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Does digitalization in higher education help to bridge the gap between academia and industry? An application to COVID-19

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Does digitalization in higher education help to bridge the gap between academia and industry? An application to COVID-19

Abstract

There are three different types of activities performed in higher education institutions that, taken together, form the components of a trilemma in higher education. These include traditional academic activities (research and teaching), along with those that aim to transfer knowledge beyond academia (industry-oriented activities). Increased use of digital technology resulting from face-to-face encounters being replaced by digital interactions, or digitalization, leads to transformations in higher education and affects the trilemma; universities face new challenges, and opportunities emerge. Drawing on the lessons learnt from COVID-19, I explore whether digitalization helps to bridge the gap between academia and industry.

Keywords: Australia; COVID-19; digitalization; higher education; industry; market; teaching; Triple Helix; research; trilemma.

1. Introduction

The functions of higher education (HE) are shifting. While research and teaching are two traditional core HE missions, the increasingly prominent role played by knowledge in economic development has opened up a third: the direct contributions made by universities to industry (Etzkowitz and Leydesdorff 2000). I argue that the university activities related to these three functions, i.e., academic (research and teaching) and industry-oriented, form a trilemma in HE. At the same time, the increased use of digital technology in HE resulting from face-to-face encounters being replaced by digital interactions (hereafter referred to as digitalization), leads to transformations that challenge higher education institutions (HEI) and present them with opportunities. Therefore, I analyse whether digitalization helps to bridge the gap between academia and industry. To do so, I draw on the transformations observed in the wake of the COVID-19 pandemic.

Márquez-Ramos and Mourelle (2018) recognized that future HE will involve both physical and virtual scenarios. Nearly two decades earlier, when commenting on the way ahead for universities, Gerrard (2000) claimed that “The concept of the fully developed virtual university [...] is that a server will replace campus-based universities” (page 320). As a hybrid (virtual and face-to-face) working economy emerged, HEI started to conduct some of their activities remotely; however, it was not until the outbreak of the COVID-19 pandemic that universities worldwide were forced to perform all their activities in a virtual format.

Therefore, a scenario of “virtuality” in HE, as described by Gerrard (2000) and Márquez-Ramos and Mourelle (2018), has become a reality—at least for several months in 2020. Although it is unclear to what extent virtuality in HE is here to stay, we are already observing transformations in HEI, which I suggest are more pronounced in higher education systems (HES) that are more dependent on market forces.

I focus the analysis on Australia for three main reasons. First, when considering the global context, it seems that the shift in favour of remote teaching and work is an Anglosphere phenomenon (Financial Times 2020; The Economist 2020). Second, there is an established Australian market for HE. Third, education is a key sector for the Australian economy: it is the largest service export, to which HE makes the largest contribution (see, e.g., Cavoli et al. 2020; Hall and Hooper 2008).

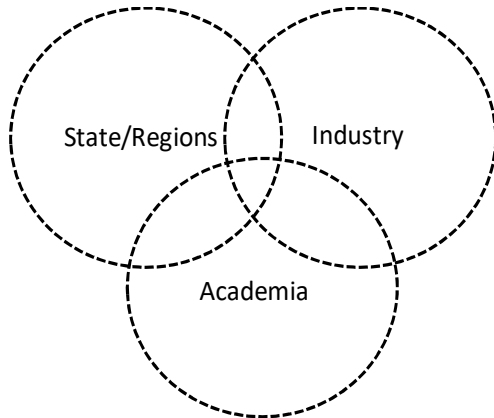
The rest of the paper proceeds as follows. As digitalization is a global phenomenon, in Section 2, I contextualize the Australian HES by means of a cross-country comparison that brings together elements from both the Triple Helix model and Clark’s triangle of coordination. In Section 3, I formalize the industry-research-teaching trilemma in HE and set the stage for a multi-dimensional analysis in a dynamic framework. In Section 4, I explore how digitalization transforms HE, with a focus on the impact of COVID-19. I discuss five dimensions of transformations, as well as how these transformations challenge HEI and provide them with opportunities. Section 5 concludes the paper by confirming that digitalization may help to bridge the gap between academia and industry, setting out some of the key implications for policy and practice, and highlighting some of the limitations of the paper and avenues for future research.

2. The Australian higher education system as a comparison to other systems in the world

Existing HES are based on some form of triple helix aimed at achieving an innovative environment combining trilateral initiatives from the state, industry, and academia (Etzkowitz and Leydesdorff 2000). Universities engage in basic research, industries produce commercial goods, and governments regulate markets. As interactions increase, each component evolves to adopt some characteristics of the other institution, which then gives rise to hybrid institutions. Danson and Todeva (2016) highlight that effective triple helix constellations depend on both how universities blend with the regional institutional landscape, and the existence of regional authorities as a coordination agency. The interaction between global, national, and regional aspects is important in the Australian context, where one can distinguish between challenges at the global level (e.g., climate change) national level (e.g., reconciliation), and regional level (for example, specific industries such as wine

in, e.g., South Australia; or mining in, e.g., Western Australia). Accordingly, as reflected in part A of Figure 1, I incorporate the regional aspect.

Part A: Triple Helix (TH)



Part B: TH + Clark's triangle

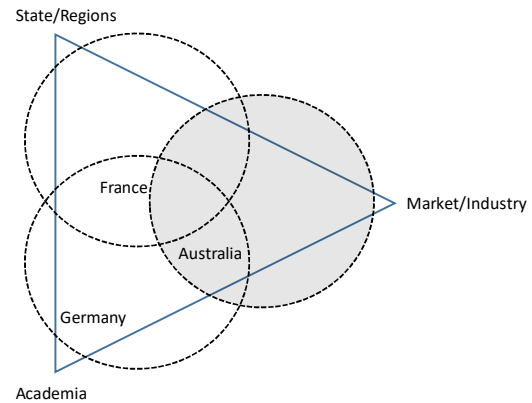


Figure 1. A cross-country comparison of higher education systems within a Triple Helix model of university–industry–government relations. Source: own elaboration based on Clark's triangle, Etzkowitz and Leydesdorff (2000), and Angermuller (2017).

HES around the world can be characterized by the actors that ultimately make decisions about HE: the state, the market, or the academics. Therefore, every university system can be seen as a specific solution to the problem of the distribution of decision-making power. Going back to Clark (1983), it can be visualized by locating it within a triangle, with the three different actors on its corners. This enables the identification of relevant indicators for a cross-country comparison. For example, researchers are valued differently in different university systems; see Angermuller (2017).

Part B in Figure 1 combines a regional Triple Helix and Clark's triangle. It depicts three countries: Germany, France, and Australia, which represented the third, fourth, and fifth largest destinations for overseas students before the COVID-19 pandemic (in 2005), behind the United States and the United Kingdom (see Hall and Hooper 2008). Such a comparison can yield useful insights from a Triple Helix perspective. For example, Etzkowitz (2015) advocated for the abandonment of austerity policies in Europe when comparing European HEI to US entrepreneurial universities. Also, Clark's triangle can help identify relevant elements to consider in different HES around the world. For example, universities' primary mission differ in different HES. In a state-centred model, the goal is to meet national socio-

economic objectives; in a market-oriented model, it is the provision of services to “academic consumers” and meeting market demands; and in a model of academic self-governance, it is academic freedom and long-term commitment to the production of knowledge (see Dobbins et al. 2011). Part B in Figure 1 also illustrates three key insights. First, traditional HE boundaries (as reflected by the triangle) may be overcome. Second, the future of HE may be an as-yet unknown scenario in uncharted terrain for HEI. For Australia, this is indicated by part of the shadowed circle being located outside the triangle. Finally, a global shock may lead to growing divergence between different HES around the world. In the context of this research, digitalization may represent a catalyst of such divergences because universities in systems closer to a pure market-oriented model may well start to follow paths that more closely resemble those in industry than universities in HES more in line with a pure state-centred model.

3. The industry-research-teaching trilemma

Recent reforms in HE have led to the emergence of managerial universities, which focus on effectiveness and efficiency and give rise to notable changes in related organizational structures (Hagerer 2019). In this context, universities’ success in rankings becomes more important, but at the same time they still have to be able to attract funding and transfer knowledge beyond academia. A key trade-off is how to secure more funding, which normally arises from applied, professional, and industry-oriented projects, while ensuring the necessary level in research quality that allows universities to maintain their reputation and prestige in national and international rankings. In addition, teaching is a key university function that, in the context of Australian HE, constitutes an important source of revenue. The difference between teaching revenue and costs (or teaching surplus) provides funds that can be used to pursue objectives that are not financially self-sustaining (e.g., research). Research is supported by large surpluses from university teaching in Australia: one dollar in every five spent on research comes from surpluses on teaching (this is based on conservative assumptions, see Norton and Cherastidtham 2015).

I focus on three HE components: industry, research, and teaching. Balancing the different activities in these components, even in a static and foreseeable university context, is challenging. The academic staff are under pressure to publish their research in esteemed publications, while still performing their teaching activities. Higher pressure on academic staff might reduce their incentives to invest their time in improving their teaching, as they focus on their research outcomes. This, together with the fact that many universities have increased their involvement in engagement and impact activities (e.g., transmitting new knowledge to research end-users beyond academia, catalysing societal change, and creating direct benefits for the wider community) and pressure to secure more funding from applied, professional, and industry-projects, creates a trilemma.

According to this trilemma, transfer of knowledge beyond academic activities, research quality, and teaching quality are all desirable but cannot be easily balanced. There are three possible responses that balance the demands of two of the three elements of the trilemma, but which then jeopardize the achievement of more effective and efficient HEI. The first is to opt for a mix that prioritizes traditional university activities, i.e., research and teaching, to achieve high research and teaching quality. This option does not provide an optimal response to the fact that Australian universities not only need to conduct engagement and impact activities, but also to generate additional income beyond teaching. The second possible response is to pursue a business model that centres on revenue-generating activities (i.e., industry-oriented and teaching). However, to successfully attract students and funding from research end-users, a university not only requires high teaching quality, but also high research quality, which is key for maintaining a good position in national and international HE rankings; in turn, these positions are heavily influenced by research outcomes and performance. And the third and final possibility is to set less ambitious targets regarding teaching quality, thus limiting the potential for developing a sound teaching reputation and community worldwide (e.g., through alumni networks), and missing out on an important source of income.

Assuming that these three components (industry-research-teaching) are interrelated,¹ they can be seen to constitute a trilemma in HE. From the trilemma, we learn that the effects of digitalization and the dynamics of HEI cannot be explored by considering academic activities (research and teaching) in isolation. Therefore, I explore three additional dimensions of transformations that have arisen with digitalization.

4. Transformations in higher education arising with digitalization: An exploration of the impact of COVID-19

I identify and discuss five dimensions of transformations: the academia-industry relationship; research (academic activities); teaching (academic activities); employment, management, and technology; and finance and infrastructure. Table 1 presents a summary of this section.

The academia-industry relationship: Implementation of effective university-industry research partnerships remains a challenge in Australia (see, e.g., Sciacca 2019). Along these lines, the trilemma in HE has illustrated the difficulty of balancing its three components in a static framework. In a dynamic framework, it can be conceptualized how a global shock may affect the academia-industry relationship. In this regard, the international mobility restrictions caused by the COVID-19 pandemic reduced the teaching surplus in Australian HEI and there is now less funding available in the system. Given that the enhancement of university-industry relationships has rested on the assumption that there is considerable

¹ For an analysis of the feasibility of solving the trilemma in a static framework, see Márquez-Ramos (2020).

resource available (Grigg 1994), this relationship may have stalled. At the same time, when there are fewer students in the system, strengthening the industry-research collaboration may be a feasible response to the trilemma. Also, concerning the industry-teaching collaboration, COVID-19 may have underscored the existing gap between graduates' skills and competencies and those required by industry. Consequently, HEI may prioritize efforts to bridge the gap between university curricula and industrial needs for work/career readiness. COVID-19 may have also enhanced collaboration to investigate and innovate in particular topics. In the pharmaceutical industry, for example, institutions that are usually competitors are now collaborating (Ledford 2020). We are witnessing how research and enterprise/industry are playing a growing role in supporting the rebuilding of regions. Therefore, universities may play a more important role in supporting the recovery of the post-COVID-19 economy (see, e.g., Group of Eight Australia 2020). In this vein, universities might become more relevant to local and national communities (Witze 2020). At the same time, there is an increasing need to "look beyond the campus" and HEI may become even more crucial for meeting global challenges (see, e.g., the podcast about "Universities and climate" by Pietsch 2020). Along these same lines, in a digital global world, HEI face competition that is no longer only merely local, regional, or national, but is now global.

Academic activities (research): COVID-19 has impacted those HE academic activities traditionally performed in face-to-face environments. It has transformed the way of networking (Mallapaty 2020; Viglione 2020) and publishing (Callaway 2020), as well as the topics investigated (Gibney 2020). More efficient processes may be established through cost reductions (e.g., in international travel and subscriptions), and open and fast publishing; but quality issues may emerge with publicly-available research that has not gone through a thorough peer review process. At the same time as we may observe the emergence of new research interests, researchers may face greater difficulties in securing funding for topics that do not offer immediate value to the community or society as a whole. Lower teaching surpluses may lead to reductions in internal research capability and at least part of it may be externalized.

Academic activities (teaching): Universities have fewer international students, have shifted many classes online, and students' learning preferences are changing (Witze 2020, Gibney 2020). The decline in the numbers of international students, and the consequent reduction in the teaching surplus, may lead to a re-focus on local, regional, and national problems in university curricula. Staff in HEI are developing new online resources and new academic collaborations are emerging. The growth in publicly-available online resources may help to "democratize" knowledge by making it more accessible (Márquez-Ramos and Mourelle 2016); however, academic staff face constraints (e.g., in terms of time and resources) that impact the quality and effectiveness of these new online materials (Longhurst et al. 2020). Needs and expectations of students in the future will differ from those of students in the past

(Márquez-Ramos and Mourelle 2018). New types of students are already emerging, such as those with concerns of sustainability and the carbon footprint of their travel (Western Union Business Solutions 2020). COVID-19 has modified perceptions about distance education and there is now greater acceptance of remote HE activities (see, e.g., Canvas 2020). The changes in students' learning preferences in terms of both topics selected and the format of HE delivery (through an improved perception of online teaching) may increase the market demand for new (blended and online) courses and academic programmes. But with COVID-19, and hence distance learning, there is evidence that more students than before are falling behind in their studies (Canvas 2020). Also, due to unequal access to technology, we have observed rising inequality in terms of, e.g., students' success and engagement, or unconnected lecturers wanting to learn how to apply e-learning techniques for use in their own classes. Inequalities between elite and marginalized lecturers, students, and researchers may be exacerbated because unequal access to education persists, even in developed countries like Australia (see, e.g., Hillier 2018), broadening the digital divide. Overall, students' academic performance (in terms of, e.g., students' success and academic progress, work/career readiness, etc.) may be negatively impacted if digitalization continues to intensify inequities in HE.

The transformations in the dimension of *employment, management, and technology* arose with the digital economy. Accordingly, this dimension includes trends in the industry that existed before COVID-19. For example, Ramaprasad and Johnson (2000) envisaged how electronic medicine would transform health care. With COVID-19 there has been an intensification in the use of high-tech devices in HE. For the efficient implementation of digital technologies, HEI may challenge the foundations of the (permanent, full-time) employment relationship, and open up new possibilities not only for competition and control over workers, but also for collaboration. New forms of employment may transform the traditional relationship between employer and employees in HEI. These new forms of employment, together with new management approaches that, e.g., increase control over staff, could end up de-skilling the workforce (Degryse 2016). However, these transformations may help HEI to deal better with change. If HEI opted for a so-called digital transformation, a radical transformation towards a customer-driven strategic business model may be taken on board by university managers, which would result in cross-cutting organizational change (Bloomberg 2018). Transformations in this dimension interact with transformations in other dimensions. A case in point is the interaction with finance and infrastructure, as organizational change may impact funding allocation. These reforms can follow different approaches. In this context, Tahar and Boutellier (2013) distinguish between "high-touch" approaches, which follow a more qualitative and negotiation-based strategy and put the emphasis on strategic choice making, and "high-tech" approaches, which are quantitative in nature and use a predefined formula to generate competition. These authors argue in favour of high-touch approaches for funding allocation as, according to their

findings, they are better suited to HE domains.² As high-touch approaches rely on information from qualitative reports, face-to-face meetings and discussions to make well-founded decisions, COVID-19 may well have had an impact on the possibility of performing some of these activities (e.g., face-to-face meetings). Consequently, high-tech approaches might be prioritized.

Finance and infrastructure: COVID-19 has had a significant financial impact on research due to the decline in the numbers of international students (Nogrady 2020). Long-term consequences for research funding will vary by country. Although research may remain intact in other countries, Australia warned that 7,000 university research jobs were at risk in 2020 (Subbaraman 2020). With COVID-19, we have seen that physical spaces are less important, and working from home is not only possible, but often preferable (Iansiti and Richards 2020). HEI may benefit from cost reductions in terms of, e.g., office space needed. Synchronicity in time and space becomes less important, which may increase adaptability and flexibility (e.g., in terms of arrangements for meetings and working hours). However, this may also result in greater work-related fatigue, worsening the perceived work-life balance (Palumbo 2020). This trend was observed with the digital economy before COVID-19; in this vein, Degryse (2016) recognized that the intensification of “anytime, anywhere” work may blur the boundary between private and work life, leading to stress and burnout. If COVID-19 results in a permanently more digitalized HES, we may observe an increase in concentration of HEI in urban areas with good facilities. There may be an increase in the number of mergers among HEI to take advantage of economies of scale in order to produce more HE products and services and lower costs. An increase in competition and concentration of HEI (see, e.g., Márquez-Ramos and Mourelle 2016, 2018), may limit access to quality HE for different groups of students (e.g., in rural areas). At the same time, highly-esteemed HEI may focus on preserving their exclusivity, raising the prices of their academic programmes to differentiate themselves from lower-cost HE providers. Government regulations that affect the financial structure of HEI are also transformative. In this regard, the Australian government has recently introduced changes to incentivize study for “the jobs of the future”. Following these changes, the cost of a social sciences degree will more than double, while nursing, mathematics, and teaching degrees will become cheaper (ABC News 2020; Duffy 2020).

² Note that the application by Tahar and Boutellier (2013) is for a state-oriented HES and, therefore, it is unclear how they may be generalized to other systems.

Dimension	Transformations	Challenges	Opportunities
Academia-industry relationship	Fewer resources available	Enhancement of the relationship may have stalled	New collaborations between academia and industry (e.g., to bridge the gap between university curricula and industry needs)
	Need to innovate in particular topics		Enhanced collaboration in particular industries
	Growing role of research and enterprise in rebuilding regions		Growing role of HEI to support the recovery of the post-COVID economy Increasing relevance of HE activities to local and national communities
	Looking beyond campus	Increasing global competition	Increasing demand for solutions to global issues
Academic activities: Research	Networking	Losing opportunities for close collaboration	New collaborations emerge Cost reductions (e.g., international travelling)
	Research outlets and publishing	Reduced quality of publicly available resources	Fast, open publishing Cost reductions (e.g., subscriptions)
	Topics investigated	Diversion of funding towards topics with immediate value (e.g., coronavirus vaccine)	New research interests
	Less funding available for research	Reduced internal research capability	Externalization of research activities
Academic activities: Teaching	Fewer international students	Reduced teaching surplus	Increasing focus on local, regional, and national problems in university curricula
	More online teaching	Time and resource constraints on preparing new materials Reduced quality of publicly available resources	Democratization of knowledge and increased accessibility
	Change in students' learning preferences (in topics and format)		Demand for new courses and academic programmes (blended and online)
	More unequal access to education	Broader digital divide	
Employment, management, and technology	Intensification in the use of high-tech devices	Increased control and competition	Increased collaboration
	New forms of employment and management	De-skilled workforce	Dealing better with change
	Intention to become a customer-driven strategic business	Cross-cutting organizational change	Implementation of more effective funding allocation approaches
Finance and infrastructure	Fewer international students and less teaching revenue	Obtaining funding for HE activities that are not financially self-sustaining (e.g., research)	
	Increasing competition and concentration of HEI	Potential for mergers in the HE sector Less access to quality HE for some	
	Synchronicity in time and space is less important (work and study "anytime/anywhere")	Greater work-related fatigue; stress and burnout of staff and students Offices are less important	Adaptability and flexibility Cost reductions (e.g., offices rented)
	More support for "the jobs of the future"	Bias against some studies	Incentivized academia-industry relationship

Table 1. Transformations, challenges, and opportunities of digitalization.

5. Conclusion

I present a trilemma in higher education that includes the three components of industry, research, and teaching. By considering a dynamic framework and drawing on the lessons learnt from the COVID-19 pandemic, I explore transformations in higher education that have arisen from digitalization. The trilemma illustrates the interrelationships among its components and, therefore, the fact that transformations in academic activities cannot be explored in isolation. I identify three additional transformations that go beyond the traditional domains of research and teaching: namely, the academia-industry relationship; employment, management, and technology; and finance and infrastructure. Transformations are then linked with challenges and opportunities for higher education institutions. Two key insights gleaned from this analysis are that digitalization may help to bridge the gap between academia and industry; and that COVID-19 exacerbated existing trends in the industry and even in higher education. As this study focuses on Australia, it may not be possible to generalize some of the insights gained to other higher education systems. Also, Australia has certain economic and geographic characteristics that it does not share with other countries in the world. Specifically, it is strongly dependent on a few large “neighbouring” countries, especially China, and it is highly specialized in a few sectors, particularly primary industries and education services. Applicability to other countries is left for further research. Regardless of existing limitations, it seems that the transformations identified call for a more symbiotic relationship between academia and industry to meet market and social needs. As a consequence, universities in some parts of the world may well start to follow paths that more closely resemble those in industry.

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