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Fostering Equality in Education: The Blockchain Business Model for Higher Education (BBM-HE)

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Abstract: This paper seeks to address which business model in higher education that fosters SDG 4, is adequate for the post-pandemic period. To that end, it introduces the "Blockchain Business Model for Higher Education" (BBM-HE) and a transformed business model canvas framework based on existing literature, concepts, theories and findings relating to most of the pressing issues in higher education from the present study. To determine these issues, secondary data is used in the qualitative research design by applying inductive content analysis techniques to online reports. The originality of this study lies in the "adaptive" perspective to the requirements of the post-pandemic higher education landscape, which consists of modifications to the core elements of higher education, the integration of blockchain technology into the entire system, and a stronger approach to sustainability practice through sustainability tokens. The envisaged model sets out to provide a roadmap for all stakeholders, but most importantly, "decentralized" higher education institutions of the future and the "employable skills-seeking" proactive students all over the world, as opposed to the former "solely degree-focused and affluent" consumers of educational offerings. This study contributes to higher education literature in terms of business models, blockchains, pandemics, and sustainability.

Keywords: blockchain; business model canvas; sustainable university; SDG 4; sustainability; pandemic; COVID-19

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1. Introduction

Setting off an immense health crisis that exacerbated predating educational disparities, the novel coronavirus COVID-19 posed one of the greatest challenges in history to the higher education system and its stakeholders. Higher education institutions (HEIs) as transformative organizations [1] already were confronted in resolving the vague sustainable development (SD) problem, particularly since it had become clear that, in times of economic crises, SD is mainly driven by education-related innovation [2]. As such, HEIs most notably influence future generations in how they will deal with the societal [3], environmental, and economic challenges ahead.

Overcoming the barriers to SD integration in the pre-COVID-19 period has increasingly been a focus of researchers. Some of these obstacles are the lack of awareness, interest, concern, knowledge and involvement by management, students, staff and faculty, the organizational culture of the HEI [4], the lack of governmental enforcement [5], financial limitations [6] and the resistance to change [7]. Added to the obstacles to SD, HEIs must now overcome new challenges rocked by the pandemic, concerning particularly the quality and consistency of their educational offerings [8], and work toward massive-scale adaptation of technological innovations in the industry in the face of striking complexities of the altered educational landscape accentuated by remote learning modalities.

Unquestionably, not only direct stakeholders (students, staff, faculty) but also indirect stakeholders of HEIs (alumni, partnerships, government, local community, and the society at large) [9,10] will suffer even more setbacks in the future [11] if HEIs fail to transform and reimagine their value propositions and missions [12].

Foremost, the socio-economic after-effects of the widened learning gaps among students during school shutdowns and the anxiety of Generation Z about the recurrence of a new pandemic and its economic costs may linger for many years [13]. As a result, among others, ideally, one of the top priorities of a sustainable university [14], Sustainable Development Goal (SDG) 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [15], is doomed to suffer serious setbacks. In fact, many students will "virtually" be "left behind" [15].

The early 2020 estimate of the financing gap to reach SDG 4—in low and lower-middle-income countries was a staggering $148 billion annually. It is estimated that the COVID-19 crisis will increase this financing gap by up to one-third [12].

There is no doubt now that a revolution in HE is underway that, in contrast to earlier revolutions, which aimed at democratizing access to an earlier collegiate model, is producing a much greater magnitude of educational models that target distinct demographics [16]. However, more needs to be invested in diversity and inclusion than mere rhetoric.

This necessity and many more eminent issues regarding the core activities on HEIs are pronounced in numerous large-scale surveys that have been and are still being administered globally to stakeholders in higher education around the globe. Among these, the overarching theme that seems to be most prevailing is the current exploration of new business models in higher education [17].

Considering these unprecedented developments, this study sets out to answer the following main research questions: (1) what are the most pressing issues in need of attention that pose a survival threat to the post-pandemic HEI and its main stakeholders and (2) how can HEIs adapt their existing business models to the urgent demands of the altered educational landscape while continuing to focus on SD, and particularly, SDG 4? To answer the latter, sub-research questions developed are: (2a) Who are the main and potential key stakeholders in higher education? (2b) What should be the elements of the new meaningful value proposition of the contemporary HEIs, and how can it be communicated in an effective and inclusive way? (2c) What kind of tools are currently available to support the infrastructure of the HEI to deliver this value proposition in a timely, effective, flexible, and efficient manner? (2d) How can the cost/revenue structure of the HEI be modified to enable this delivery in a smooth, consistent, and continuous way for an indefinite time? and (2e) How can all stakeholders be motivated to keep the entire model functioning?

Put succinctly, this study seeks to explore feasible ways of accomplishing the long-awaited "transformative change" in the value proposition and the whole business model of the sustainable university [14].

To that end, the present paper introduces the Blockchain Business Model for Higher Education (BBM-HE). The BBM-HE is a post-pandemic higher education (HE) business model that takes a modified business model canvas (BMC) perspective [18] and habituates several elements of the Higher Education Sustainability First System (HESFS) [19] in addition to accommodating other contemporary concepts, such as blockchain technology (BT), the metaverse, tokenization, the learning designers bridging academic and professional domains [20], and remote learning modalities, to the present educational climate. Its multi-theoretical foundation rests on self-regulated learning (SRLG) [21], empowerment [22], stakeholder theory with a co-creation framework [23], and sensemaking [24]. Furthermore, the BBM-HE is "adaptive" in nature, in that it harmonizes all the core elements (education, research, campus outreach, campus operations, community outreach) of the sustainable university as explained in [25], and the entire HEI itself with findings of the content analysis conducted in this study.

This original paper serves several purposes: (1) by developing an adaptive and innovative model for HE, it contributes to the business model, sustainability in higher education, and the growing pandemic literature, (2) it combines several interdisciplinary theories and introduces the application of new concepts building a comprehensive business model that addresses SD and various needs to the stakeholders, (3) it discusses imminent issues in HE from a stakeholder perspective, (4) it provides a basis for sustainability learning

that focuses on the importance of sustainability education [26], and (5) it has the potential to present a best practice example for practitioners.

Table 1 shows all pillars and the possible strength of their potential interrelationships of the BBM-HE.

Table 1. Components of the BBM-HEI.

Section 2. Frameworks, Concepts, Elements	1. BMC	X	X			
	2. HESFS	X	X	X		X
	3. Sustainable University & SD	X	X	X	X	X
	4. Remote Learning & the Learning Designer	X	X	X	X	X
	5. Blockchain	X	X	X	X	X
	6. Tokenization	X	X	X	X	X
	7. Metaverse			X	X	
Section 3. Theoretical Framework	1. SRGL	X	X	X	X	X
	2. Empowerment			X	X	X
	3. Stakeholder & Co-Creation	X	X	X	X	X
	4. Sensemaking	X		X		
Section 4. Pressing Issues		Aim ("Why does HE exist?")	Benefit ("What is HE good for?")	Manner ("Which state are we in?")	Method ("What tools do we have" and "How can HE be delivered best?")	Mission ("Whom does HE ultimately serve?")
General Idea		Existential	Instrumental	Cognitive	Operational	Social/Ethical
Key Concepts		Redefine aim, restore the trust lost (quality, consistency, accreditation, oversight, values-oriented, partnership-focused.	Lifetime learning, adapt to changing labor market, skills-oriented, interconnected with industry, outcomes-based, opportunity-cost.	Help to learn anew, increase motivation, address mental health, adaptive and collaborative, increase financial resilience.	Restructure curricula and flexible teaching methods, train for digitization, invest in technology.	Inclusive, accessible, equitable, serve the common good, accountable, foster SD, promote peace, justice, non-violence, and diversity.
Section 5. Discussion on SDG 4 Targets Addressed *	4.10.	X	X	X	X	X
	4.9.	X	X	X	X	X
	4.8.	X	X	X	X	X
	4.7.	X	X	X	X	X
	4.5.	X	X	X	X	X
	4.4.	X	X	X		X
	4.3.	X	X	X		X

Explanations: X indicates a relationship. * 4.10. "[. . .] increase the number of qualified teachers, including through international cooperation for teacher training in developing countries [. . .]". 4.9. "[. . .] expand the number of scholarships available to developing countries, [. . .] for enrollment in HE [. . .]". 4.8. "Build and upgrade educational facilities [. . .] and provide safe, non-violent, inclusive and effective learning environments for all". 4.7. "[...] ensure that all learners acquire the knowledge and skills needed to promote SD, including among others, through education for sustainable development [...]". 4.5. "[...] eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, [...]". 4.4. "By 2030, substantially increase the number of youth and adults who have relevant skills, [. . .] for employment, decent jobs and entrepreneurship". 4.3. "By 2030, ensure equal access for all women and men to affordable [...] tertiary education, including university".

The paper is structured in line with the components of the BBM-HE. Following the introduction, the models, concepts, and elements are presented together with a short

background on COVID-19 and its effects on HE, and SDG 4 in Section 2. Section 3 builds the theoretical framework, and Section 4 contains the methods and model, which discusses the details of the content analysis and its findings and introduces the BBM-HE. Section 5 provides a discussion of the findings and how the model addresses the targets of SDG 4 while serving several stakeholders and concludes with remarks on the limitations of the study, policy implications of the findings, and further research suggestions.

2. Frameworks, Concepts, and Elements

This section provides a short overview of COVID-19 and its repercussions for higher education and introduces existing models and new elements that may serve as tools to address the realities that HEIs may need to accommodate in the not-so-distant future.

HEIs that already had in place viable business models and effective risk management tools at the start of the pandemic have been able to make a semi-smooth transition to virtual learning and a remote work environment. The less fortunate others, who had followed traditional teaching methods, neglected or put-off, the acquisition of adequate collaborative learning solutions, and failed to invest into state-of-the-art information and communication technologies, are now struggling to get their resources ready on time for the "new normal" semesters ahead. Added to this, the drastic interruption to the usual operations of HEIs [27] has come at a high cost. Many institutions, especially those who had no emergency funds, are at risk of going bankrupt or preparing to shrink their operations and course offerings to affordable sizes next to suspensions or delays of their research activities [27]. As talks continue about a change of mentality and a revamp of traditional education to a modified online, hybrid [28] or even decentralized [29] version, students are demanding sizable reductions in tuitions and fees, and yet others have already started questioning the value of a college degree if it does not increase employment prospects [12]. For instance, there is news about British universities potentially facing a £760 million loss as a result of one in five students planning to defer their 2020 commencement until universities return to their normal operations. Thus, there is a possibility of a projected collapse in international student recruitment [30]. Moreover, the ensuing economic recession is severe and may have further deteriorated the financial resilience of the educational system, and ultimately, culminated in a global education crisis that has left students now risk losing $17 trillion in lifetime earnings in present value or the equivalent of 14 percent of today's global GDP [31].

Especially, institutions relying on state and private funding will find it more difficult to cope with tighter budgets and to diminish cash inflows. Next to existing travel funds cuts, surely research grants will get their share from cut-offs as well. With very low mobility for staff, students, and researchers, minimal face-to-face contact-making collaboration, and knowledge creation difficult, mediated online teaching and meetings that lack depth and richness, coupled with the lost autonomy of HEIs to technology providers and online learning platforms, the post-pandemic university will see its intellectual and existential foundations shaken. Consequently, even if the uncertainty surrounding the fate of the virus should diminish, the higher education system has already undergone an unprecedented change in mentality, which cannot be undone.

2.1. BMC

Business models are abstract representations of how a business generates value. Founded upon nine building blocks (key partners, key activities, key resources, value propositions, customer relationships, customer segments, channels, costs, and revenues), the BMC provides a shared language and framework for describing, visualizing, assessing, and changing business models [18]. The BMC has been used and modified by various scholars across a multitude of disciplines. While not as frequently used as in the business administration discipline, the BMC has gained attention by education scholars increasingly over the past decade.

2.2. HESFS

The HESFS [19] presents a conceptual model based on three pillars (sustainability, funding, and employment) to engrain SD into the institutional culture, instill sustainability literacy in the stakeholders, and help achieve the SDGs, and particularly, SDGs 4 and 8 [15].

A by-product of the HESFS, the SDG joint value business model canvas (Figure 1) presents a rather modified version of the BMC. It is also distinctly different from the business models of traditional HEIs where students (i.e., customers) are seen as the sole recipients of value [23] with faculty and staff as the creators of such, offering individualized value propositions, and thereby enticing multiple stakeholders to collaborate as co-creators of joint value. This value is reflected in the quadruple bottom line [32], which in turn impacts the bottom-most SDGs through the dynamic and intertwined relationships and actions of the stakeholders.

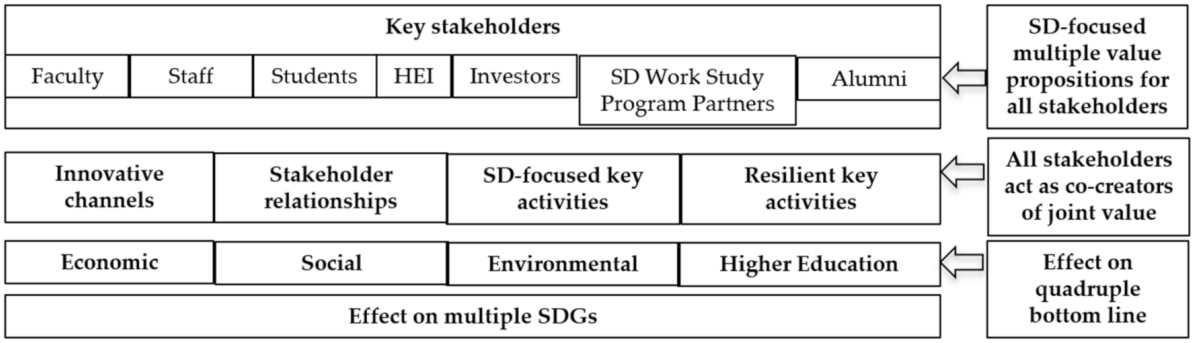

Figure 1. SDG joint value BMC. Adapted from [19].

2.3. The Sustainable University and SD, SDG 4

Parallel to the originally environment-centered, historical evolution of the concept of sustainability, SD with respect to HEIs, until recently, has been narrowly interpreted as solely "greening the campus" [33], and has later on unfolded itself into the "sustainable university" [14].

While there is no consensus among scholars as to what constitutes a sustainable university and how to measure SD for HEIs, countries (HEIs) with different priorities are developing varying preferences in their sustainability practices [34]. That said, [3] suggests that a sustainable university project tackles the challenge of sustainability in HE at the institutional level.

The partial and fragmentary approach, with HEIs addressing only one or two sustainability domains [5] has contributed to the failure of driving organizational change for most HEIs to develop systemic sustainability [35]. Furthermore, the lack of institutional support and planning and having limited resources or a lack of trained staff, among others, lead to difficulty in the implementation of integrated approaches [6]. In addition, the absence of appropriate funding is troubling not only sustainability efforts but also the traditional domains of HEIs, such as research.

Among the 17 SDGs agreed upon by the UN [2] members in 2015 [15], SDG 4, with its ten targets, focuses on achieving quality education around the globe. The socio-economic after-effects of the widened learning gaps among students during shutdowns and the anxiety of Generation Z about the recurrence of a new pandemic and its economic costs may linger for many years. As a result, among others, ideally one of the top priorities of a sustainable university, SDG 4, "all-inclusive education", is doomed to suffer serious setbacks [12]. In fact, many students will "virtually" be left behind: Students coming from disadvantaged backgrounds with no laptops or Internet connection, those that require special learning aids, freshmen who have had no chance to experience the "glamourous" pre-Covid campus-life and failed to enmesh into the university culture and graduating students with gloomy employment prospects. Almost all sub-groups of students may feel

overwhelmed trying to meet the advanced requirements of college courses administered through technological platforms and live up to the demands of the already tight job market.

2.4. Remote Learning and the Third Space/Learning Designer

Currently, with various remote-learning types (such as synchronous/asynchronous, hybrid/fully online, etc.), educational stakeholders and HEIs are situated in a low-cost, multi-level quality, and uncertain competitive setting. With hundreds of free Massive Open Online Courses (MOOCs) and cost-effective online certificate programs, HEIs will no longer be able to differentiate themselves solely through their educational mandates. Even if they could, MOOCs that set out to democratize education and transform learning globally seem to have been too optimistic about their motto. MOOCs largely fell short of their purported mission of transforming education worldwide based on data that covers 5.63 million learners in 12.67 million course registrations from 2013–2014 to 2017–2018 [36]. An average of only less than 10% of registered MOOC participants complete these courses and receive certification [37]. The high attrition rate is said to mostly occur during the first few weeks of the course [38] and is caused by the fact that MOOC participants present different levels of commitment and involvement in these courses and, consequently, not all of them establish clear goals for their successful completion [39]. This means that the higher education landscape suffers more and more from a multitude of offerings, various levels of quality, and fierce competition.

The emergence of the "third space" and co-creation of learning designers as 'hubs' in MOOC development networks could offer a potential solution to the abrupt and large-scale move to virtual learning. This complex environment demands the presence of "learning designers" that act as intermediaries in dealing with administrators, educators, technology experts, and various HEI stakeholders to develop appropriate solutions for different demands and needs. Virtual education and MOOC development necessitate a network of relationships between these actors and relevant resources, rules, and technologies, with the learning designer operating as a central 'hub' role within these networks [40]. Learning designers incorporate technologies into the blended professional spaces, knowledges, legitimacies, and networks with which they work, often finding subtle ways to control the development process with the aim of accomplishing educational, strategic, or practical goals [20].

The term 'learning designer' is used here to describe a role that demands, among others, pedagogical expertise, project management, academic writing, resourcing, and 'delivery strategies' [41].

2.5. Blockchain

The pandemic has created a sense of urgency for all industries to improve their sustainability credentials and HEIs are no exception. As the revolution continues, eyes have simultaneously shifted to BT, referred to as "the most important IT invention of our age [42], not only with respect to crypto markets, where they originated with the now infamous Bitcoin, but also their application to all kinds of businesses. A survey revealed that 2% of higher education respondents have already deployed blockchain. Another 18% of respondents are planning to do so within the next 24 months [43]. Blockchain is a decentralized database, which verifies transactions between participants and, through its encryption mechanism, verifies that the information pertaining to these transactions are timestamped, verifiable and tamper-proof. Consequently, blockchain technologies ensure trust between parties or other stakeholders who are interested in accessing the information provided through the blockchain.

Briefly, the features of BT are (1) immutability, where information on transactions, once validated by the decentralized system participants and recorded as blocks on the blockchain, cannot be changed, ensuring permanence, increased security, and incorruptibility, (2) decentralization, in the sense that there is no single governing authority or person. Anybody can directly access the system and store their assets in the form of cryptocurrencies, legal

documents, licenses, credentials and can furthermore offer their own courses, create their own currencies directly controllable through their own private key, (3) consensus algorithms, and faster settlement, which enables faster, reliable, and reliable decision-making, (4) a distributed ledger that is kept by all participants in the blockchain, thereby providing efficient and accessible, transparent information, guaranteeing ownership verification. The several advantages of BT in this realm are listed in Table 2.

Table 2. Advantages of BT.

BT Advantages	Predictions about How Blockchain Will Significantly Disrupt the Higher Education Space
Academic degree management [42].	Distributed ledger technologies will lead to greater research coordination and collaboration between private sector entrepreneurs and public HEIs [44].
Summative evaluation of learning outcomes [45].	BT will change the subject matter taught HEIs and offer a broad range of degree offerings and certifications at the interSection of commerce and technology [46].
Storage and access of degree records and certifications [47]	Distributed ledger technologies will eliminate the labor-intensive process of administering student information and learning management systems that track admissions, registration, degree progress, and graduation, replacing them with Blockchain templates and smart contracts [48].
Reduction of diploma and credentials fraud [49].	BT will generate proof of intellectual work, thereby streamlining copyright, intellectual property, and digital rights protection for employees at HEIs [50,51].
Monetization of academic skills and reward for scholastic achievement [52].	Distributed ledger technologies will convert HEIs from degree-centric, two-level (undergraduate and graduate) institutions, preparing young adults for the workplace, to supply chain providers of education certifications (professional, continuing and online), providing learning and training opportunities throughout an individual's entire lifetime [51].
Reducing administrative waste and expense by increasing process efficiency in such areas as admissions, registration and time-to-degree reporting [51].	"Learning is earning": The ledger makes it possible to get credit for learning that happens anywhere. The student profile displays all the "Edublocks" earned. Employers can use this information in job offers to match the skills of the candidate. Income and skills can be tracked, and use that data to provide feedback on the courses [42].

Source: Author's own table based on [53].

Presumably, HEIs will shift from being degree-centric institutions to educational supply-chain providers and, through BT, track, store, and verify students' credentials and educational credits earned from other institutions. Students will be in control of the whole process and, with private keys, will have access to this immutable, trusted, secure and fraud-free portfolio of their achievements, including references, student club memberships, etc. and be able to share this information with other requested parties. From improved business processes, enhanced record keeping, new funding options for students may be made available through the application of BT. Applications of transformed HEI business models are only a handful at present. For instance, Woolf University prides itself in being the world's first all-blockchain HEI, and Arizona State University strengthens its ties with community colleges through an alternative transfer evaluation based on blockchain [54].

2.6. Tokenization in Higher Education

Digitization increasingly has led to the ongoing rise of the platform business model, which creates a marketplace virtually matching supply and demand. A positive network effect is generated when the value that a customer on one side realizes from the platform increases with the number of customers on the other side. This will ultimately lead to the realization that subsidization, the most popular incentive up to now, which has yet proven to be costly and unreliable, may be replaced through the network effect generated by BT platforms that enable an alternative incentive mechanism through tokenization [55]. Tok-

enization is a process of converting the rights to an asset into a digital token that facilitates the trading of those assets and permits micropayments [56]. Instances of tokenization in sustainability are increasing; however, tokenization in education is relatively rare. In a pilot study, a collaboration of universities tested whether sustainability tokens, they called "EDU" tokens, can play a catalyzer role to blockchain technology adoption in education and an instrumental role for the growth and the sustainability of the projects of which it is part of [57] An educational model from Spain called Tutellus (https://www.tutellus.com, accessed on 9 February 2022) has its own tokens and attracts not only students and teachers but also employers with the aim of solving various problems in the educational segment, such as students' lack of motivation to study, high cost of education, unemployment caused by a significant "separation" of the education system from the labor market [58].

2.7. The Metaverse

Game-based learning is an effective method for building collaboration, diversity of thought, design thinking, critical thinking, decision-making, emotional intelligence, problem-solving, and sensemaking competencies [59].

Mostly associated with gaming, the metaverse is, in fact, much more than that. It is a virtual space that simulates the real world and is enabled through software and physical hardware (i.e., augmented reality glasses). People can interact in the metaverse using various technologies.

Unlike games, since metaverses do not impose any set rules or objectives, inhabitants are free to define the rules and conditions that should govern their environments [60] and are thus, be able to go to concerts, attend meetings, study, practice sports, and lectures. Although it is a fairly new concept and there are still a lot of issues to be addressed (i.e., how to handle privacy issues, ensuring the interoperability of digital items, determining a standardized currency that allows the metaverse economy to grow), and questions on how far it will penetrate into our lives, the metaverse presents an opportunity for many industries to expand any activity from the physical world into the virtual [61].

As such, the metaverse in the realm of education can potentially engage students to be proactive and interactive and increase their overall motivation.

3. Theoretical Framework

The proposed model's theoretical framework is grounded in stakeholder theory with a co-creation framework [23], self-regulated learning (SRGL) theory [21], empowerment theory [62], and sensemaking theory [24]. For explicative reasons, a modified version of the business model canvas [18] to concretize the term "business model" and to show the assumptions and their interrelationships behind a business model, is used. Ref. [63] provides an extensive discussion on the evolution of sustainable business models.

3.1. SRGL Theory

SRGL theory refers to the accomplishment of the learning process through three phases; forethought, performance, and self-reflection, which repeat cyclically throughout the learning process [21]. Active learners who possess these skills are presumed to have the capacity to set their own learning objectives, be realistic about their achievement criteria and monitor their progress, and as a result, are more likely to succeed in MOOCs [64].

3.2. Empowerment Theory

According to [65], empowerment is the mechanism by which people, organizations, and communities gain mastery over their lives. Ref. [62] argues that empowerment is a distinct approach for developing interventions and creating social change. Empowered people, at various levels of empowerment and with respect to structures, processes, or outcomes, may feel in control and show more dedication in whatever it is they are doing as a group or community.

3.3. Stakeholder Theory and the Co-Creation Framework

Ref. [23] argues that from a stakeholder perspective, a joint purpose should result from the shared values of the organization and its stakeholders, whose collective efforts are the core of value creation. As a result, for legitimacy purposes, the value should be created with and for various shareholders for them to benefit the institution and increase its efficiency and impacts. Stakeholder theory [66] concerns itself with whom and for whom value is being created. Originally, the argument was that HEIs employed their assets (i.e., physical space, technology, education- and research-related know-how) to create value in their two core impact areas (education and research); however, with the increasing sustainability narrative demanding the creation of value for the society and the economy, the discussion expanded to how other core elements of HEIs, such as campus operation, campus experience, community outreach, stakeholder relations, governance [25] could contribute towards the achievement of SDGs.

3.4. Sensemaking Theory

Sensemaking [24] is best defined as a way that group members discover ways of understanding and talking about complexity with eight theoretical features [67]. It involves (1) communication of the circumstances, (2) of a complex and uncertain nature, a group of people find themselves in, (3) retrospection of the puzzle observed, (4) noticing and using mental models to ask, "what is this about", (5) focusing on extra cues and labeling/categorizing reoccurring experiences, (6) creating understanding through plausibility rather than accuracy, (7) creating a story and a path to move the group to action, and (8) updating and revisions of the story [68]. The plausible sensemaking story has created a path to action and sensemaking is one process by which groups thread their way through complex issues and discover good enough common ground to move toward action [68]. This model can "harness group memory" [69] and serve to influence the stakeholders' sense of accomplishment [68].

4. Methodology and Model (BBM-HE)

This section provides details on the applied methodology and then moves on to explain the proposed BBM-HE, which is also founded on the findings of the present study.

4.1. Qualitative Inductive Content Analysis of Online Reports

The methodology that lends itself best to this study's purpose is the inductive approach to a qualitative content analysis of recently published comprehensive reports as the primary source of information.

This methodology enables the researcher to attain a condensed and broad description of the phenomenon (the issues surrounding higher education, sustainability, and the pandemic from the viewpoints of various stakeholders), and the outcome of the analysis is categories describing the phenomenon and then using these categories to build up a model, conceptual system, conceptual map or categories [70].

The inductive approach to content analysis is used if the knowledge on a phenomenon is insufficient or fragmented [71], whereby the categories are derived from the data to form a general statement [70] and provide useful evidence to testing hypotheses or, in lieu of hypotheses, answering research questions that guide the research [72].

This framework merely demands that the content analysis can be validated in principle [73] and thus, it is expected that this indirect method of validation of the results of the analysis should at least correlate with observed behaviors or polls [74]. Since the aim of qualitative research is not generalizability but rather transferability (where findings from one context should be applicable to another), sampling is purposive because it does not need to ensure that all objects being analyzed have an equal or predictable probability of being included in the sample [72].

During data collection, large-scale surveys covering predominantly numerous countries have been found and included in the analysis. As such, the methodology also fits the

definition of a meta-analysis which is an analysis of analyses—in that sense, it interprets, develops and operationalizes common concepts from existing studies [75]. Since the online reports contain multiple methods like surveys, expert consultations, and secondary data, these different types of data provide cross-data validity checks. Therefore, a validity check is inherently provided: triangulation of methods to test for the consistency of results [76].

The three-step procedure for the inductive content analysis as outlined in [70] involving (1) the preparation phase and the selection of the unit of analysis (sampling) and making sense of the data, (2) the organizing phase of open coding, creating categories and abstraction, and the (3) reporting phase that results in a model, conceptual system or main categories, is followed.

Step 1: Preparation, Research Questions and Purposive Sampling

The first research questions posed in the introduction is reiterated below:

"What are the most pressing issues in need of attention that pose a survival threat to the post-pandemic HEI and its main stakeholders?".

Keywords were determined by the researcher based on experience, extant literature, and current news headlines. To determine the appropriate reports to be selected through the Google Search engine, the following keyword combinations were used: "higher education" in combination with "pandemic" and/or "COVID-19", "future", "current state", "prospects" and "report".

The database of reports has been compiled through a rigorous keyword search using the Google Search engine to find recent reports on higher education, its current state and future outlook in the backdrop of the pandemic.

Close to 700,000,000 records were found out of which three independent analysts applied the following selection criteria:

(1) Recency: Only reports published between 2020–2021 were chosen.
(2) Relevance and scope: Only the initial five pages of the results were grouped according to how relevant, comprehensive and applicable to broader audiences the results are.
(3) Publisher: Reports should be published by reputable and trustworthy institutions that are frequently cited in academic research [77,78].

As a result, 30 reports were selected, out of which 13 were eliminated since they repeated findings from other reports, leaving the researcher 17 reports to be analyzed in detail.

Table 3 presents the relevant information on these documents with specifics about stakeholders (i.e., presidents, students, governmental representatives), coverage/sample (i.e., countries, continents, members of organizations, single country), and the publishing source.

Seven reports are from the perspectives of the leaders (presidents, chancellors, rectors, high-level administrators), four reports are from the perspectives of the students, and six reports rely on the opinions of experts (third party consultations and independent statistical information).

Eleven reports are based on surveys (one of which contained both survey and expert opinion), four contain (expert) consultations and the remainder are based on observations and secondary data.

Five focus on only the USA, one on solely the UK, and the remaining on numerous countries or regions.

Step 2: Organizing: Coding, Grouping, Categorization

Categories and main categories are determined through careful analysis of the texts and interpretation of data that is classified as 'belonging to a particular group" (Elo and Kyngäs, 2008).

Accordingly, the texts are analyzed and coded according to the most frequently appearing concepts, and then are grouped into five key domains. Each domain corresponds to a central question that emerges from the culmination of these key concepts:

(1) Why does higher education exist (existential)?, (2) What is higher education good for (instrumental)?, (3) In which state is higher education currently operating? (cognitive)?, (4) What tools to deliver higher education are available and can be put to best use (operational)?, and (5) Whom does/should higher education serve (social/ethical)?

The categories that emerge as a result of these high-level questions, respectively, are labelled as (1) the aim of HEIs, (2) the benefit of higher education, (3) the manner in which HEIs and their stakeholders operate, (4) the methodology that should be used for the provision of higher education services, and (5) the mission that HEIs should embrace.

These categories summarize the "most pressing issues" and provide an answer to the first research question.

Step 3: Reporting the Findings

The findings of the content analysis revealed that all stakeholders concern themselves with the five questions above, although to varying degrees.

As shown in Figure 2A, from the perspective of all stakeholders combined, the most pressing issues that need to be addressed, in the order of priority, are those related to manner (31%), method (28%), benefit (19%), aim (12%), and mission (10%).

This means that stakeholders care most about the cognitive domain or the way HEI stakeholders operate, presumably as the result of the anxiety and changes in habits triggered by the pandemic. This is exemplified by the answers to surveys such as health and adaptation to new modes of teaching are the primary concerns for students and institutions, students need to learn anew; HEIs should address lasting uncertainties and the new normal; the main challenges are social isolation, general anxiety, and financial concerns and the need to support mental health issues, the faculty needs to adjust to a new teaching pedagogy; HEIs should maintain student engagement and increase their own financial resilience; increase course satisfaction and motivation of students; change the ways of learning, provide space for dialogue and collaboration among all stakeholders, and setting up emergency funds [10,11,13,27,79–82].

The second domain is the operational domain or the methodology to be applied in the transformed educational landscape. This category is exemplified by answers highlighting the restructuring of curricula and fostering flexible teaching methods, digitization training for staff, faculty, and students, and the necessity to invest in technology [13,79,83–86].

The third domain concerns the instrumental aspect of higher education, or the benefits stakeholders get out of having a university degree. The most common answers for this domain center around the idea that HEIs should provide training (repeated and updated in the form of lifetime learning) so that students acquire the necessary skills demanded by the changed and tightened labor market; HEIs should be interconnected with the industry; and education should be outcomes-based rather than being degree centric [9,10,84–88].

Fourthly, the aim, or the existential domain, evolves around the need for "making sense" and redefining the raison d'être of HEIs, and particularly restoring the trust lost in higher education based on inconsistencies, concerns regarding accreditation and oversight; the longing for stronger partnerships and value-orientation with a "soul"; and re-addressing HEIs' value propositions [9,10,27,86].

The fifth social/ethical domain involves the mission of the HEI and their working towards the "common good", to a great extent, converges with SDG 4. This domain includes the call for HEIs to support and ensure diversity, inclusivity, equal access, equity, guarantee women's and minority rights, protect against abuse and harassment, promote peace and non-violence, and foster accountability and [9–13,27,89].

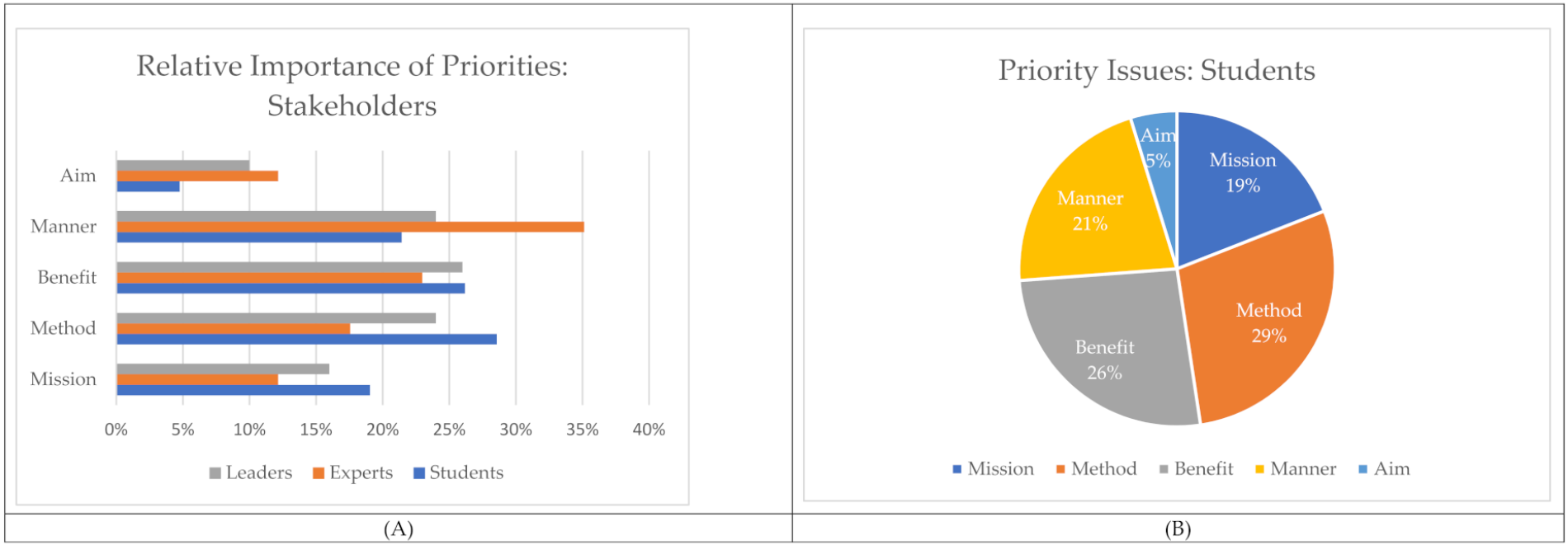

Figure 2. (**A**) Relative importance of priorities for stakeholders and (**B**) priority issues for students.

Table 3. Database of Reports.

	Method	Sample	Reference	Main Research Questions	Pressing Issues (Demands from Stakeholders)
1	Expert consultation	HE experts from 25 countries	[9]	(1) How would you like higher education to be in 2050? and (2) how could higher education contribute to better futures for all in 2050?	Transformed HEIs should (1) be inclusive, accessible, interconnected, and flexible, (2) encourage diversity, SD and lifelong learning, (3) be a public good to benefit society, (4) face the challenge of and get support from technology, and (5) be value-oriented with a "soul" and create space for physical and virtual dialogue.
2	Global consultation	Globally over one million people	[10]	(1) What are the main challenges faced in education, (2) how would education function in a society where only a small minority of people have formal employment, and (3) what new education would people need to live without formal work?	Transformed HEIs should (1) assure quality, (2) be a common good, be accessible to all, re-instill trust in education, encourage diversity and fight corruption, (3) bring in industry partnerships, (4) provide lifetime learning opportunities to adapt to new labor market conditions and be outcomes- and value-based with clear aims, and (5) renew its mission, foster interconnectedness, digital innovation and support interdisciplinary, collaborative learning.
3	Secondary data analysis and observation	US HEIs	[89]	What are the disparate impacts of COVID-19 on students in elementary, secondary, and higher education, including those attending historically black colleges and universities, and Tribal colleges and universities, Hispanic serving institutions, and other minority-serving institutions?	Restructured HEIs should (1) ensure high-quality education through academic modifications, (2) fight discrimination, ensure inclusion, and, encourage equity and equal opportunity, (3) increase financial support for food and housing of students, (4) provide equal access to all including students with disabilities, and (5) address harassment, abuse and violence.
4	Expert opinion	Global HEIs	[12]	(1) How has education fared before and during COVID-19? (2) What can be learned from these challenges and changes?	Transformed HEIs should (1) reimage its mission and change mode of learning, provide quality education to all, (2) prevent a learning crisis through quality education and protection of education financing, (3) build resilient systems for equitable and sustainable development, (4) change teaching and learning by providing flexibility, inclusivity, connectivity, equity, monitor assessment, and (5) support employability of skills in the labor market.
5	Compilation of OECD indicators	OECD countries	[86]	(1) What has been the impact of COVID-19 on education? (2) What lessons can be learned?	Transformed HEIs should (1) address student mobility, (2) loss of revenue streams, (3) readdress value proposition, (4) increase digital technology skills of teachers, and (5) renew commitment towards SDGs.
6	Secondary data analysis	European HEIs	[83]	(1) What has the effect of COVID-19 been on HE? (2) What are the main challenges to be addressed?	HEIs should (1) address lasting uncertainties and new normal, (2) address issues related to remote learning and disruptions in research, (3) introduce new ways of working to bring back the core values of HEIs, (4) improve discussions on SD and resilience, and (5) prepare for changed funding structure and labor market.

Table 3. *Cont.*

	Method	Sample	Reference	Main Research Questions	Pressing Issues (Demands from Stakeholders)
7	Survey and expert interviews	194 countries and 115,000 responses from students and experts	[87]	(1) How have the perceptions and plans of current and prospective international students changed? (2) What does the future behold?	HEIs should foster (1) increased quality, (2) online education, (3) more flexibility and sustainability and (4) increased access.
8	Survey	330,000 UK students from hundreds of institutions	[84]	Questions about academic life, including the quality of teaching, feedback on work, and learning resources.	HEIs should address (1) quality of hands-on courses, (2) increasing learning resources, (3) increased mental health support.
9	Survey	180 HEI leaders around the globe	[85]	(1) How have you found the past 18 months? (2) What about the future, economic, political and environmental?	HEIs should (1) embrace innovation, (2) increase revenue streams, (3) adapt to running fully online.
10	Survey	222 UNESCO Chair Program Host Universities	[27]	(1) What are the immediate challenges facing higher education provides, (2) What are individual institutional efforts to continue their learning, teaching and research missions during the COVID-19 pandemic?	HEIs should address (1) main challenges of remote learning (Internet connectivity, social isolation, general anxiety, financial concerns, and keeping a regular schedule), (2) invest into digital technologies, (3) adjust to a new teaching pedagogy, (4) provide learning flexibility to students and encourage active learning, (5) define clear learning objectives, and (6) mental health issues.
11	Survey	800 rectors from 33 higher education systems	[79]	Questions relating to health safety and proof of vaccinations, online teaching, support services, social activities, rules for incoming international students, enrolment and drop-out rates, and changes evoked by the pandemic that are likely to remain.	HEIs should (1) enhance online services, (2) adopt to increase blended and online learning, (3) increase learning flexibility, more teleworking for staff, instructors, and faculty, more online testing, and (4) change the ways learning and testing.
12	Survey	187 US HEI president and chancellors	[90]	Questions relating to immediate- and long-term issues that emerged as a result of COVID-19 and remote learning challenges.	HEIs should address (1) Mental health issues, (2) increase equity and accelerated dropouts, (3) overall financial stability and decline in alumni/donor giving rates, (4) Maintaining student engagement and access, (5) train faculty in digital technology, (6) ensuring student access, (7) improving the learning experience, and (8) ensuring high academic standards.
13	Survey	172 US HEI president and chancellors	[11]	Questions relating to immediate-term issues that emerged as a result of COVID-19, the institutional response, and remote learning challenges.	HEIs should address (1) mental and physical health issues, (2) unbudgeted financial costs, (3) accelerated rate of student attrition, (4) maintaining student engagement, quality and access, (5) training faculty in digital technology, and (6) improving the learning experience.
14	Survey	Students from 28 HEIs from United States, Spain, Australia, Sweden, Austria, Italy, and Mexico	[88]	Questions relate to contemporaneous outcomes and future expectations regarding three fundamental aspects of students' lives in the pandemic: the labor market, education, and health.	HEIs should address (1) health outcomes (worried about own family health), (2) educational outcomes (finds lack of contact with faculty and students challenging), and (3) labor market outcomes (cancelled internship, followed by cancelled job offer).

Table 3. *Cont.*

	Method	Sample	Reference	Main Research Questions	Pressing Issues (Demands from Stakeholders)
15	Survey	332,500 students from UK HEIs	[81]	Questions relate to students' experiences of learning and teaching as impacted by COVID-19.	HEIs should address (1) increasing learning resources, (2) supporting the learning community, and (3) increasing course satisfaction, particularly for distance learners.
16	Survey	348 presidents from US HEIs	[80]	Questions on how the pandemic has affected enrollment and financial health, adaptations made to institutional services and support for students, and predictions on future fall enrollment and state appropriations.	HEIs should address (1) the mental health of students and staff, (2) long-term financial viability, (3) racial equity issues, and (4) enrollment numbers.
17	Survey	Representatives from 599 US HEIs	[82]	Questions related to COVID-19's impact on campus life, international students, US students studying abroad, and HEIs future plans as a response to the addressed challenges.	HEIs should address (1) changed grading policies, (2) plan for moving fully online, and (3) set up more emergency funds.

When analyzed on a stakeholder group basis, results reveal that for the student population, as seen in Figure 2B, the priority of the pressing issues in higher education has a different ordering. This difference can potentially be explained by the direct and observable effects on students: Students with heavy workloads and/or coming from poorer backgrounds and not being able to afford state-of-the-art laptops enabling convenient access to lectures to feel they have a hard time with remote learning. Furthermore, given the extra effort, they must invest into learning and education, coupled with the present uncertainties and complexities, they are most likely to question the value of a degree and the opportunity cost of paying tuition. Learning to learn in a new way and become fully equipped with digital skills also demands additional resources from this stakeholder group, whereas the aim and mission of higher education are of relatively lower importance as they are to all stakeholders. The current landscape for students seems to be rather blurry and with low expectations regarding the future.

In contrast, leaders around the globe, display optimism, accentuate their ability to manage complexities, and see the necessary transformation underway in higher education as an opportunity rather than a threat [80,82].

4.2. The BBM-HE

With the findings to the first research question in convergence with the frameworks, elements and concepts, and the theoretical framework, the second research question, and its sub-questions, the BBM-HE is built. The answers, all pertinent in the previous sub-Section and concepts and theories discussed in Sections 2 and 3, are listed beneath the corresponding second research question (2) and its sub-questions (2a–e) below:

(2) How can HEIs adapt their existing business models to the urgent demands of the altered educational landscape while continuing to focus on SD, and particularly, SDG 4?

An all-encompassing adjustment is needed that reflects the long-standing demand for a "transformative change" [14] in the HE business model. This transformation can only be brought about by providing a space for dialogue for all stakeholders, and acknowledging the unique conditions triggered by the pandemic that may be here to stay. Investments in technology, training for digitization, the offering of various remote learning modalities, motivating students, faculty, and researchers by embracing their wants and needs, training intermediaries that can help revamp curricula and act as a bridge between the educational

and the professional domain so that students acquire lasting and versatile skills demanded by the current and potential job markets internationally, and ingraining sustainability into all core elements in education while providing feasible incentives for all stakeholders to support sustainable development. This type of grand adjustment calls for a radical transformation in the business model and the value propositions of the HEI.

(2a) Who are the main and potential key stakeholders in higher education?

The primary stakeholders are the students, faculty, staff of the HEI, in addition to an intermediary (the learning designer) who needs to act as a third space to accomplish the necessary transformation. Next, there are partners, like industry collaborators, alumni, sponsors, recruiters, and investors. Moreover, there is the local community and the society at large.

(2b) What should be the elements of the new meaningful value proposition of the contemporary HEIs, and how can it be communicated in an effective and inclusive way?

The value proposition of the transformed HEI should underscore outcome-based learning and services, delivered in a meaningful, flexible, accessible, non-discriminatory, and equitable way, focusing on and respecting individual differences in background, capacity, socio-economic situation, disabilities, ethnicity, and supported over a lifetime with adjustments to the changing demands of society, sustainable development, and the economy.

(2c) What kind of tools are currently available to support the infrastructure of the HEI to deliver this value proposition in a timely, effective, flexible, and efficient manner?

Blockchain technology, the metaverse, tokenization, remote learning platforms and online/interactive resources.

(2d) How can the cost/revenue structure of the HEI be modified to enable this delivery in a smooth, consistent, and continuous way for an indefinite time?

The HEI, by nature, is a going concern and, thus, has an indefinite lifetime. To live forever, finance and securing strong and persistent cash inflows is a sine qua non. The revenue streams of the average HEI are dependent on tuition, state funding, alumni/donor/investor contributions like the Civic Crowdfunded SD Fund [91], study-work programs [92], and the HESFS [19]. A model encapsulating all these potential funding elements in the form of flexible modalities is needed, where contributors or stakeholders may enjoy various rewards (i.e., "sustainability-trained" graduates, tokens, badges for achievement to be displayed on social media, tax exemptions), which is the key component to give all stakeholders a sense of empowerment and freedom to co-create their joint values [23].

(2e) How can all stakeholders be motivated to keep the entire model functioning?

Making sense through co-creation of joint value (what's in it for everybody?)—understanding the meaning and outcomes of their efforts and investing trust in education through embracing the HEI mission.

Empowerment by being integrated into the HEI business model and trust, which is secured by blockchain technology, ensuring transparency, accountability, good governance, consistency, and quality, among others.

The freedom to individualize and self-regulate their learning (Section 3.1), enjoy the material, relate it to real life, engage and be proactive through transformed curricula through the learning designer conveying changed teaching pedagogies to educators, motivation fostered through tokenization, trust supported by blockchain technology and gaming and immersion through a metaverse platform.

Having funds available for training, research, laboratories, field trips, bridging new connections with industry through the integration of flexible funding modalities as those put forth by the HESFS [19].

4.3. Model Building: The BBM-HE

Clearly, the core elements of the traditional HEIs need to be re-envisaged and "adapted" to the needs and demands of the stakeholders, as explained previously.

As indicated in the findings of the content analysis, an important challenge is the financial resilience of the HEI itself and the funding constraints of students. Therefore, models like the funding pillar of the HESFS [19] can be used to increase financial resilience and secure funds for sustainability practices, through securing seed capital, finding corporate partners to engage in a work partnership program, obtaining crowdfunding contributions from the civil society and alumni, and other long-term options, such as setting up eco-farms

Figure 3 shows the core elements of the traditional HEI model (in the upper part) for a centralized institution with a degree-centered approach and no measurable or verifiable mechanisms in place to implement and monitor sustainability practices. This mechanism is destined to be "transformed" or "re-imagined" in the course of nature with rapid changes in mindset, technologies, and a serious determination to engrain sustainability into all core elements.

The middle part of Figure 3 displays the impacts of the move to hybrid modalities where the traditional "curriculum" core element is expanded to encompass teaching, learning, and training activities for all stakeholders and on a continuous basis with outcome-based results. A new stakeholder (the learning designer) and a novel core element (the third space/learning design hub) emerge to interlink all core elements, particularly teaching, learning, and training with the professional domain and the community. As can be noticed, the boundaries of the traditional core elements are more rigid than those of the transformed ones illustrating collaboration, interaction, knowledge transfer, democratization, accessibility, and unity.

All stakeholders of the HEI should work towards a common goal and identify themselves with the HEIs aims and mission. For that to happen, they must be able to trust the mechanism and freely engage, interact, collaborate in an equal, democratic and non-violent manner. The transformed, transparent, and de-centralized HEI is therefore boundaryless with a learning designer who understands the needs and demands of each stakeholder, conveys new teaching pedagogies, reconstructs curricula and offline and remote learning modalities in a flexible, convenient, and meaningful way as demanded by the stakeholders (and explained in the previous section).

The lower part of Figure 3 represents enabling tools like the Metaverse, online learning platforms and resources, sustainability tokens, the funding pillar, and the blockchain-supported infrastructure.

The Metaverse will serve to engage mainly the students to be more proactive and immerse in the learning experience. However, next to offering a new venue for the learning and teaching function, the Metaverse also has the potential to affect all other transformed core elements at different levels. For instance, board meetings can henceforth be more productive or the campus experience more fun and effective in accommodating social anxiety for current students. Metaverse can also be conveniently used for promotional purposes with potential students as visitors during open days that can last throughout the year.

Sustainability tokens in the form of hard tokens or even the HEIs own cryptocurrencies can be exchanged in all domains of the HEI. This may serve several purposes: (1) Tokens may be handed over to employers as an incentive to hire students from the respective HEI and contribute towards SDGs, (2) tokens may be displayed virtually on employers' websites, thus creating a network effect (as explained in the previous Section) motivating other companies to become part of HEI business models. This network effect can further be increased if local authorities provide subsidies for token holding companies, (3) the more stakeholders join in, the more the demand for HEI sustainability tokens will be, which in turn, will increase the value of the tokens for the holder. Thus, a market for HEI sustainability tokens may emerge and attract new investors, and (4) HEIs will be able to show "proof of impact", both in terms of how far they have reached SDG goals.

Finally, as discussed previously, the theoretical framework explains why and how stakeholders together create value across the virtual supply chain, for themselves, and for their common goal: the achievement of all 17 SDGs.

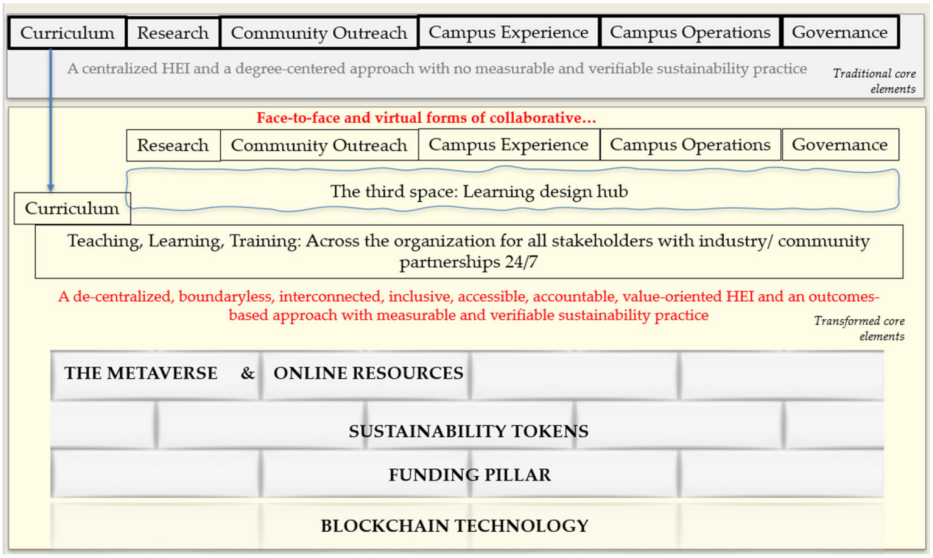

Figure 3. Core elements of the HEI: Traditional and "Transformed". Source: Author's own elaboration based on various literature sources and concepts explained in Section 2.

Figure 4 presents the BBM-HE through a transformed BMC perspective: The original nine building blocks (key partners, key activities, key resources, value propositions, customer relationships, customer segments, channels, costs, and revenues) have been modified as follows: Replacing the concept of customers and partners with stakeholders who, together with transformed key resources delivered face-to-face and online on a 24/7 basis, and by collaborating on the transformed core elements contribute to the co-creation of joint value. The outcome is translated into a quadruple bottom line, instead of solely profit consisting of revenues and costs. The quadruple bottom line represents the triple bottom line (Elkington, 1994) and an added "intrinsic value obtained out of higher education. Financial resilience of the HEI and financial resources for the student are obtained through partnering and the joint-value creation process with stakeholders, who all together, work towards value-oriented goals and a common mission: SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The intrinsic value (defined in finance as the present value of probable future net cash flows or the objective value of an asset) is the satisfaction/pleasure/material and non-material rewards obtained in the long run by contributing to this mechanism. For the students, rather than the credentials, the skills, vision, experience, and network obtained in this system, and updated through lifelong learning programs, will prove to be indispensable to live up to the demands of the uncertain conditions of the future labor market. HEIs will enjoy increased trust, a restored reputation, and an influx of motivated students and researchers which will translate into donors/alumni/sponsors/investors willing to financially support the institution to be part of this successful sustainability story. Faculty and staff, will reap the benefits of extra resources available to fund research and enjoy a lighter workload due to automated operations will favor working at institutions that embrace the presented vision of the future HEI.

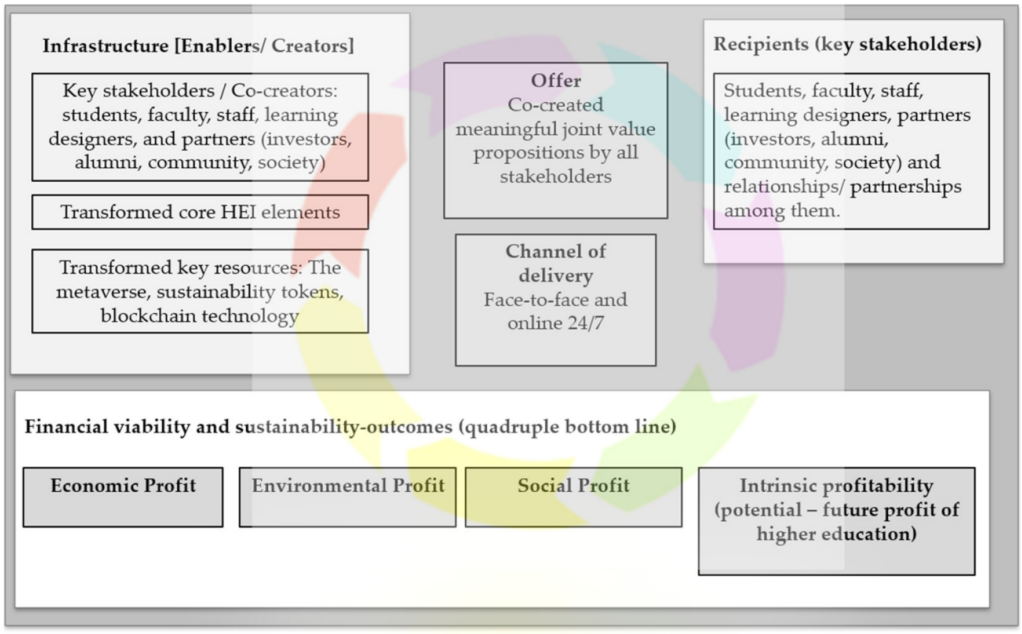

Figure 4. The BBM-HE is illustrated through a "transformed BMC" perspective: The BBMC-HE with the "transformed" building blocks. Source: Author's own elaboration based on Figure 4 and concepts explained in Section 2.

5. Discussion and Conclusions

This paper has (1) explored the most pressing issues faced by HEI stakeholders currently through inductive content analysis and has (2) developed a comprehensive model (the BBM-HE) that may serve as a template for HEIs undergoing the necessitated transformation in their value propositions and business models.

Table 1 in Section 1 of this paper provides an overview of how each component (frameworks, concepts, elements, theories, and targets of SDG 4) shown in the leftmost column is related to the five domains (pressing issues: aim, benefit, manner, method, mission) listed on the middlemost row.

For instance, sensemaking theory addresses the existential question of why the HEI exists, and for that to happen, a credible, trustable, consistent enabler is needed. In higher education, "the very notion of academic freedom is predicated on a foundation of trust" and "for universities to become more innovative and risk-taking, trust is essential" [93]. Blockchain is operated through a trust protocol, and its currency, sustainability tokens, facilitate smooth working and ensure accountability.

Among the ten targets of SDG 4, targets 5–10 are supported by addressing issues related to all five domains, while four domains (except for the method) serve to foster targets 3 and 4. As a result of applying the BBM-HE, equal access to higher education by men and women, students with disabilities, students coming from low-income backgrounds by providing the number of scholarships available (SDG 4.9.) is ensured (SDG 4.3.), and gender disparities are eliminated (SDG 4.5.), in a safe, non-violent, inclusive and effective learning environment for all (SDG 4.8.) facilitated by learning designers and the metaverse to increase the satisfaction and training in the digitization of faculty and staff and by the oversight mechanism supported through blockchain, the number of qualified teachers can be increased (SDG 4.10.). The tokenization element and industry collaborations are fostered by a mechanism enabling the co-creation of joint value to ensure that all learners acquire the knowledge and skills needed to promote sustainable development (SDG 4.7.). Furthermore, the underlying rationale of the entire business model contributes to substantially increasing the number of youth and adults who have relevant skills for employment, decent jobs, and entrepreneurship (SDG 4.4.).

However, not only does the BBM-HE support SDG 4, but also due to the interrelated nature of all SDGs, it contributes to all other 16 SDGs as well and supports higher education to become a fierce advocate for free and open access to knowledge and science [10].

The BBM-HE and the BBMC-HE developed in this study have several implications for practitioners and policymakers:

1. They can be re-adjusted to the transformed post-pandemic corporation or all primary and secondary schools.
2. HEI sustainability tokens can potentially be traded on crypto-exchanges or ideally be exchanged for fiat money in the future by the employer, who then, in turn, can hand in those tokens to tax authorities to receive tax subsidies as SDG supporters.
3. The effects of a tokenized education and a decentralized model, as opposed to a traditional system where students need to pay for learning, they are now paid or rewarded so that activity, retention, and conversion grow [94], and may trickle down to the well-being of all households and the entire society.
4. SDG orientation of HEIs is becoming an increasingly important issue, in the eyes of learners and students. This is evidenced by the newly created first global SDG impact rankings, published by Times Higher Education (https://www.timeshighereducation.com/impactrankings, accessed on 2 January 2022), which evaluate university performance with respect to the SDGs, and have the potential to stand as triggers of "proof of university impact" (i.e., motivation to increase competitiveness and a roadmap for implementation) for HEIs for SD integration [19]. BT operated educational models and tokenization in education, therefore provide the perfect tools for sustainable practice. Moreover, researchers can get HEI sustainability tokens as recognition for outstanding research, thereby motivating all stakeholders to contribute through new performance appraisal structures.
5. This type of interconnected structure may benefit HEIs and their students from developing countries to access education and equitably compete with peers from developed countries.
6. Similarly, the BBM-HE may serve to prevent many forms of corruption in education, such as the diversion of resources intended for procurement and supplies, bribery for grades and admissions, nepotism in hiring and scholarships, academic plagiarism, and undue political and corporate influence on research and weakened societal and institutional trust can decrease confidence in education's value and integrity [10].

As with every academic study, this paper also contains several limitations. The content analysis relies on secondary data mainly obtained from large-scale surveys that were administered during the pandemic and on observations and experiences mostly driven from "emergency remote learning" rather than planned online learning. Although this study provides a comprehensive model for higher education encompassing all core elements, adapted to the new normal conditions, for succinctness purposes, the focus is more on the teaching and learning component. Further research may expand the model to explain in detail the other transformed core elements, or even apply elements of the model to a different industry.

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Abbreviations

BBM-HE	Blockchain Business Model for Higher Education
BBMC-HE	Blockchain Business Model Canvas for Higher Education
BMC	Business Model Canvas
BT	Blockchain Technology
COVID-19	Coronavirus disease of 2019
HEI	Higher Education Institution

HESFS	Higher Education Sustainability First System
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
SD	Sustainable Development
SDG	Sustainable Development Goals
SRGL	Self Regulated Learning
THE	Times Higher Education
QS	Quacquarelli Symonds

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