Data centres in the university. From tools to symbols of power and transformation

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Final draft version (accepted)

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Abstract:

The almost compulsory and compulsive use of digital platforms through which the university community connects to knowledge, research, teaching and management activities has intensified in the pandemic. Faced with this challenge, higher education institutions must address fundamental questions about learning in a post-digital landscape. This paper explores how universities have created or adapted research centres to deal with data generation in their day-to-day activities. Although the centres analyzed in this paper have different profiles and expertise, they all seek to better prepare higher education institutions to cope with the datafication of society manifested in different ways (e.g., digital inclusion, artificial intelligence, privacy, ethical use of data, etc.). Based on a co-design and virtual ethnography, this work is structured in two phases (1) identification and analysis of 31 websites affiliated to university datafication centres, and (2) selection and deepening on 4 core dimensions of work of these centres. These comparative results highlight global trends, research agendas, and priorities, but also illustrate the need to move towards a more multidisciplinary approach, understanding data not only as "tools" but also as "subjects" with an increasingly economical and symbolic power.

Keywords: Educational innovations; Educational technology; Digital platforms; University

1. Introduction

The recent phenomenon of society's datafication (understood as the intensive transformation of human life into data through processes of quantification) has brought multiple opportunities, but also dilemmas and challenges that have direct implications in the role of higher education institutions. The almost compulsory and at the same time compulsive use of digital platforms through which the higher education community connects to knowledge, do research, carry out management activities and give or receive classes has intensified in the pandemic (Williamson & Hogan, 2021). In fact, it is unlikely a "back-to-business as usual" for higher education institutions after this global health crisis. In that sense, university communities need to address fundamental questions about learning in a post-digital landscape.

Prior to the global pandemic, education in general, and the education system in particular, had been questioned about its social function (Biesta, 2006; Giroux, 2014; Sancho et al., 2020). The digitalisation of society has brought profound transformations in ourselves and in the way we live in the world. This is particularly clear in terms of access to information. Before the digital revolution, teachers enjoyed some sort of monopoly on information. Today, information is everywhere. To such an extent that we can consider this historical moment as one of "information abundance" (Boczkowski, 2021). Faced with this new scenario, the pandemic has led us to an intensification of the relations between citizens with platforms, information and data. In this context, it is critical to face the challenge of how to relate to a digitized world.

If we understand education as a public good (Biesta, 2020), then it becomes a major challenge we must address, in the face of the growing expansion of "surveillance capitalism" (Zuboff, 2019). This becomes urgent, as universities are being absorbed by an accelerated and asymmetric process of datafication that redefines the traditional structures of economic and social power (Williamson & Hogan, 2021; Raffaghelli et al., 2020)

In this context, the main objective of this work is to explore how universities have created or adapted agencies or research centres (before or during the pandemic) to deal with data generation and use in the face of the exponential growth of digital tools and platforms in their day-to-day activities. We analyse higher education data centres and agencies in different contexts and with different profiles and expertise, but with a common focus on better preparing higher education institutions to cope with the datafication of a society, namely digital inclusion, artificial intelligence and society, privacy, legal and ethical use of data, etc.

Based on a co-design and virtual ethnography, this is exploratory research, which approaches and analyses the information on the websites and virtual platforms of 31 centres or university institutions on datafication from different regions of the world. Of course, this is not an exhaustive list of centres, but rather an approximation to what could be a larger and more extensive study.

The results contribute to comparing and understanding the overall priorities of these centres regarding the above-mentioned dimensions. Finally, the findings of this work might be useful for those universities interested in addressing the challenge of datafication in their own institutional and social context.

2. Theoretical and contextual approach

2.1.- Theoretical approach

The first 20 years of the 21st century have been marked by the cult of the digitization of everyday life. Contemporary societies, economies, cultures and development prospects are increasingly defined by data, indicators and metrics. In this context, higher education is not the exception. Kitchin (2014) defines datafication of processes and services as an emerging phenomenon that is creating a new form of digital divide. As a result, Universities need to address the social, political and economic transformations derived from the massive shift from offline to online practices and how these processes affect contemporary societies (Selwyn & Gašević, 2020).

Higher education is living with a process known as "governance by numbers" (Piattoeva & Boden, 2020). This means, demands for measured accountability, large-scale international assessments, performance benchmarking, and the proliferation of metrics and indicators from early schooling through higher education. In addition, student data sources are becoming increasingly interoperable, enabling extensive data linking, time series analysis, and aggregation of data sets as they are connected to large-scale networked infrastructures to measure, assess, and govern the performance of students, staff, and entire schools and institutions (Williamson, 2019; Saura et al., 2021).

Alongside the social, economic, and political enthusiasm for big data and artificial intelligence (AI), the universities have developed, promoted, and adopted technologies such as: learning analytics - to help decision-making- (Anderson and Rivera-Vargas, 2020), adaptive 'personalized learning' platforms and robotic teaching assistants (Williamson, 2017). Datafication in education has even begun to extend to systems such as facial recognition (Andrejevic and Selwyn 2019) and 'emotional artificial intelligence' based on wearable biosensors, analysis of body gestures and facial expressions (McStay, 2018). It is not surprising, therefore, that the datafication of higher education is seen as part of an ongoing process of 'marketization' of the sector (Busch, 2017).

In this sense, it is worth considering that digital technologies are not neutral. They bring with them a set of values, norms, and an ideology (Selwyn, 2016; Sancho-Gil et al., 2020). Despite being presented as unbiased, objective and innocent, all data must be produced and therefore bear the imprint of their producers (Kitchin, 2014). Data do not simply represent the reality of the world independent of human thought; they are constructions about the world that have been assembled for specific purposes (Jasanoff, 2018). Thus, digital data generation and analysis technologies are not merely tools that make people's lives easier and simplify their tasks. These technical instruments have such an impact on people's lives, perceptions, and subjectivities that they can influence our practices without us being aware of it (Sancho-Gil et al., 2020).

Data act as key reference points for constructing sense about the world (Esposito & Stark, 2019). Thus, the politics behind the datafication of society operate in two ways: through struggles over the production of data and its subsequent implementations, and through the generation of new power relations at various scales (Bigo et al., 2019).

Emerging technologies have a direct impact on people's lives through the simplification of mediations and their subsequent relationship with information. Practices such as machine learning, neural networks, deep learning, and AI have established new quantitative models of knowledge production and decision-making (Kitchin, 2014; Ruppert, 2018). Under the slogan of "making our lives simpler", the complex processes of knowledge construction are made invisible or hidden. However, it is worth noting as Williamson, Bayne & Shay (2020) point out:

> "Dataism is a style of thinking that is integrally connected to processes of neoliberalization, as competitive logics and the desire to compare the performance of entities against each other, as if they are competing in markets, have been incorporated into various forms and technologies of measurement" (p.354).

Consciously or unconsciously, 21st century citizens live with this systematic way of seeing the world, which is measured in likes, views, followers, reviews, ratings and influences. It is in this sense that

higher education efforts cannot depend solely on the initiative of teachers. Faced with systemic problems, institutional responses are required. This requires the involvement and commitment of all actors in the ecosystem, a challenge that opens new research agendas for universities.

In that sense, interesting and new debates are emerging from within the universities themselves, issues that have to do with the architecture (and ownership) of digital platforms. That is to say, with its policy (the predominant policy of the 21st century) (Raffaghelli et al., 2020). According to Williamson and Eynon (2020) the focus of the discussions could then be on the designs (skeletons) and subsequent the functioning of these platforms.

A substantive part of these debates is taking place from a post-digital approach and positioning (Cramer, 2014; Knox, 2019; Llamas, 2020), in which the need to explore and analyse initiatives that seek to foster human development and well-being beyond short-term technological solutionism is advocated.

> "I have always taken 'postdigital' to mean looking beyond apparent technological progress and novelty, and instead acknowledging our uncomfortable sense of ennui and disillusionment with contemporary technology-laden society" (Selwyn & Jandric, 2020, p. 994).

2.2.- Contextual approach

Today we appreciate that leading higher education institutions have mostly been inclined to use services provided by large international or "Big Tech" companies, which have custom-designed platforms (Zuboff, 2019; Williamson & Hogan, 2021). That is: easy to learn how to use them, simple in their processes and eliminating the responsibility for maintenance and security from a technical point of view. The paradox is that as technologies become more sophisticated, they also become opaquer (Rivera-Vargas & Cobo, 2020).

Increasingly higher education institutions are studying and addressing the complex process of datafication and eventually promote innovation in terms of their role in this process. In this case, it is not just about fostering instrumental literacy, but about being aware of how political and organizational decision-making about data and learning analytics can influence the vision and future of higher education (Atenas et al., 2020). Data infrastructures are not just the results of complex technical processes, but also are constructed with political objectives that seek to produce and promote concrete social and educational practices (Williamson, 2020).

To address these challenges, university centres need to have roadmaps, protocols, or guidelines to determine how to relate to and problematize these challenges (Rivera-Vargas et al., 2021). This gap in terms of roadmaps makes it necessary to explore and identify the different approaches and initiatives already in place, in order to know their inertias, objectives and purposes.

3. Methodology

The research question challenged us to analyse how universities have created or adapted agencies or research centres to deal with data generation and utilization in the face of the exponential growth of digital tools and platforms in their day-to-day activities. With this focus, the exploratory study was conducted from the design and execution of qualitative research, based on co-design (Gros, 2019) and virtual ethnography (Hine, 2004; Falzon, 2009).

3.1.- Procedure

This study was conducted in two phases.
The first phase was developed from a a co-design proposal (Gros, 2019) based on the dialogue, experience, and knowledge about the field of the authors, we identified 31 worldwide websites affiliated to university data centres. These centres were grouped in a table, and subsequently explored and analyzed. Considering the characteristics of the problem addressed, we adopted a position close to the postulates of virtual (Hine, 2004) and multi-sited (Falzon, 2009) ethnography. This perspective allowed us to examine the digital idiosyncrasy of the centres, analyzing more than one space at the same time, and identifying the connections between them (Morozov, 2018; Miño et al., 2019), their social and educational positions, and different digital governance models.
In the second phase, the authors independently reviewed 10 of the 31 cases identified in the first phase. Subsequently, and during a two-month period of collective dialogue and co-design (Gros, 2019), we analyzed together those ideas and proposals that we found most significant and relevant from these data centres. This allowed us to identify a set of emerging dimensions that favored the individual analysis of each centre and the establishment of relationships between them. In this chapter we highlight four of these dimensions - research, education, political strategy and institutional development - constructed following this process of ethnographic interpretation (Hine, 2004; Rivera-Vargas et al., 2021b).
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3.2.- Sample and information gathering

During the first phase, an intentional sampling was carried out, including 31 centres from 16 countries (Table 1). Their selection followed two strategies. First, we analyzed the Global Network of Internet and Society Research Centres to select those members focused on Datafication that belong to university institutions. And second, we included additional centres we knew from previous works or that were explicitly recommended by experts in the field from of a snowball sampling strategy (Noy, 2008). Then, all the centres' websites were explored, which led us to identify descriptive relevant information as well as other data related to the mission, the activities, and the priorities of each institution.

Table 1. List of agencies/data centres analyzed

Country	Institution Name	Year of foundation	Link
Australia	Centre for Research on Learning and Innovation	2016	https://www.sydney.edu.au/arts/our-research/centres-institutes-and-groups/centre-for-research-on-learning-and-innovation.html
Australia	Monash Data Futures Institute	2019	https://www.monash.edu/data-futures-institute
Australia	UTS Data Science Institute	2018	https://www.uts.edu.au/data-science-institute

Australia	Australian Artificial Intelligence Institute	2017	https://www.uts.edu.au/research-and-teaching/our-research/centre-artificial-intelligence
Brazil	The Centre for Technology and Society	2003	https://direitorio.fgv.br/pesquisa/centro-de-tecnologia-e-sociedade
Chile	Instituto Data Science	2016	https://ingenieria.udd.cl/data-science/
Chile	Millennium Institute for Foundational Research on Data	2018	https://imfd.cl/en/
Estonia	Centre for Educational Technology	1996	https://www.tlu.ee/en/dt/research/centre-educational-technology
France	The Grenoble Alpes Data Institute	2017	https://data-institute.univ-grenoble-alpes.fr/
Germany	Alexander von Humboldt Institute for Internet and Society	2011	http://www.hiig.de/
Ireland	National Institute for Digital Learning (NIDL)	2013	https://www.dcu.ie/nidl
Italy	Nexa Centre for Internet & Society	2006	http://nexa.polito.it/
Japan	Keio International Project for Internet & Society	2010	https://www.kri.sfc.keio.ac.jp/en/lab/society/
México	Alianza	2021	https://alianza.unam.mx
South Africa	Centre for Innovation in Learning and Teaching (CILT)	2014	http://www.cilt.uct.ac.za/cilt/about-cilt
South Africa	Wits Institute of Data Science (WIDS)	2019	https://www.wits.ac.za/wids/
Spain	eLearning Innovation Centre	2008	https://www.uoc.edu/portal/es/elearncenter/index.html
Spain	UC3M-Santander Big Data Institute	2015	https://ibidat.es/
Spain	Instituto Andaluz interuniversitario de datos	2019	https://dasci.es/es/
The Netherlands	Open Science programme of Utrecht University	2018	https://www.uu.nl/en/research/open-science/about-us
UK	Oxford Internet Institute	2001	https://www.oii.ox.ac.uk/
UK	The Alan Turing Institute	2015	https://www.turing.ac.uk
UK	Centre for Research in Digital Education	2008	https://www.de.ed.ac.uk/digital-cultures/projects

UK	UCL Big Data Institute	2013	https://www.ucl.ac.uk/data-science/ucl-big-data-institute
UK	Leeds Institute for Data Analytics	2014	https://lida.leeds.ac.uk/
Uruguay	Cicea	No information	https://www.cicea.ei.udelar.edu.uy/que-es-cicea/
USA	Berkman Klein Centre for Internet & Society	1997	http://cyber.law.harvard.edu/
USA	Human Sciences and Technologies Advanced Research Institute	2005	https://hstar.stanford.edu/
USA	Data Institute	2009	https://www.usfca.edu/data-institute
USA	Data Institute for Societal Challenges	2020	https://www.ou.edu/disc
USA	Goergen Institute for Data Science	2015	https://www.sas.rochester.edu/dsc/

In the second phase, a selection of 6 relevant centres for each of the four analytical dimensions was made (Table 2). The choice of the sample followed the criterion of the strength and quality of the information available on the websites in relation to the analytical dimensions. The differences in the ways they approach each of them drove the decision of choosing what seemed the strongest centres in each dimension rather than selecting cases through which to cover the four dimensions. Thus, we purposefully (Palinkas et al., 2013) selected 6 cases for each dimension which provided quality information and allowed us to identify variety among them.

Table 2. Centres selected for the second (in depth) analysis phase

Institution name	Research	Training	Political Strategy	Institutional Development
Oxford Internet Institute	Yes	Yes	Yes	No
Alexander von Humboldt Institute for Internet and Society	Yes	No	Yes	No
Berkman Klein Centre for Internet & Society	Yes	No	Yes	Yes
Nexa Centre for Internet & Society	Yes	Yes	No	No
Open Science programme of Utrecht University.	No	No	Yes	Yes
Human Sciences and Technologies Advanced Research Institute	No	No	No	Yes
Centre for Research in Digital Education	No	Yes	No	Yes
Centre for Educational Technology	Yes	No	No	No

eLearning Innovation Centre	No	No	No	Yes
National Institute for Digital Learning (NIDL)	No	Yes	Yes	No
Goergen Institute for Data Science	Yes	Yes	Yes	Yes
UC3M-Santander Big Data Institute	No	Yes	No	No

3.3.- Process of information analysis and presentation of results

The definition of the analytical dimensions was fixed in the same ethnographic interpretative process (Rivera-Vargas et al., 2021b) so that they would be capable of capturing the diversity of realities presented by the different centres but, at the same time, be specific enough to avoid major overlaps between them.

(1) The research dimension gathers those centres conducting research projects nationally and internationally funded, that are framed in a broader line of research explicitly set on the website.

(2) The education dimension groups the centres providing formal Graduate, Post-Graduate, Masters and PhD training. Informal courses were also taken into account if there was also formal provision.

(3) The political strategy dimension collects information regarding the centres' willingness to have impact on public policies, international organizations position, activism, and civil society as well as to set relationships with the EdTech industry.

(4) The institutional development dimension was defined to identify those initiatives aimed at enriching the internal culture of the centre regarding their actual and potential role in the data production process.

Once defined, the four dimensions structured the process of extraction of the information from the centres' websites.

The presentation of the results is divided into two sections. Firstly, "Mapping the characteristics of HE data centres" describes the main features of the whole sample based on the first extraction of information (see Table 1). Second, "Analysis of the dimensions: research, education, political strategy and institutional development" gathers the results of the detailed analysis of the 4 dimensions (see Table 2). This dialogic, interactive and interpretive process, based on the review of the websites of each of the selected centres, reading and constant feedback among the authors, led us to configure the following structure for the presentation of each dimension: (I) the introduction and definition of the dimension as the starting point of a ethnographic interpretative process; (ii) The work of construction and analysis based on empirical evidence (virtual observation), with relevant literature; (iii) Possibilities; (iv) Challenges.

4. Results

4.1.- Mapping the characteristics of HE datafication centres

This section describes the temporal evolution of the 31 centres, their territorial distribution, their institutional placement and funding, and their general trends regarding the aspects of datafication they stress in their research, the kind of training/education programmes they provide, and their emphases on political impact and on institutional development. It is important to remember that the study uses a purposeful sampling rather than a probabilistic or random one (Palinkas et al., 2013). Hence, the characteristics we describe in this section are useful only to better know the sample, but they are not understood as general trends.

If we look at the year of creation of the different centres it is visible that they have proliferated as the digitalisation and datafication phenomena intensified all around the world (Table 3). Therefore, only two of them existed before 2000, 7 of them appeared in the first decade of the 21st Century, and the rest were created from 2010 onwards, 15 of them only since 2015. The territorial distribution of the centres (Table 3) shows a clear predominance of Europe, which is followed at a distance by North and South America.

Table 3. datafication centres by geographical placement and year of creation

Continent	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019	2020-2021	Unknown	Total
Africa				1	1			2
Asia				1				1
Europe	1	1	3	4	5			14
North America	1		2		1	1		5
Oceania					4			4
South America		1			2	1	1	5
Total	**2**	**2**	**5**	**6**	**13**	**2**	**1**	**31**

Source: own elaboration

In order to better understand the institutional shape and aims of these centres it is worth looking at their administrative location. This information can give us an idea of their orientation in terms of research and teaching, but also regarding their institutional relevance and margin of manoeuvre. Almost half of the analyzed centres (15) are independent, that is, they are not administratively placed within any Faculty or School, but they have their own governance boards. Eight centres belong to Engineering, Computer Science and Digital Technology university institutions, both Schools and Faculties; four centres are located within Social Sciences and Education faculties or schools; and four others directly belong to the University administration or to their delegated bodies in some particular areas such as Libraries or Offices of Research Development.

Finally, we are interested in the trends in the development of the four analytical dimensions. Table 4 summarizes the main features of the observed institutions in relation to the dimensions of datafication they work in; their position regarding the provision of formal and informal education;

whether they develop political strategies; and whether they promote institutional development in the university they are located.

Table 4. Dimensions of datafication of the centres

| | Research | | | Education | | Political strategy | Institutional development |
	Technical object of study	Philosophical / Political object of study	Tool(s) for research	Formal education	Informal education / Impact		
No	12	10	3	12	6	7	14
Yes	18	21	27	19	25	22	15
Not clear	1	0	1	0	0	2	2

Source: own elaboration

Datafication is obviously a central issue for the research conducted by all the selected centres. However, their approach to the topic is not homogeneous. The huge majority of them use data and data-driven strategies as a tool for their research, but not necessarily have datafication as an object of study. Approximately two thirds of the centres do research on technical aspects of datafication and a similar proportion analyses philosophical and political aspects of datafication processes. The proportion of centres that offer formal education in some of the fields concerning datafication is also close to this ratio, and their catalog of non-formal education supply is even higher.

Given the nature of this comparative study, the authors cannot know what political strategies the centres promoted. Whether their orientation is linked to fostering a fair use of data or to increase transparency and accountability of the different systems in which their universities and themselves are involved is something we cannot know through our preliminary study, and that surely requires further investigation. Something similar happens if we try to understand their institutional development strategies to increase the awareness, the knowledge and the skills regarding the use of data the people in their communities have. However, from the analysis of their websites we do see that only half of them are carrying out some kind of in-house capacity building strategy.

4.2.- Analysis of the dimensions: research, education, political strategy and institutional development

4.2.1.- Research

For analyzing the diversity of the research areas thoroughly, we have chosen 6 of the 23 centres that are engaged in research somehow related to datafication.

All the selected centres promote competitive research funded through national and international public calls for proposals, or by private initiatives. Their projects aim to address - and eventually shape - the social, political, pedagogical and economic transformations resulting from the massive shift from offline to online professional and educational practices affecting contemporary societies (Selwyn & Gašević, 2020). Their lines of research can be structured under two broad categories, depending on whether they are oriented to social sciences or to computational/data sciences. Interdisciplinarity is promoted by most of the centres and reflected in the composition of their

research teams, but the emphasis in one area of knowledge or another is distinguishable when their research programmes and projects are analyzed in detail.

Social sciences research projects share the concern about the way technological development and spread is affecting social life. In this regard, they are putting their focus on the social impact of the designs and functioning of the digital platforms, as Williamson and Eynon (2020) suggested. This is translated in several lines of inquiry about the production of knowledge and digital culture, the impact of the Internet and the social media in education, the ethical and philosophical implications of the massive use of data, the politics and policies driving or driven by the digitalization and the platformization trends, the distribution of power and the erosion of rights beyond the systematic use of algorithms, among others. The Oxford Internet Institute (UK) or the Centre for Educational Technology (Estonia) are illustrative examples of these lines. In addition, other initiatives provide evidence and recommendations for the public administrations to promote a fair use of data and set the basis for regulating datafication processes -i.e., the Assessment of Open Source Software for Public Administrations project, by the Nexa Centre (Italy).

In the intersection of social and computational/data science, different research is focused on the impact of AI in diverse social, economic and political areas. As shown by the Berkman Klein Centre (USA) research lines, the interest of these projects is distributed between the analysis of the actual functioning of different applications of AI -in education, in Justice administrations, in communication or commercial strategies, etc.- and the design of AI solutions to health, urban planning, business models, and political strategies, among others. These fields of research usually combine the expertise provided by social scientists with the work done by computational and data scientists.

Data/computational science research, in addition to what presented regarding AI, analyses the potential of "big data" to design new -distributed, decentralized- computational infrastructures, and to develop prediction models of natural or social phenomena, inter alia. The research conducted by the Goergen Institute for Data Science (USA) is particularly focused on these issues, whilst the one of the Alexander von Humboldt Institute for Internet and Society (Germany) prioritizes cybersecurity, privacy and access issues. The interconnections between technical and ethical/political concerns point to what was addressed by Caidi, et al. (2005) when considering that technology cannot be understood as a neutral device.

The scope and the relevance of the research topics addressed by these centres is broad and strong. Their interest for increasing the available evidence about the impact and the ramifications of the post-digital society, and for fostering a critical evidence-based intervention is clear in most of the cases. What is almost non-existent in their research agendas is the analysis of the very role of Higher Education institutions in shaping the process of datafication. It is possible that this omission responds precisely to the lack of prominence of universities in relation to big technology corporations when it comes to setting the agenda of the process.

4.2.2.- Education

Almost all the centres analyzed develop a variety of educational activities that include datafication as a central subject. In fact, 28 of the 31 centres at least offer some type of online course or open and asynchronous training.

In relation to formal education, i.e., bachelor's, master's or doctoral programs, 23 of the 31 centres provide studies on the subject of datafication. This is an educational offer specific from the centres and not necessarily linked to the general educational portfolio in the universities analyzed.

In order to provide a greater analytical depth in relation to this dimension, we have selected six of these 23 centres, which have an educational offer that is significant, specific and interesting for the focus of this paper.

It is relevant to highlight that all these six centres offer open and asynchronous courses and training to the community, such as MOOCs (Massive Online Open Courses) and online courses. Most of these courses focus on the development and acquisition of technical and analytical skills on datafication, big data, learning analytics.

In relation to the type of formal studies offered, master's degrees predominate the main thematic lines are circumscribed within the framework of the social sciences and data/computational sciences.

In the field of social sciences, programs in education tackle topics such as digital citizenship, data ethics and protection, childhood and technology predominate. Along the same lines are studies focused on the Internet and the social use of data. In general terms, the master's degree programs in this field seek to help students understand relevant issues of crucial interest to the social sciences, technological industry, and policy-making including social, economic and political behaviour, interpersonal relationships, market design, group formation, identity, international movement, ethics and responsible ways to enhance the social value of data, among other topics.

In the field of data/computer science, such as Master of Science in data science or Master of Science in big data analytics programs, in most cases these programs are geared towards those interested in Big Data processing. In general terms, Master's programs in this field try to familiarize students with current statistical approaches and methods that are being used to generate algorithms, and also to process and analyse large amounts of data in different fields of application. Their approach tends to be more instrumental and functional, as they promote the training of professionals capable of solving the problems and facing the challenges faced by institutions within the framework of the datified society (van Es & Shäfer, 2017).

In the PhD level, all the centres offer doctoral programs that include the problem of datafication among their lines of research. The six doctoral programs analyzed, seek to offer the opportunity to researchers in training, to formulate and address novel research questions at the intersection of the computational and social sciences, supported by the multidisciplinary faculty from their host universities. Most of the programs also focused on exploiting fast expanding possibilities in large-scale data collection, machine learning, and statistical modelling.

As we have seen, there is a varied and growing range of official courses and curricula that address datafication with a more instrumental-functional orientation or are oriented towards critical literacy. The orientation of these studies is generally conditioned by the positioning (on the use of data) of the institutions offering them.

4.2.3.- Political strategy

From the 31 centres chosen for the analysis, 22 have visible political or environmental connection strategies. We selected 6 which are mainly dedicated to transferring knowledge and influencing decision-makers, industries and community through their research and training activities.

The strategies of the selected centres in order to connect their work with the environment are diverse. Mainly, efforts are made to disseminate the different lines of action they have and to influence debates, practices and policies. Their aim is to make substantial contributions to a better understanding of the relationship between innovation and governance in the digital society.

The main focus of these six centres included in the analysis is to address or even react against the consequences of the digitalization of society. The objectives they demonstrate on their institutional sites are, on one hand, to have a significant impact on the political (and public) debate at the national and the international levels. This is the case, for example, of The Oxford Internet Institute or The Berkman and Klein Centre at Harvard University. On the other hand, they also intend to provide tools and impact on people's wellbeing, safety and understanding. In that sense, they try to connect their research with current issues (linked to the effects of emerging technologies on

society). This is the case of the Alexander von Humboldt Institute for Internet and Society, which has a Hub for internet research, or the Open Science programme of Utrecht University, which has a specific platform to achieve this goal.

It is interesting to analyse how these centres consider themselves as network organizations. That is why one of their focuses is to allow society to reap all potential benefits of research. To achieve this goal, they should not just make results available, but also engage with potential users, funders and contributors to research, and with people whose lives may be affected by digital technologies.

One of the main possibilities of these centres is to create spaces for significant civic participation of their students and the community. This is the case of the National Institute for Digital Learning and the Goergen Institute for Data Science, two centres with a strong and powerful activity in social media platforms. In order to develop these spaces, it is necessary to create sustained and innovative communication strategies over time. This could let them promote instances of debate, dialogue, reflection and action among their educational community, and also (and most important) give voice to their communities (students, teachers and researchers), becoming channels for free speech, active citizen participation and activism.

The challenges facing universities with regard to digitisation are to react to the effects and determinations that markets and technological industries exert on society in general and on academic praxis in particular. In this sense, they need to transform themselves into pillars for citizens in order to be able to regain sovereignty over their data. This implies that academia needs to transform the asymmetrical relationship that exists today. The achievements of sciences (computational, social and human sciences) should influence the agendas of companies in the development of emerging technologies and also guide governments in regulating the market of digital platforms and taking care of citizens' privacy.

4.2.4.- Institutional development

Only 13 of the 31 centres analyzed in this study have a line of action linked to the development of internal capabilities. In order to provide an accurate analysis of this dimension, we have selected six of them to gain an in-depth understanding of their work objectives, possibilities and challenges. In analyzing these six centres, we have identified two different approaches: (1) Awareness and critical literacy; (2) Technical and operational tools.

About awareness and critical literacy, some centres seek to promote greater awareness and literacy in the secure, inclusive, ethical and fair use of data in the university community. At the same time, they are generating institutional channels for the promotion of open science. This is the case, for example, of the "Open Science" centre of Utrecht University (The Netherlands), the Berkman Klein Centre of Harvard University (USA) and, to a lesser extent, the "Data Society" of the Centre for Research in Digital Education of the University of Edinburgh (UK). These three institutions manage data, program, gather evidence, generate digital platforms, generate action protocols, transfer knowledge, provide digital literacy and finally prepare their university community regarding the possibilities and limits of the use of data. According to Knox and Llamas (2020), these would be initiatives that would foster human development and institutional well-being before short-term, technological solutionism.

About technical and operational tools, there are centres that play a more functional and operational role within the organizational structure of the universities in which they are located. That is to say, rather than focusing on the ethical dimension, they are more of a technical tool at the service of the institution, which proposes solutions to pedagogical and management problems through an instrumental use of data. This is the case, for example, of the Georgen Institute for Data Science of the University of Rochester (USA) and the H-Star of Stanford University (USA). These three centres are preferably made up of academics from different areas of each university, as well as technicians

and specialists in big data and programming, who offer services to the educational community, and especially to teachers, advising them on the analysis and redesign of subjects and programs, and gathering their needs and ideas for the evolution of the educational model. They also help to conceptualize and develop teaching innovation projects, providing experimentation spaces for pilot tests, and are oriented to the exploration and analysis of learning data (learning analytics) to help decision-making (Anderson & Rivera-Vargas, 2020). In addition, they act as an observatory to transfer the latest trends in the learning landscape through digital platforms and assist in internal and external training, datafication and digital education. This action is in line with what Busch (2017) calls the 'marketization' of the university

From our point of view, the relevance and complementarity of both types of centres in universities is significant. However, in the six cases analyzed, we recognize that there is a marked institutional commitment to one direction or the other.

5. Discussion

The results collected during the revision of the research centres and similar agencies gathered from the five continents need to be read as a high-level relational analysis of how higher education institutions are dealing with the increasing relevance of data in a variety of fields and contexts.

This mapping exercise has highlighted what are the main attributes, research, education and institutional agendas that shape the goal and activities of these centres.

The results of this work provide lessons and trends which could be of interest for better understanding some of the opportunities and challenges that universities are facing in data-rich societies. This mapping also shed light on what are some of the new institutional and human capacities that need to be consolidated, in order to integrate the positive aspects from data intensive products and services without ignoring the emerging conflicts and risks in terms of data governance, privacy, ethical, or societal implications, among others.

There is little novelty in declaring the growing relevance of data in higher education (Atenas et al., 2020). However, better understanding how the datafication is gaining relevance in the institutional, research and education agenda is an aspect in which this work could highlight relevant trends. Being aware of the limitations of conducting a high level comparison it is necessary to understand that these trends here documented might not be equally representative for each one of the regions, countries or institutions documented.

Data as a tool and/or as a subject

A central distinction that comes out of the relational analysis of 31 research centres is the differentiation between using data as a "subject" and data as a "tool". Although these attributes are not mutually exclusive (e.g. a research centre can be advanced in the use of data as a tool while also investigating the political or ethical implication of a datified society). The importance of using "data as a tool" is observed as a transversal factor in most of the cases here examined. That means the adoption of methodologies, systems and techniques to collect, process, analyse or represent large volumes of data (commonly digitally generated). In all these cases "data as a tool" becomes the raw material to be used for producing research, generating new knowledge, or elaborating associated information services. Higher education institutions also leverage large volumes of data so they can access or produce data intensive research. Therefore, what we observed in the analyzed institutions is aligned with what Kitchin (2014) or Ruppert (2018) pointed out when stressing the

impact of deep learning and AI in the establishment of new models of decision-making and knowledge production based on the use of new quantitative models. The use of "data as a tool" in the context of these institutions, has implied both a change in the way of researching, given the active use of new platforms and digital tools to collect and analyse information (Daniel, 2016), and also in the way of making organizational and pedagogical decisions (Piattoeva & Boden, 2020).

On the other side, perhaps with less numeric preponderance but with equal interest, "data as a subject" has gained relevance. The creation of new institutional capacities in this field, in the last 10 years or so, is an expression of the growing interest for understanding what happens when societies are heavily influenced or governed by the phenomena of datafication. In other words, the increasing digitalization of society, the expansive use of digital technologies in almost every area of modern life, is leading towards a growing interest in exploring and studying how data is shaping our comprehension of reality in all sorts of fields (e.g. democracy, health, environment, socialization, among others). As Esposito & Stark (2019) stress, data act as key reference points for constructing sense about the world. In that sense, data has become an essential lens (or filter) through which we can see and analyse (or manipulate) modern life, with imminent legal, social or psychological consequences.

The multi-disciplinarity nature of data rich analysis

A second aspect observed during the comparison of the institutional affiliation of these research centres and agencies is the distinction between those which are administratively housed within a Faculty, School, or single-discipline institution and those which are more inter or multi-disciplinary in their nature. While some centres are created as an endowment for a Computer Science or Political Science Schools or Colleges, in other cases, these institutions are created under the mission to "bridge" and "connect" different disciplines and knowledge perspectives. In general, inter-disciplinary is defended in most of the centres studied and it is reflected in the constitution of the respective research teams. This is not a surprise given that data has direct or indirect links with a variety of disciplines (Bates et al., 2020). A multiplicity of perspectives can be reached in different manners, e.g. by creating multi-disciplinary institutions, by allocating research funding that prioritizes multi-disciplinary perspectives or by creating new post-grad programs that offer inter-multi or cross-discipline training. Data and the associated phenomena of datafication, although can be understood as a challenge, it also becomes an opportunity to bridge different disciplines and fields of knowledge to understand the societal implications. In that sense, "data as a tool" but also as a "subject" is enriched when different disciplines interact with each other and unfold the different layers and interdependence of this topic.

A (more) critical perspective

A third aspect that is worth highlighting has to do with one of the central concerns of this chapter. How can higher education institutions and the education communities in general, take control of their data when it is produced, shared, consumed, analyzed or traded in the context of education? Datafication opens new research avenues to investigate what are the unintended consequences of the high concentration of data in a limited number of commercial institutions ("Big Tech", asymmetric deployment of AI, advanced surveillance systems, unethical use of personal data, etc.).

This concentration of data is not only generating economic benefits to some but also has derived in new means of control, surveillance, manipulation, cultural or political influence, among other expressions of power asymmetry (Zuboff, 2019). These critical perspectives of datafication ("data as a subject") are not absent from the institutions here documented. In fact, several of the higher education institutions studied are much more proactive to raise critical perspectives than other (public and/or private) organizations. However, the growing relevance of data-rich research and education needs to evolve towards consolidating new political strategies and institutional capacities, including rigorous debates about data transparency and sovereignty (Rivera-Vargas and Cobo, 2020), and about the news forms of digital divide these trends are reinforcing (Kitchin, 2014).

6. Conclusions

The COVID-19 has been very active and in expansion during the elaboration of this study. In light of the implications of this pandemic during the last 20 months or so, there is no reason to believe that the relevance of information and communication technologies (e.g. adoption of new information systems for education and research, but also for administration, collaboration or institutional development) in today and tomorrow's society won't keep accelerating and expanding. Considering the main objective of this work stated in the introduction of the chapter: "explore how universities have created or adapted agencies or research centres (before or during the pandemic) to deal with data generation and use in the face of the exponential growth of digital tools and platforms in their day-to-day activities", the conclusions of this global mapping highlight four major trends that open new opportunities for further discussion and research:

Data savvy institutions

This interdisciplinarity must be manifested not only when collecting or processing data ("data as a tool") but also when reflecting on the societal implication of massive data collection ("data as a subject") (Bates et al., 2020). A rich combination of perspectives and disciplines could contribute to providing a wide-ranging discussion on how the predominance of digital systems is having technical, but also social, economic, legal, geopolitical implications in today's and tomorrow's society (Jarke & Breiter, 2019). More flexible institutional models and policies, designed to connect and integrate disciplines could allow us to extract and process data-rich information without bypassing questions such as why, when, and who is included and who is excluded from this data intensive process. Future studies could also explore to what extent this is applicable to both dimensions previously mentioned "data as a tool" and "data as a subject".

The role of higher education institutions in society

This analysis opens the possibility of enquiring how much of the existing work produced by the research institutions and related agencies can be linked with the idea of "using data for social good" (UDSG). In this context, UDSG can be seen as an opportunity to amplify the social and collective benefits but at the same time understand how to mitigate the negative or unintended effects. UDSG

could be translated into expanding the work in areas such as ethical accountability of algorithms; data transparency and trackability; explainability; data literacy and capacity building; bias and disinformation awareness; data and privacy protection; keeping humans in the loop; reduction of new digital divides; cyber security; among others. These areas can be approached as external issues for research and, at the same time, understood as increasingly intertwined with the internal activities of higher education institutions themselves, both organizationally and pedagogically. This means that these institutions could explore how to incorporate (or expand) the UDSG not only as a research subject but also as a concern regarding their own institutional practices. This analysis opens the possibility of enquiring how much of the existing work produced by the research institutions and related agencies can be linked with the idea of "using data for social good" (UDSG). In this context, UDSG can be seen as an opportunity to amplify the social and collective benefits but at the same time understand how to mitigate the negative or unintended effects.

At the same time, today Sustainable Development Goals (SDG) lead by the United Nations is a clear example of how the effective use of data can support the improvement in issues, such as education, inequality, economic development, climate, science, and technology, among others.

Network-oriented institutional designs

As this analysis highlighted, it is critical to better prepare the institutional agenda for consolidating or expanding capacities within higher education institutions in all the core dimensions examined (research, education, political strategy, and institutional capacities). Short and long-term plans will be critical for the years to come. Research centres and agencies will require to adopt more flexible governance models to work within their institutions. Closed, or siloed institutional designs won't be enough to face the challenges ahead. This openness and flexibility need to translate into integrating different academic communities within the institutions but also adopting a much network-oriented model where the inter-universities work and academic exchange will be the norm and not the exception. This implies a stronger alliance with the public but also with the private sectors. At the same time, universities today are not alone (anymore) in this field. New players and organizations with strong funding and highly skilled professionals from "Big Tech" should not be seen as a threat by social scientist, but as an opportunity to create and consolidate new partnerships. In that sense, the consolidation of institutional agendas and capacities should not be read-only as trying to join the top-ranked universities (e.g. Ive league) which publish more papers or get more citations, but also as the institutions that generate the highest social impact (or benefits such as UDSG) in society.

Globalization but also integration

Last but not least, this study overemphasized some regions and geographies of the word (the analysis didn't include any language beyond English, Portuguese, Spanish and Italian). The language produces an unintended geographical imbalance that overrepresented some regions while misrepresenting or underrepresenting others. The authors acknowledge that and call for a broader data collection in order to include the work and experiences from other regions and cultures beyond the scope of this work. That means that, in our study, the global North is much more prominent in terms of where data is more intensively studied and researched, while the global South is still underrepresented. This is not only a reflection of other pre-existing inequalities or asymmetries (e.g. access to higher education, digital divides, or availability of research funding),

but also is something that should lead to a broader conversation in the multi-lateral agenda with the critical necessity of generating new bridges not only between disciplines and languages but also connecting different geographies, cultures, and realities.

We must take into account that all the centres analyzed mostly belong to academic institutions. It is therefore important to address the long-standing gap between academia, government and civil society. In the present, it is essential that academic research and scientific advances can be connected and translated with other social institutions.

Finally, we would like to point out some limitations of the study. It should be noted that this analysis cannot be read as a detailed description of each one of the agencies examined but as a preliminary exploration where future research is needed. The authors are well aware of the constraints and limitations of this analysis. For instance, the already expressed language limitation (only English, Portuguese, Spanish and Italian) generates consequences in the scope, diversity of the analysis**.** This limitation has clear implications for the diversity of the centres included in the analysis. All those centres whose websites were not published in the languages previously mentioned were excluded. As a side effect, the second phase of analysis the focus of this analysis is centred on a small number of western (mostly European, North American) academic institutions. Additionally, the study examined and documented the information available on the respective institutional websites. Only using institutional websites also leads to some limitations given that all the institutional initiatives which were not available in their respective websites during the time of data collection have been ignored for this study.

However, the study also opens up new routes of inquiry and analysis that we believe need to be addressed in future research exercises on the subject. For example, how can we build a data centre that not only solves the technical problems of data use in the educational institution itself, but also promotes a secure, fair and social use of data throughout the university community? How can we evaluate the impact of these centres internally and externally? How can we deepen the analysis of the sources of funding for these centres -and their eventual impact-? The answer to these and other questions connects with the need to increase scientific knowledge on the phenomenon of datafication in higher education. But also, about the central role that universities must play to promote the understanding of data and digital platforms as symbols of power, and not only as tools.

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