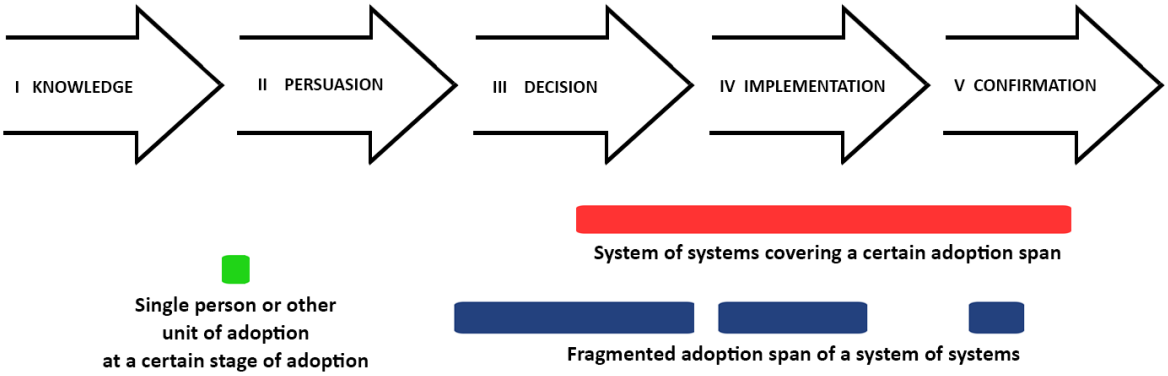

Fig.1: Adoption span and adoption stages

The adoption span does not have to be continuous. It can also be fragmented with some leading parts and some parts staying behind. A system of systems can partly be at a span of confirmation, while other parts are still in a persuasion span. If there are no other elements of the system in between, we can conclude that the system has a fragmented adoption span. We subsequently used the suggested term in our model and tested it`s applicability in our test study on MOOC diffusion in the academic systems of Austria, Germany, and the USA.

5. RESEARCH MODEL FOR THE ANALYSIS OF MOOC ADOPTION IN NATIONAL ACADEMIC SYSTEMS

Investigating Massive Open Online Courses on the sample of all Austrian, German, and American academic MOOCs starting between March 15, 2016 and April 15, 2016, we created four hypotheses which were based on three assumptions.

Assumption A: Higher national market supply leads to more international market power. The assumption follows Bauer (2011), who says quantity of supply is an indication for the determination of market shares. Thus, a higher adoption rate leads to more market power.

Assumption B: Product variety is proportional to market power. The stronger the market is, the more diverse are its products.

Assumption C: Higher provider diversification (which equals less market concentration) within a country leads to more international dominance of the national market.

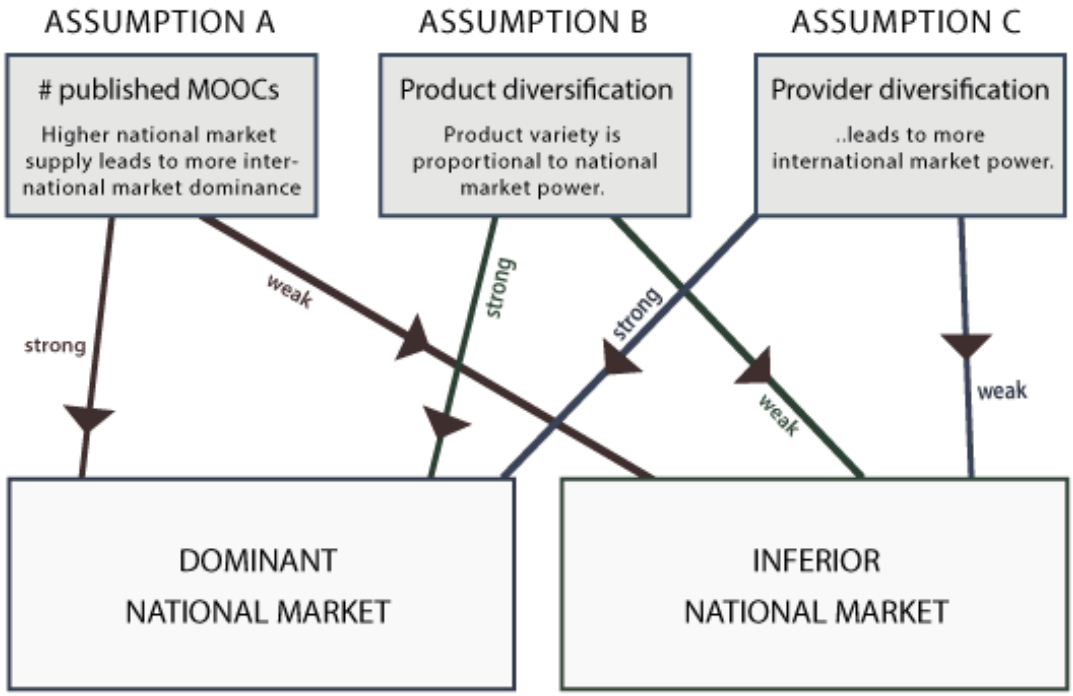

Fig. 2: Assumptions KPIs and market dominance

The data derived from the three assumptions result in three different country rankings (MOOCs per capita, diversification, and national market concentration). The adoption index A of the respective category results of A = 10/r (r = ranking).

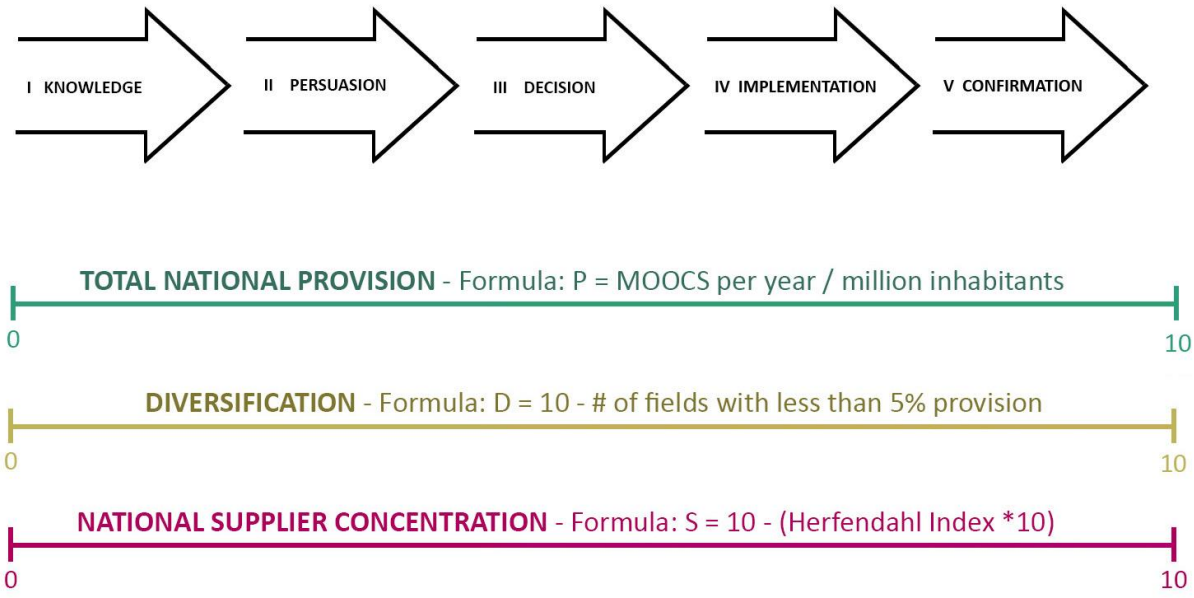

Fig. 3: Adoption indices with formulas

6. RESEARCH RESULTS

Researching MOOC supply in Austria, Germany, and the USA with a sample of courses offered between March 15, 2016 and April 15, 2016. We only included public MOOCs published by private or state universities. MOOCs provided by companies (like Microsoft or SAP), professors (without official support from a university), schools, or other institutions were not taken into consideration, no matter how reputable they

are. The validity of our test study is limited by a small sample (especially for Austrian and German courses). However, the aim of the test was not to provide unquestionable concrete results, but to show the applicability of the research model.

Total number of published MOOCs

American Universities started exactly 199 MOOCs in the given time period, four were started by German Universities and only one by Austrian TU Graz. This means that American Universities started 0.615 MOOCs per million people living in their country. Austria launched 0.115 MOOCs per million and Germany 0.045. Assuming that the MOOC will stay constant for twelve months, this means that Austria launches 1.38 academic MOOCs per million inhabitants within a year, while in Germany it is a little more than one in two years. Our classification for the total number of MOOCs goes from one to ten reckoning extrapolating the given data to MOOC provision in one year (MOOCs per month and million * 12). Any result higher than ten stays at maximum score of ten which stands for highest stage of adoption.

Diversification related to fields of study

Dividing American MOOCs in ten fields of study (Business, Economics, Computer Sciences, Education, Engineering, Fine Arts, Health, Humanities & Communication, Natural Sciences, Social Sciences), considerable level differences between the numbers of provided MOOCs can be seen. Almost 50% of the 199 American MOOCs starting between March 15 and April 15 belong to only two fields of study: 49 can be attributed to business, 44 to computer science. The other eight disciplines range from 23 (natural sciences) to five courses (health). Thus, only the health sector provides at fewer than 5% of all courses. The four German courses divide into two courses in business and economics and both one in computer science and in social sciences. The single Austrian course is about online learning and belongs to the field of education. For any field of study that provides less than five percent of all courses we subtracted one point from the maximum of ten (10 – number of fields with less than 5% course provision).

Market concentration within the national market

The 199 American MOOCs were published by 53 different universities. Details on the allotment of courses can be seen in fig. 4.

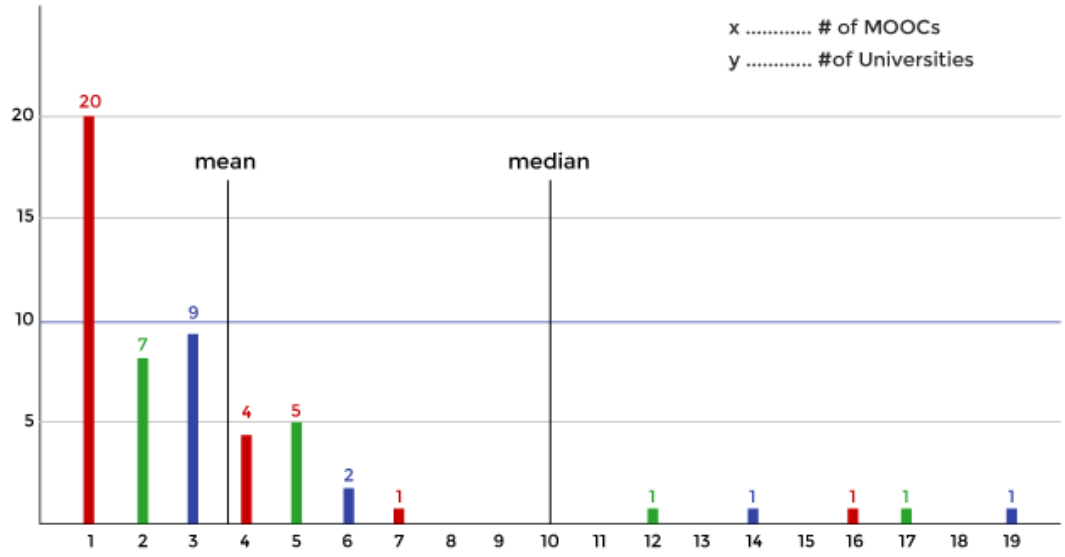

Fig. 4: Us Universities Offering Certain Number of Moocs

The four German MOOCs were started by four different universities and the Austrian MOOC was co-produced by one university and three non-academic institutions. For the calculation of market diversification, we used the standard formula for the calculation of market concentration, the Herfendahl index (fig. 5). A Herfendahl index of 1 indicates a total monopoly. The smaller the index gets, the more diverse is the market.

$$H := \sum_{i=1}^{N} a_i^2$$

Fig. 5: Herfendahl Index

For the American market we calculated the following index:

[(1/199)^2]*20 + [(2/199)^2]*7+[(3/199) ^2]*9 + [(4/199)^2]*4+ [(5/199)^2]*5 + [(6/199)^2]*2 + (7/199)^2 + (1*12/199)^2+ (1*14/199)^2+ (1*16/199)^2+ (1*17/199)^2 + (1*19/199)^2 = **0.0425**

For the German market we have the following calculation:

[1/4)^2]*2 + 1/2)^2 = **0,375**

Austria has only one provider, so the calculation produces a total monopoly:

1^2 = **1**

In our model, we multiply the Herfendahl index by ten and subtract it from ten, calculating with the formula *S (supplier diversification) = 10 - (Herfendahl Index *10).*

Results combined in the adoption span

The three rankings result in the following adoption spans.

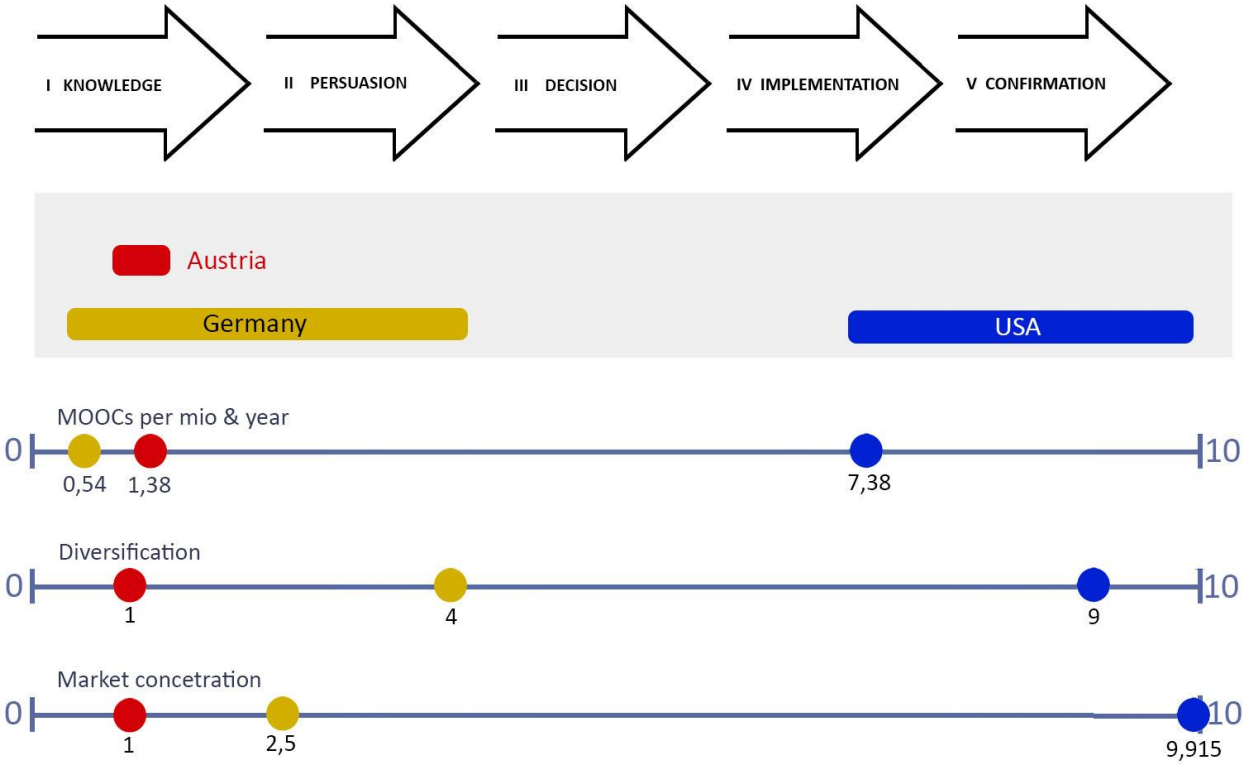

Fig. 6: Adoption spans of three academic systems

We can see that the American system is between the end of implementation and total confirmation of the MOOC innovation. Germany and Austria are far behind with Germany showing the widest span from knowledge to finalized persuasion. Still persisting in the stadium of learning and gaining knowledge about MOOCs, the Austrian system lies far behindhand.

7. CONCLUSION

We found that IDT provides a suitable framework for the evaluation of MOOC adoption within national academic systems. Nevertheless, to suit the research model we created, we needed to establish a new way of looking at the diffusion of innovations. Interpreting adoption in national academic systems as a broad and multi-branched process, we suggested the adoption span as a new term in IDT. With the total number of courses, MOOC diversification, and MOOC market concentration we measure three key performance indicators of the respective academic system and translate them into an evaluation scale ranging from zero (stage of ignorance) to ten (stage of full adoption). Although we are aware that the measurement of diversification could still be optimized (as all fields of study providing 5 to 100 percent of the national MOOC output have the same weight in our system) and other performance numbers might be added, we think our research scheme is capable of comparing and evaluating MOOC adoption in any academic system of the world. Thus, we hope that our model will soon get tested and discussed among educational researchers and look forward to criticism, suggestions, and further applications of our research.

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