sustainability

Review

Unpacking Smart Campus Assessment: Developing a Framework via Narrative Literature Review

Ken Polin, Tan Yigitcanlar *, Tracy Washington and Mark Limb

City 4.0 Lab, School of Architecture and Built Environment, Faculty of Engineering, Queensland University of Technology, 2 George Street, Brisbane, QLD 4000, Australia; k.polin@hdr.qut.edu.au (K.P.); tracy.washington@qut.edu.au (T.W.)
* Correspondence: tan.yigitcanlar@qut.edu.au; Tel.: +61-7-3138-2418

Abstract: The emergence of the smart campus approach for university campuses addresses the digital transformation needs of higher education institutions, driven by the increasing capability and popularity of digital technologies like artificial intelligence and the internet of things. While existing research has laid a foundation for conceptualizing smart campuses and developing implementation frameworks, a significant gap remains in understanding how to assess a university campus's 'smartness' effectively. The lack of a robust assessment framework makes it challenging to gauge the effectiveness of smart campus initiatives and identify areas for improvement. This study aims to bridge this research gap by identifying key indicators for evaluating the 'smartness' of university campuses. Using a narrative literature review method, the study comprehensively reviews the recent literature on smart campuses, organizational management, and societal applications, focusing on identifying pertinent indicators. By incorporating insights from different domains, the study presents a holistic understanding of the indicators necessary for assessing the 'smartness' of university campuses through the proposed smart campus assessment framework. The framework and the insights generated inform researchers and decision-makers in assessing and monitoring the effectiveness of smart campuses.

Keywords: smart campus; higher education institution; performance assessment indicators; performance assessment framework; smart city

check for updates

Citation: Polin, K.; Yigitcanlar, T.; Washington, T.; Limb, M. Unpacking Smart Campus Assessment: Developing a Framework via Narrative Literature Review. *Sustainability* **2024**, *16*, 2494. https://doi.org/10.3390/su16062494

Academic Editor: Ayyoob Sharifi

Received: 14 February 2024
Revised: 13 March 2024
Accepted: 14 March 2024
Published: 18 March 2024

1. Introduction

In response to the recent artificial intelligence (AI) revolution, higher education institutions have recognized the potential of AI-driven transformation to improve campus operations and enhance the learning experience. As a result, the concept of the 'smart campus' has emerged to address the impact of the disruptions driven by AI [1]. So far, a number of conceptual frameworks for the smart campus [1–4] have been proposed in terms of identifying its dimensions and the AI system. Among the early innovations is the framework in which Pagliaro et al. [5] highlighted the fields of action of smart campuses; driven by governance, management, information, and control. The dimensions included people and living, economy, environment, energy, and mobility.

In addition, Nan et al. [6] advanced the development by proposing a campus construction process from digital to smart campus to address the integration of digital technology and the smart campus. Moreover, Ahmad et al. [7] proposed a framework comprising dimensions of smart education, smart mobility, smart health services, smart buildings, and access control management. The 'Intel End to End' smart campus system was developed to integrate digital technology with the smart campus [7]. Furthermore, Fernández-Caramés and Fraga-Lamas [8] postulated the creation of a digital ecosystem of the main fields and technologies related to the deployment of a smart campus/university. Blockchain technology was adopted to propose an 'Edge Computing-Based Architecture'. The focus on digital systems advanced to big data innovations where Villegas-Ch et al. [9] postulated the significance of big data for facilitating pillars of a sustainable campus comprising security, learning, mobility, administration and government, environment and efficiency, and lifestyle for education.

The advancement of smart campus frameworks explored smart city concepts and emphasis on stakeholders, such as where Dong et al. [10] developed the human-centered learning-oriented smart campus (HLSC) framework which facilitated the smart campus to activate domains such as economy, society, and legislation/regulation. In addition, Min-Allah and Alrashed [11] developed a sketch of a smart campus based on smart city concepts comprising a smart microgrid, smart utilities, resource management, improved services, people management, and educational services. Moreover, Ikirisi and Mazri [12] proposed smart campus areas to establish a distinctive list of dimensions including smart governance, smart people, smart mobility, smart environment, smart living, and smart economy. Furthermore, Omotayo et al. [13] proposed the elements of a smart campus infrastructure comprising four categories of smart building construction or repurposing, technology and IT networks, continuous improvement and smart learning, and teaching systems. Finally, a recent work by Hidayat and Sensuse [14] on the knowledge management model for enabling a prioritized approach to decision-making for alignment with the goals and visions of a university.

While the abovementioned attempts to conceptualize the smart campus were the building blocks of the initial attempts, most recently a novel conceptual framework, as shown in Figure 1, was presented as the most comprehensive basis for understanding the smart campus concept and led to its successful development. However, this framework was limited to an overview of smart campus dimensions and lacked key indicators for performance assessment or progress monitoring. Such indicators are necessary to make the conceptual framework an operational assessment framework. A comprehensive smart campus assessment framework currently does not exist. The development of a suitable assessment framework is essential to inform smart campus decisions.

A framework of this kind should include indicators that display the aspects of particular settings and must be significant and relevant [15]. These are also expressed as criteria and key performance indicators (KPIs) for evaluating smart campuses [16–18]. In this context, the indicators, therefore, are the components responsible for the dynamics of the framework where their assessment will determine the extent of smart campus application. The literature on this topic is sporadic and only suggests and highlights indicators within their confined purposes and does not provide a complete set of indicators for a university campus.

This study aims to bridge this knowledge gap by identifying key indicators for smart campus assessment. The research seeks to understand how the dynamics and influence of the smart campus concept can be evaluated based on a conceptual framework that encompasses the dimensions of the smart campus—i.e., economy, society, environment, and governance. To do so, the study adopts a narrative literature review method.

The paper firstly introduces this methodology in Section 2. Section 3 describes the indicators of smart campus assessment that emerged from this review before presenting the results and discussing the findings and the proposed framework in Section 4. Section 5 concludes the paper.

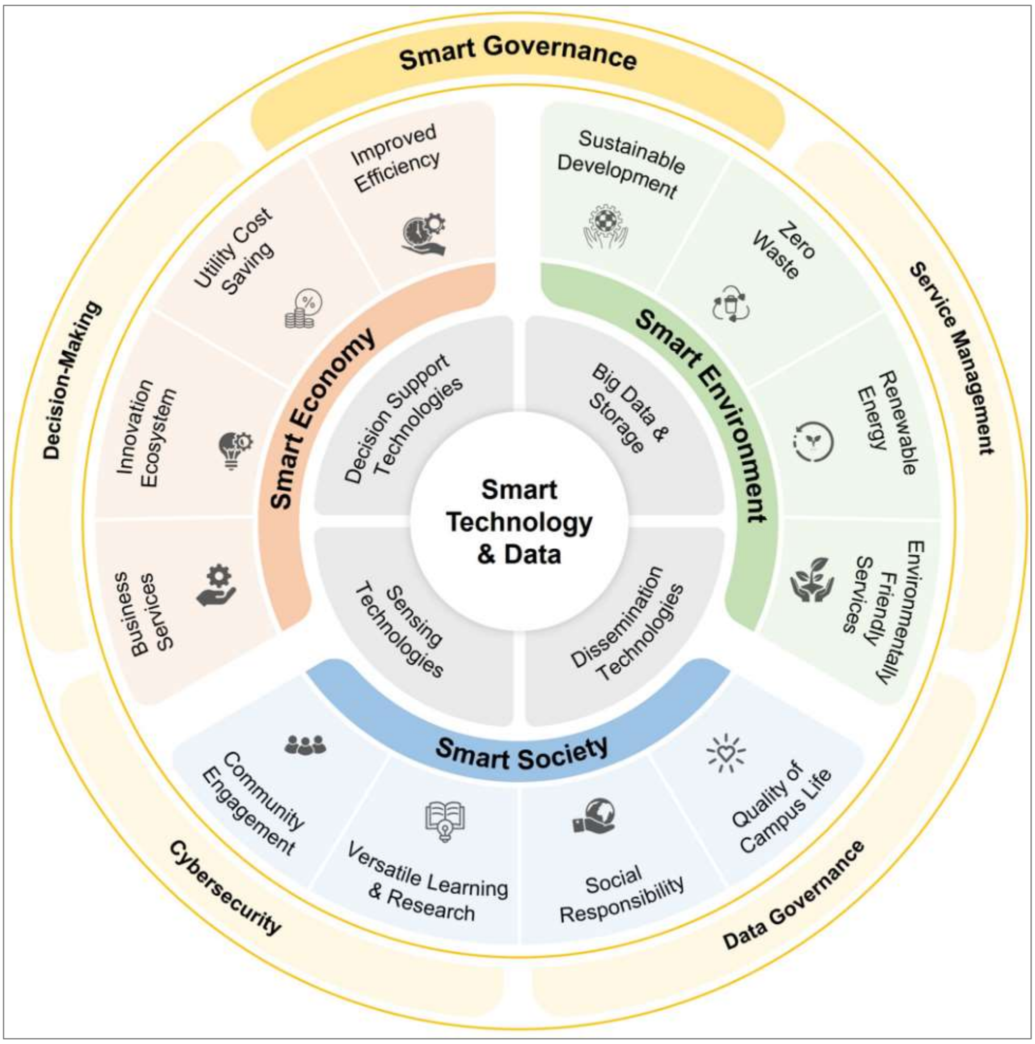

Figure 1. Smart campus conceptual framework [1].

2. Methodology

The research uses a narrative literature review method to enable a "comprehensive, critical, and objective analysis of the current knowledge on a" smart campus [19]. The study specifically avoided a systematic literature review approach, such as using the PRISMA protocol, as the nature of smart campus indicators is that they are distributed over a very large number of disciplines, making systematic review impractical.

As depicted in Figure 2, a total of 48 indicators were identified based on a previously developed conceptual framework [1]. An initial search of academic databases, Scopus, the Web of Science, and Google Scholar was conducted to identify the relevant literature on smart campuses and their associated indictors for the period from 2008 to 2024. The 2008 starting date represents when the smart campus was first introduced in the literature. The search included only English language full-text online available journal articles relevant to the investigated topic.

The abstracts and conclusions were screened based on relevance to the selected indicators and the overall focus of the study. Articles that were not directly relevant to the smart campus context or that did not provide actionable insights in terms of the selected indicators were excluded from further analysis. A total of 144 articles were selected for review and incorporated into the indicator identification process for smart campuses.

Analysis of the selected literature works led to the identification of key indicators for smart campus assessment as shown in Table 1.

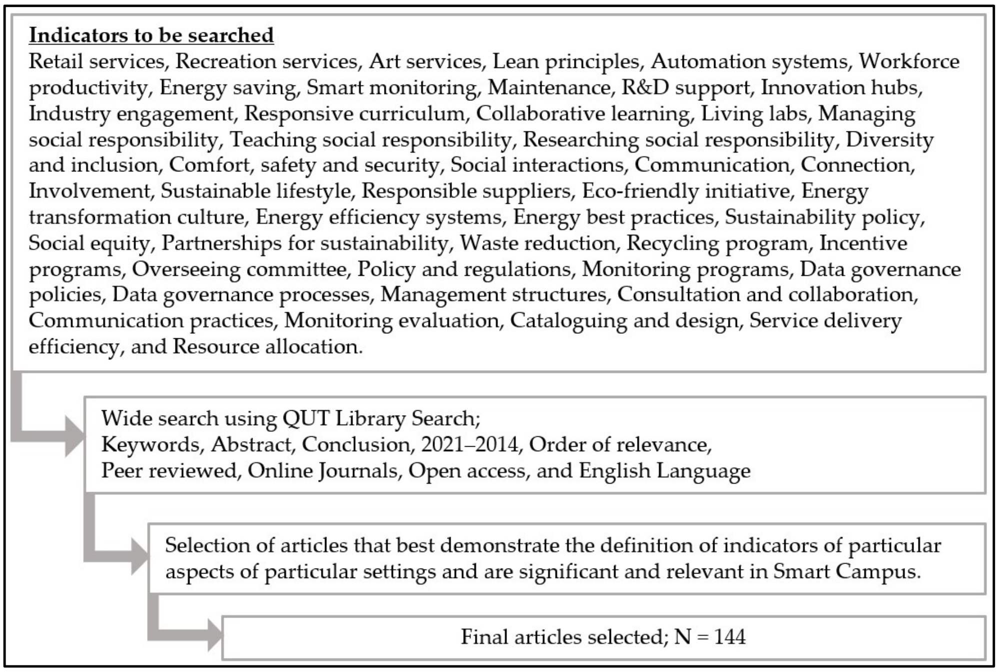

Figure 2. Search flow diagram.

Table 1. Indicators of the smart campus assessment framework.

Dimension	Category	Indicator	Description	Definition
Smart economy	Business services	Retail services	Quantity and quality of food, retail, and other business services	A variety of food, retail, and other business services on campus
		Recreation services	Quantity and quality of sports and recreation services	Various sports and leisure activities on campus
		Art services	Quantity and quality of art galleries and performance services	Range of art galleries and theatre for performance shows on campus
	Business efficiency	Lean principles	Effective practice of lean principles	Improvement of workplace efficiency for value creation in businesses on campus
		Automation systems	Effectiveness of collaborative automation systems	Robust automation systems in businesses on campus
		Workforce productivity	Level of workforce productivity	The output of workforce activity in businesses on campus
	Utility cost saving	Energy saving	Effectiveness of energy-saving mechanisms	The robustness of energy-saving mechanisms on campus
		Smart monitoring	Effectiveness of smart monitoring and control mechanisms	The robustness of smart monitoring and control mechanisms on campus
		Maintenance	Level of appropriate maintenance and service upgrade	The adequate maintenance and service upgrade of campus facilities to reduce costs
	Innovation ecosystem	R&D support	Level of incentives and support for R&D	Having an R&D promotion culture of incentives and adequate support
		Innovation hubs	Effectiveness of incubators and accelerators	Provision of incubators and accelerators for innovation on campus
		Industry engagement	Level of industry engagement and partnership	The extent of industry engagement and participation in innovation

Table 1. *Cont.*

Dimension	Category	Indicator	Description	Definition
Smart society	Versatile learning and research	Responsive curriculum	Successful adoption of a responsive curriculum	Having a curriculum meeting changes in the market and employment sector
		Collaborative learning	Offering of operational collaborative teaching and learning resources	Having robust teaching and learning resources
		Living labs	Effectiveness of living labs for knowledge sharing	Having robust living labs for knowledge sharing
	University social responsibility	Managing social responsibility	Effective management of the social responsibility agenda	Resilient leadership and successful implementation of the social responsibility agenda
		Teaching social responsibility	Effective integration of social responsibility into teaching	Success in integrating social responsibility into teaching
		Researching social responsibility	Effective integration of social responsibility into research and projects	Success in integrating social responsibility into research and projects
	Quality of campus life	Diversity and inclusion	Practice of diversity and inclusion	Presence of a culture of diversity and inclusion on campus
		Comfort, safety, and security	Presence of comfort, safety, and security	Having a comfortable, safe, and secure campus community
		Social interactions	Presence of vibrant social interactions	Promotion of vibrant social interactions on campus
	Campus community engagement	Communication	Effective communication channels	Means of enabling communication on campus
		Connection	Level of connectedness among the campus community	The campus community becoming connected together through some means
		Involvement	Level of socially involved members of the campus community	Members of the campus community becoming involved in accordance with their social identities
Smart environment	Environmentally friendly services	Sustainable lifestyle	Level of sustainable lifestyle on campus	A lifestyle of campus residents that harmonizes with the natural environment
		Responsible suppliers	Level of engagement with environmentally responsible suppliers	Suppliers of goods and services to the university conforming to an environmental sustainability agenda
		Eco-friendly initiatives	Level of development and practice of eco-friendly initiatives	Eco-friendly development practices and endeavours
	Renewable energy	Energy transformation culture	Effectiveness of energy transformation culture	Shift towards positive changes in campus energy
		Energy efficiency systems	Effectiveness of energy efficiency system utilization	Implementation of systems to improve energy efficiency
		Energy best practices	Level of good practices in renewable energy use, generation, and storage	Promotion of good practices in renewable energy use, generation, and storage
	Sustainable development	Sustainability policy	Effectiveness of environmental sustainability policy	Successful implementation of environmental sustainability policies
		Social equity	Effective practice of social equity	Campus citizens' sense of responsibility in social equity
		Partnerships for sustainability	Effective practice of building partnerships for sustainability	Identifying and engaging parties of common interest in sustainability

Table 1. *Cont.*

Dimension	Category	Indicator	Description	Definition
	Zero waste	Waste reduction programs	Effective utilization of waste reduction programs	Promotion of initiatives to reduce waste in the overall operation of the university
		Recycling program	Effective utilization of recycling programs	Promotion of the reusing of used materials and goods to sustain the operations of the university
		Incentive programs	Effective establishment and practice of incentive programs	Implementation of incentive programs to promote zero waste
Smart governance	Cybersecurity	Overseeing committee	Effectiveness of the cybersecurity committee	Establishment of a select group of people to be responsible for cybersecurity
		Policy and regulations	Effective cybersecurity policy and regulations	Establishment of overall guidelines and rules for cybersecurity implementation
		Monitoring programs	Effective monitoring programs for follow-ups	Establishment of means for checking and following up the implementation of cybersecurity
	Data governance	Data governance policies	Effectiveness of data governance policies	Establishment of overall guidelines for the use of data in governance
		Data governance processes	Effectiveness of data governance processes	Establishment of means to deal with the governance of data
		Management structures	Effectiveness of data governance management structures	Establishment of levels of power and authority to control the governance of data
	Decision-making	Consultation and collaboration	Effective consultation and collaboration	A wide inquisitive and interactive campus community
		Communication practices	Effective communication practices	Presence of robust communication avenues throughout the campus community
		Monitoring and evaluation	Effective monitoring and evaluation mechanisms	The consistent checking and evaluation of campus operations
	Service management	Cataloguing and design	Effectiveness of cataloguing and design	Constant updating of product and service stocks and meeting campus stakeholders' needs
		Service delivery efficiency	Effectiveness of service delivery efficiency	Means of providing services to campus stakeholders when needed
		Resource allocation	Effectiveness of resource allocation	Resource distribution reaching all of the campus community as required

3. Analysis and Results

The selected literature provided evidence supporting the use of selected indicators for evaluating the effectiveness of smart campus initiatives. It offered insights into how these indicators have been applied in various contexts, their limitations and challenges, and potential improvements for their use in assessing smart campuses.

A visual representation of the proposed framework for smart campus indicators is shown Figure 3. This figure depicts the framework by Polin et al. [1] and expands it to incorporate indicators across the four dimensions of smart economy, smart society, smart environment, and smart governance. These indicators are presented in the context of the smart campus in Table 1 and elaborated in the following sections.

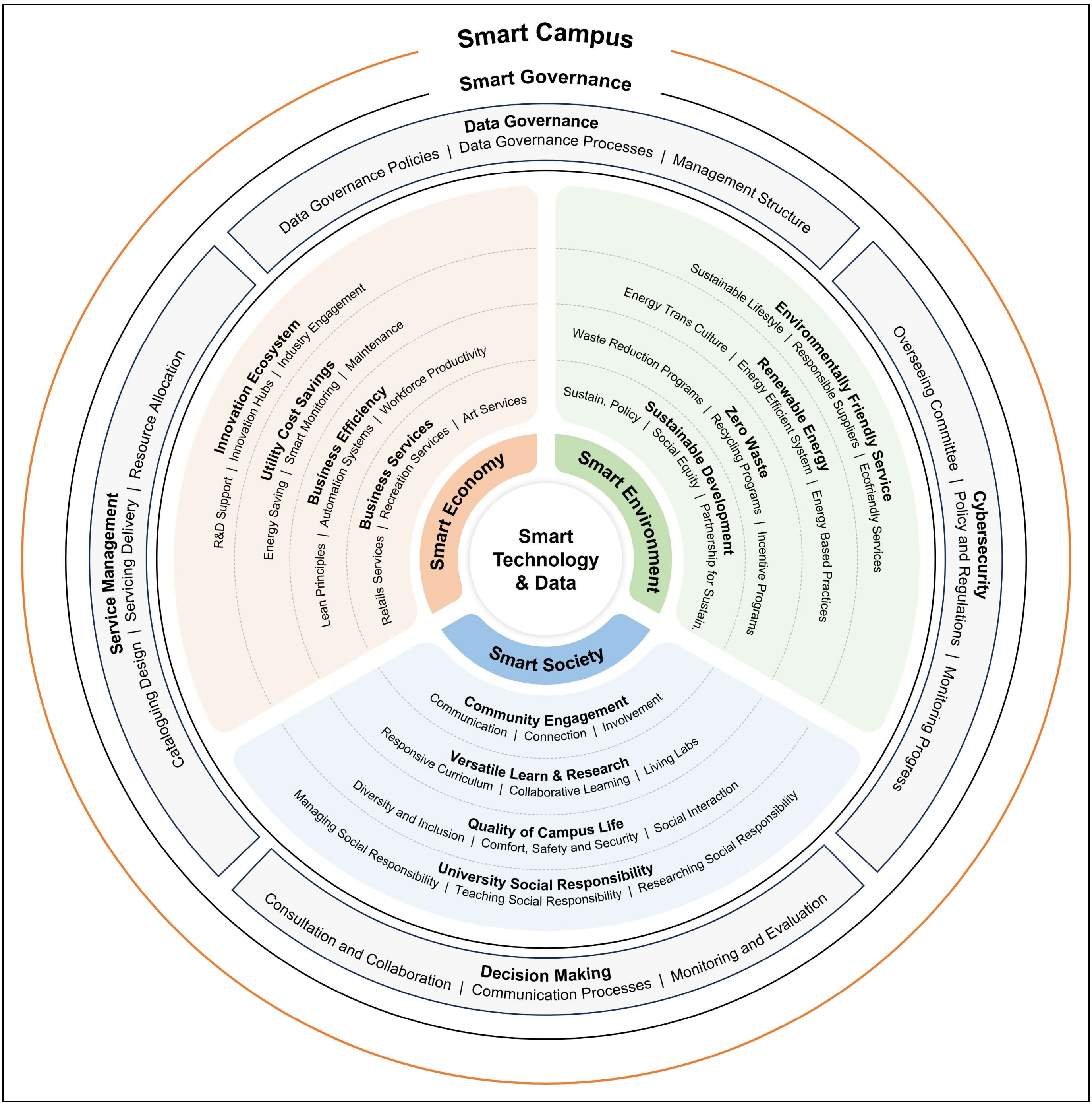

Figure 3. Smart campus assessment framework.

3.1. Smart Economy

The categories of the smart economy comprise business services, business efficiency, utility cost saving, and the innovation ecosystem.

The *business services* category is measured by retail services, recreation services, and art services where retail services entail the quantity and quality of a variety of food, retail, and other businesses comprising cafés, restaurants, grocery shops, specialist shops, such as barbers and hair salons, book and stationery shops, and clothing shops. Other businesses, like clinics and parking spaces, are also provided. These services are recently boosted by online technology such as a framework for interventions, policies, and practices in the online food retail space [20]. In addition, the digital facilitation of primary care for healthcare staff and patients will address accessibility to web-based clinical services [21,22]. Finally included is a dynamic pricing algorithm which fosters incentives for pricing control in parking utilization rates and profits [23].

The recreation services indicator, on the other hand, measures the quantity and quality of various sports and leisure activities which comprise tennis and basketball courts, soccer and rugby fields, swimming pools, entertainment centres fitted with pools, and games machines. The need for recreation services has academic benefits for international students [24] and student ID card data can be useful in terms of enabling the effective planning and management of recreation facilities [25]. Finally, intramural sports develop distinct and holistic benefits and physical health and wellness [26].

The art services indicator, on the other hand, measures the quantity and quality of the range of art galleries and theatres for performance shows which comprise exhibition and performance halls and venues. Contemporary galleries and visual arts venues advance in the digital age through collaborations yielding innovative approaches [27]. Moreover, art galleries proactively engage with visitors using the internet of things (IoT) [28]. Finally, an open library gallery engages the campus and community through collaboration where academic programmes are integrated and aligns exhibits with visitors through information and literacy concepts [29,30].

The *business efficiency* category is measured by lean principles, automation services, and workforce productivity, where lean principles entails the effective practice of workplace efficiency for value creation in businesses. It was merged with Industry 4.0 for production efficiency in the manufacturing industry [31]. In addition, higher education efficiency is enhanced by investment in skilful staff and advanced technology [32]. Finally, business models became open systems for value creation [33].

The automation services indicator, on the other hand, measures the robustness of automation systems in businesses which includes self-adaptive smart assembly systems integrating humans and automated machines [34]. In addition, this includes the multi-objective approach of integrating processes, products (services) and consumer and stakeholder satisfaction [35]. Finally, the adoption of artificial intelligence system automation creates a gig economy, making traditional permanent jobs redundant [36].

Workforce productivity entails the level of output of workforce activity in businesses, where firms need a skilled workforce, agility, resilience, and a robust innovation culture [37]. This is sustained by structured management for facilitating effective recruitment and retention to boost organizational performance [38]. Stability in the long-term is attained by maintaining and increasing the achieved indicators through creative and well-trained employees [39].

The *utility cost saving* category is measured by indicators of energy saving, smart monitoring, and maintenance. Energy saving entails the level of robustness of energy saving mechanisms where there is a rise in global energy recycling as well as the environmental protection industry through four renewable energy sources such as solar, wind, hydro, and biofuels [40]. In addition, green network infrastructure offers on-grid energy saving through the collaboration of multiple operators improving energy use through energy-saving mechanisms [41]. Finally, low-energy intelligent lighting systems provide energy savings using novel control techniques [42].

The smart monitoring indicator, on the other hand, measures the level of robustness of smart monitoring and control mechanisms where green distributed generators, involving solar power systems, wind power systems, and storage systems, require optimal sizing of batteries to sustain the system through solar radiation spikes [43]. In addition, clean energy production is now demanded, in which distributed energy resources through microgrids are becoming preferable to main grids, potentially using electric vehicles (EVs). EVs can assist with continuous power supply, reduction in energy consumption, and energy storage [44]. The firefly lion algorithm (FLA) optimizes energy scheduling to reduce both energy costs and the waiting times of consumers [45].

The maintenance indicator measures the level of appropriate maintenance and service upgrades for cost mitigation, where dynamic condition-based maintenance and production policies ensure accuracy and low costs [46]. Moreover, the maintenance of high-value engineered systems is costly and can be effectively conducted through a systematic and integrated assessment of conditions [47]. Finally, a robust framework ensures sustainability and satisfaction by facilitating risk-informed decisionmaking [48,49].

The *innovation ecosystem* category is measured by the indicators of R&D support, innovation hubs, and industry engagement, where R&D support entails the level of R&D promotion culture through incentives and adequate support. In addition, the innovation ecosystem involves many elements of the creation of value through relationships, including complement and substitute relations [50]. Moreover, knowledge and incentives drive R&D through the organization of designs for innovation [51]. Finally, a lack of coherence and continuity on innovation policy can impede a drive for innovation [52,53].

The innovation hubs indicator, on the other hand, measures the level of provision of incubators and accelerators for innovation where a multidisciplinary team approach at universities offers a collaborative approach with resilient leadership, a business focus, design patency, and people-centredness in terms of the development of incubators [54]. In addition, green human resource management creates environmental leadership for the innovative performance and eco-friendly behaviour of employees [55]. Moreover, a campus open space becomes a public service space for cities to improve urban public spaces [56]. It can be a campus planning project for integrating a campus with a city; implemented as a prototype [57].

The industry engagement indicator measures the level of industry engagement and partnerships in innovation, where industry–university collaboration fosters R&D according to a shared agenda and partnerships [58]. In addition, online platforms and networks facilitate collaboration between universities and industrial firms [59]. Moreover, a university's research quality and scientific base determines its industry engagement in terms of university–industry collaboration for knowledge transfer [56]. Finally, universities must have the right values, culture, and policies for fostering researchers' attitudes for industry engagement as a collective endeavour [60].

3.2. Smart Society

The categories of the smart society included versatile learning, university social responsibility, the quality of campus life, and on-campus community engagement.

The *versatile learning and research* category is measured in terms of a responsive curriculum, collaborative learning, and living labs, where a responsive curriculum entails the level of success in having curriculum compliance with the market and employment sector for graduates to be work-ready [61]. In addition, academic programmes need to become flexible and versatile for multiple disciplines to develop civic citizenship through ubiquitous learning in an emergent pluralistic world [62]. Finally, sustainability development learning must begin in the earlier stages of education through a robust curriculum integrating development, education, and impact. ESD programmes must hol interdisciplinary and holistic values [63] for resilience.

The collaborative learning indicator, on the other hand, measures the extent of collaborative teaching and learning practices where institutions must allow academics to become competitive in creating favourable perceptions for a committed community to improve the higher education system [64]. In addition, BIM (building information modelling) is a robust system for collaborative learning, cultivating a business–academic learning environment [65]. Finally, it is essential for universities to adopt collaborative learning and e-learning to produce graduates who are entrepreneurs and lifelong learners [66].

Living labs entail the level of effectiveness of protypes for knowledge-sharing where smart urban living labs can be built in a university as in [67]. Additionally, experiential learning programs are implemented to gain methodological knowledge to prepare students for engaging responsible research and innovation [68]. Finally, universities can improve innovation and become competitive by collaborating with science parks [69].

The *university social responsibility* (USR) category is measured by managing, teaching and researching social responsibility, where managing social responsibility entails the level of resilient leadership and successful implementation of the social responsibility agenda. It involves pursuits of adopting approaches to promoting the values serving campus citizens' identities and interests and mitigating any potential impediments. This is achieved through holding the values of and adopting a stakeholder-driven approach to institutional social responsibility [70]. In addition, social responsibility drives ethical and transparent decisions and operations to meet environmental and societal benchmarks. Its impact goes beyond the community and reaches global society [71]. Finally, USR focuses on involving and impacting stakeholders for lasting and appropriate changes in terms of life issues where a social undertaking of interdisciplinary pursuits enables collaboration with neighbouring organizations [72].

Teaching social responsibility, on the other hand, entails the level of success in integrating social responsibility into teaching, where the significance of corporate social responsibility (CSR) emerges, prompting universities to adopt and improve CSR teaching. In addition, CSR skills are required for universities' human resources, broadening their teaching programmes [73]. Moreover, ethics and social responsibility (SR) are synonyms for good business practices, where business school graduate students with ethics and SR are demanded by employers. A corporation's identity is now tagged with its responsible behaviour by society, which must be captured in teaching programmes [74]. Finally, participatory teaching promotes inclusive and sensitive higher education development at the micro, mezzo, and macro levels. The micro level focuses on changes to university teaching, the mezzo on structural and cultural changes, and the macro on social opening up and inclusive processes [75].

The researching social responsibility indicator measures the level of success in addressing social responsibility in research and projects. University social responsibility (USR) drives higher education, research, knowledge and technology transfer, and education for sustainability, and is gaining global attention [76]. In addition, STEAM (scientific, technical, engineering, artistic, and mathematics) develops learning about the living environment and the community through co-cultivation and co-learning implementing education on the sustainable development goals (SDGs). It drives USR to focus on the community using new technology developments to foster immersive learning and experiences [77]. Finally, USR promotes inclusive or participatory research through effective communication with stakeholders, cultivating a pluralistic view [78].

The *quality of campus life* category is measured by diversity and inclusion; comfort, safety, and security; and social interactions where diversity and inclusion entail the extent of a culture of social acceptance. Universities are social institutions beyond learning places where a person's quality of life is improved in terms of developing a sense of wellbeing or social mobility [79]. However, the espoused values are only aspirations whereas the 'students-as-partners' approach promotes the practice [80]. This requires the declaration of values of diversity, equity, and inclusion toward a cultural change for critique, openness, and action [81].

The comfort, safety, and security indicator, on the other hand, measures the extent of a liveable community where a smoke-free policy creates smoke-free environments and advances health promotion policies, consequently changing social norms and organizational culture [82]. In addition, the proposed liveable campus framework was created to transform traditional campuses into liveable campuses [15]. Finally, having a therapeutic sensory garden on campus can improve physical, mental, and social health, and wellbeing [83].

Social interactions entail the extent of a vibrant social community, where classroom intra-social interaction must be promoted over inter-social interaction in subgroups to create close peers and not distant peers [84]. In addition, the '5-min campus' provides an environment of interaction for unplanned meetings where social user interactions are initiated leading to new collaborations [85]. Finally, there are conceived and perceived places, which are inseparable from the phenomenon of social and political dimensions in which universities have both public and private dimensions and are multifaced social institutions [86].

The *campus community engagement* category is measured by communication, connection, and involvement, where communication measures the level of communication protocols. An effective campus alert system requires the integration of diverse information and communication technologies for which both the technical and social criteria must be addressed [87]. In addition, healthy student communities are created through online programmes that facilitate interaction via a synchronous online environment. Ultimately, student engagement and academic persistence must be the community values [88]. Finally, keeping the customer informed through business-to-customer communication fosters the customer's belief in the vendor's services. This is driven by shared beliefs, the nature of the vendor's social media communication with the customer, and the vendor's SM communication enabling customer-to-customer practices [89].

The connection indicator, on the other hand, entails the level of social convergence where the smart campus facilitates interaction networks for knowledge acquisition on campuses through a Wi-Fi mobile app for constructing friendship networks using the smart mobile phone as an information sensing device [90]. In addition, the 'i-CAMPUS' mobile app integrates information, communication, and the internet through beacon technology [91]. Finally, the international landscape of universities requires holistic success through academic, social, and deeper life interactions for students [92].

The involvement indicator measures the level of social participation in a community, where universities have a 'social license' to meet international principles and human rights standards for promoting a versatile community [93]. Moreover, a 'sense of place-belonging' needs to be created in universities through shared values for intra-group cohesion in which a culture of holistic experience is cultivated to accommodate students' narratives [94]. Finally, higher levels of campus life engagement must be promoted to help students transition from secondary school to university [95].

3.3. Smart Environment

The categories of the smart environment included environmentally friendly services, renewable energy, sustainable development, and zero waste.

The *environmentally friendly services* category is measured by sustainable lifestyles, responsible suppliers, and eco-friendly initiatives in which a sustainable lifestyle entails the level of harmony between community life and the natural environment. A shift is required to serve civil society rather than the economy through prudent ecological modernization in the implementation of university sustainability planning [96]. In addition, a conducive environment must be created in universities for young adults to practice a more low-impact consumer lifestyle [97]. Finally, three relevant factors of campus infrastructure, the campus natural environment, and sustainable campus buildings are considered so that sustainable campus plans cultivate a sense of environmental care in students, integrated with education programmes to achieve sustainable architecture [98].

The responsible suppliers indicator, on the other hand, measures the extent of engaging environmentally responsible suppliers of goods and services, where supply chain processes are now scrutinized and where a hybrid fuzzy multi-criteria decision-making system is developed to address supplier selection problems [99]. In addition, green supply chain management is crucial for organizational performance [100]. Finally, innovation for environmental sustainability (IES) is becoming a flagship concept in market competition. IES is included in the selection criteria for supplier evaluation which merges three decision-making methods including stratified multi-criteria, best vs. worst, and order of preference methods [101].

Eco-friendly initiatives measure the level of development of and practice for environmental conservation, where there are three dimensions of sustainable campus development practices comprising attitude, academic tools, and infrastructure, which are implemented through approaches, plans, and actions [102]. In addition, focus must be placed on developing attitudes and behaviours for environmental sustainability through learning programmes on sustainability initiatives [103,104]. Finally, the purchase of ecofriendly products needs to be promoted through the green buying behaviour of consumers since green marketing is now emerging in product restructuring [105].

The *renewable energy* category is measured by energy transformation culture, energy efficiency systems, and energy best practices, where energy transformation culture entails the level of change towards energy conservation. It is cultivated through a holistic and transdisciplinary learning approach, where energy policies are subjected to public debate and consultation [106]. In addition, the energy transition is necessary to foster economic, environmental, and social change through an institution-wide effort and a holistic approach to solving complex processes [107]. Finally, graduate courses on public policy should be implemented to produce leaders of the local energy transition who will be relevant and engaging. Collaboration with the local community is essential to producing the next generation of leaders on climate change and the energy transition [108].

The energy efficiency systems indicator, on the other hand, measures the level of implementation of systems to improve efficiency in energy production, where there is more focus on central systems for decarbonization and less on the local district level, including campuses. This can be rectified through national frameworks that can enable transition to smart energy campuses [109]. In addition, energy saving exterior lights have been developed to promote the decarbonization of universities [110]. Finally, campus microgrids are vital load systems integrating distributed generators, power storage systems, and electric vehicles. Smart management systems, such as blockchain, artificial intelligence, or machine learning, should be used [111].

Energy best practices entails the level of promoting positive endeavours in renewable energy use, generation, and storage, where a framework for creating positive energy districts fosters added value in engaging all stakeholders through a holistic and collaborative approach to the successful management of smart cities [112]. In addition, smart campus microgrids provide renewable energy sources which reduce loading on the main grid for a sustainable energy supply and relieving environmental burden [113]. Finally, the role of public administration (PA) is a key factor in the formation of renewable energy communities (RECs) for the implementation of renewable energy projects. A model of top-down/PA-driven RECs is proposed for facilitating a municipality-led REC for modest power generation which promotes local community participation in forming a renewable energy community of citizens and local stakeholders [114].

The *sustainable development* category is measured by sustainability policy, social equity, and partnerships for sustainability, where sustainability policy entails the extent of conservation directives [115]. The green university concept is tied to performance ranking for HEI performance, where university management must develop and implement sustainability policies [116]. In addition, a gap is found between researching and implementing sustainability, resulting from tensions that exist between sustainable governance and neoliberal green capitalism, which are impeding radical change on climate change. Universities should, therefore, shift to degrowth rather than the current capitalist motives for climate change strategies [117]. Finally, academic programmes are failing to embed sustainability and global university rankings do not list sustainability among their criteria; hence, an urgent turnaround is required to foster sustainability [118].

The social equity indicator, on the other hand, measures the level of practice of fair representation within the community, where the equity–sustainability nexus promotes equality and justice among stakeholders participating in sustainability planning and is gaining attention [119]. In addition, a sustainable community is ecofriendly in its economic endeavours, adopting a holistic approach to addressing equity, economy, and environment—the 3Es of sustainability [120]. Finally, a coherent framework is needed to address the social equity dimensions of recognition, procedures, and distribution to achieve social equity goals. Practitioners must be open-minded towards social equity to adapt to new and evolving assessment and certification systems [121].

The partnerships for sustainability indicator measures the extent of involving stakeholders in conservation, where students' informal agencies can become change agents that advance sustainability transitions through campus sustainability courses and project-based programmes involving students who promote community-based stakeholder participation [122]. In addition, city–university partnerships (CUPs) for urban sustainability create a co-knowledge capacity for handling complex challenges in urban transformation [123]. Finally, universities lead the transition to conservation through a commitment by management and students toward sustainability involving six factors for implementing conservation on campuses, comprising the campus' way of life, governance, conservation curriculum, and pro-conservation approaches [124].

The *zero waste* category is measured by waste reduction programmes, recycling programmes, and incentive programmes, where waste reduction programmes entails the level of initiatives for mitigating excess and debris. The 'MySusCof' app was developed to reduce the food waste of consumers by inducing behavioural changes [125]. On the other hand, a five-step hierarchy for zero waste has been implemented, comprising decrease, recycle, improve, and disposal, resulting in cost reductions, savings, and conservation [126]. Finally, waste mitigation at universities is cultivated through a vision for conservation, the curriculum, waste perception, conservation regulations, ecological conscience, enforcement options, campus collaboration, people-centred obligations, outstanding leadership, and community media [127].

The recycling programme indicator, on the other hand, measures the level of initiatives for reusing used materials and goods, where a shift from the traditional view of waste disposal to resource management is required to maximize stakeholder participation in recycling [128]. In addition, information dissemination must reach all actors to achieve the desired behavioural change toward cultivating a sense of a recycling-focused community [129]. Finally, recycling programmes should consider the economical, community-based, and ecological factors for managing conservation of the environment through collaboration between all stakeholders up to the national level [130].

Incentive programmes measure the extent of motivational initiatives for promoting zero waste, where a promotion of stakeholder participation due to trust will sustain an incentive program [131]. On the other hand, universities are living laboratories that have the potential to address the social aspect of recycling waste by motivating campus stakeholders [132]. Finally, electric vehicle use and a cross-reward system combining fixed rewards and constant updating of the charging rates can be introduced through flexibility in electrical vehicle charging, reducing the bills for charging stations and the charging fees paid by electrical vehicle owners [133].

3.4. Smart Governance

The categories of smart governance included cybersecurity, data governance, decision-making, and service management.

The *cybersecurity* category is measured by an oversight committee, policies and regulations, monitoring programmes, and data governance, where the oversight committee entails the level of effectiveness of a select group of people to be responsible for cybersecurity. IT governance ensures value to businesses and mitigates IT risks, for which an audit committee is set up by the board to report on finance and monitor enterprise risk. Information management is then headed by a senior information manager who is accountable to the board and the audit committee [134]. In addition, enterprise risk management (ERM) and financial performance are concerns of board of directors (BOD); however, cybersecurity is not sufficiently integrated with ERM. The cyber-governance practices of BODs therefore needed urgent attention [135]. Finally, the dependable committee consensus protocol [136] is developed to create a cross-permissive feature enabling permissionless blockchains to deal with malicious nodes.

The policy and regulations indicator, on the other hand, measures the level of implementation of the overall guidelines and rules for cybersecurity implementation, where private enterprises dominate the field of cybersecurity while the government role has been limited. It is time for the government to increase its involvement to safeguard national interests [137]. In addition, information legislation, therefore, must enshrine national values, national interests, and national goals. A national cyber security coordination centre is a solution that ensures an effective and timely response to cybercrime [138]. Finally, collaboration between the state, industry, and the academic sector is required to deal with the quantum threat through assemblages comprising six main linkages including infrastructure, standardization, education, partnerships, economy, and defence [139].

The monitoring programmes indicator measures the extent of checking and following up on cybersecurity implementation, where a simple, dynamic, and adaptive governance framework is required. It permits the collaboration of all the necessary aspects and compliance through a risk-based approach to deal with the changing landscape of technology and threats [140]. Moreover, a robust architecture is needed to deal with heterogenous digital security issues with new features including complete digital processes, dynamic adaptation of operations, and real-time adjustments of inspection and monitoring processes. [141]. Finally, the dynamic software update called 'SoREn' enables updating with minimal disruption using pre-selected and pre-configured mechanisms for program modification. A reconfiguration is then triggered when new policies are added [142].

The *data governance* category is measured by data governance policies and processes, and management structures, where data governance policies entails the level of implementation of overall guidelines for data consumption. AI regulations must raise trust levels and encourage users to upload their private information online. Policymakers and legislators should collaborate to develop a robust artificial intelligence regulatory framework and control systems for the preventing abuse of personal data [143]. In addition, global-scale agreements must be adopted with common goals that are flexible and accommodate global contexts. A global network of robust national institutions to drive global data governance is evolving [144]. Finally, data governance principles should be universalized to enable compliance across regions and nations. The data lifecycle approach has been adopted to deal with data evolution in a global data governance ecosystem [145].

The data governance processes indicator, on the other hand, measures the level of means to implement data governance, where business data is driven by advanced digital technology within an evolving data management ecosystem. It connects all components and organizes heterogenous data into uniform structures to simplify the data environment and improves adaptability to varying domains with less training [146]. In addition, existing data stewardship frameworks do not involve users in data security to promote participatory innovation in data governance. A collaborative implementation is created by involving all stakeholders [147]. Finally, an operational and automation framework with data lake architecture comprising a landing, formatted zones, and metadata artifacts is required. This robust system automatically processes data from heterogenous sources to become readily available for business users from one zone to another [148].

The management structures indicator measures the extent of power and authority in terms controlling data governance, where protection of data and intellectual property must be controlled for innovations requiring mandatory sharing in data-driven markets through a governance structure that addresses both the centralized economic and decentralized legal frameworks. The structure clearly defines the control of three central tasks: investigation, decision making, and enforcement [149]. In addition, smart cities have emerged to manage the unprecedented rate of urbanization where big and complex data is required to serve the lives of residents. A framework for managing the data is used to facilitate smart decision-making, expediting operations, sustaining rich information, and meeting standards [150]. Finally, datafication and platformization are shifting to private networks from public systems, creating a gap between data providers and traders. Content moderation can only be achieved through a socially focused approach. Regulators and policymakers must, therefore, focus on the soft issues and dangers of data processing [151].

The *decision-making* category is measured by consultation and collaboration, communication practices, and monitoring and evaluation, where consultation and collaboration entail the level of an inquisitive and interactive community. Higher education institutions have become competitive and prestigious by producing high levels of quality, diversity, and efficiency in serving the needs of students and society. They are to become resilience-driven by performance-based funding emphasizing quality criteria more than the quantitative [152]. In addition, university governance has a heterogenous structure, requiring financial, organizational, and academic autonomy. Its legal frameworks and policies needed to change over time to meet increasing responsibilities [153]. Finally, policy coordination at a central level depends on collaboration between the state and universities. Institutional change is inevitable for regional convergence, internationalization, and globalization [154].

The communication practices indicator, on the other hand, measures the level of disseminating information within the community, where the shift by the public sector to adopt private sector management approaches has raised the reputation of HEIs in terms of serving the needs of students and society as they begin to address qualitative criteria rather than quantitative [152]. In addition, university governance manages its heterogenous makeup through the distribution of responsibilities and collaboration to handle internal dynamics [153]. Finally, student numbers have been on the rise, requiring information management systems to manage and utilize dynamic and complex information on university students [155].

The monitoring and evaluation indicator measures the extent of consistent checking and evaluation of operations. University autonomy is sustained and driven by dynamic regulatory and policy frameworks which change over time [153]. In addition, transdisciplinary collaborations (TDCs) are emerging and governance relating to evaluation and monitoring is becoming predominant. Participatory impact pathways analysis (PIPA) focuses on stakeholder involvement from the start. A joint governance of TDCs, including evaluation, is crucial for the process to achieve societal goals [156]. Finally, higher education institutions must engage with communities to evaluate their community engagement performance to impact societal transformation [157].

The *service management* category is measured by cataloguing and design, service delivery efficiency, and resource allocation, where cataloguing and design entails the extent of the consistent updating of product and service stocks to meet stakeholder needs. Post-graduate students require universities to be customer-focused and deliver high-value services with courtesy and professionalism [158]. In addition, a most appropriate curriculum plan should be created, aligned with goals, and maintained to remain current and relevant. An integrated decision support framework addresses two key features of curriculum planning including curriculum selection and credit allocation [159]. Finally, universities require inventory management in their business operations, where the use of software automates inventories to streamline operations and ensure robust record management [160].

The service delivery efficiency indicator, on the other hand, measures the level of efficiency in serving the needs of the community, where university social responsibility promotes universities to become customer-oriented and raise their ranking [161]. In addition, a smart services app provides a chatbot service, an interactive campus map, online purchase apps, and a university notices communication session [162]. Finally, information technology innovations enhance service delivery, transforming universities to serve students' needs. This is facilitated by the unified theory of acceptance and use of technology and assists in developing management plans for graduating with high-standard degrees [163].

The resource allocation indicator measures the extent of distributing goods and services to the community [164]. Policymakers at universities should create a sustainable balance between autonomy and accountability for a performance-based resource allocation model that reflects the social, political, and cultural environment [165]. In addition, universities comprise heterogenous operating units which need centralized and strategic resource management, where data envelopment analysis (DEA) is applied. The smart DEA technology 'lexGP' sets the optimal threshold of the central decision-maker (CDM) by producing more effective targets closer to theCDM goals and specific targets of the university for optimizing resource allocation [166]. Finally, the high demand and low supply of higher education makes it a scarce social resource. The evaluation index system with a multi-objective function model processes and optimizes the utilization and allocation of educational resources. This will enhance innovation and entrepreneurship education in institutions to cultivate talent and raise education standards [167].

The aspects of indicators identified from the 144 articles present recent findings through the development of the 48 indicators that are useful to adopt for smart campus assessment. They demonstrate the unique characteristics of the indicators for assessing smart campuses, as listed in Table 1.

4. Findings and Discussion

The following section summarizes the findings for each indicator identified within the framework, with a focus on key trends in the development of smart campus models.

4.1. Smart Economy Indicators

Indicators of the smart economy dimension category of business services have attributes of variety of food, retail and other business services, various sports, and leisure activities, and range of art galleries and theatres for performance shows. In addition, the business efficiency category comprises the improvement of workplace efficiency for value creation, the robust automation of systems, and the output of workforce activity in businesses. Moreover, the utility cost savings category has the attributes of the robustness of energy saving mechanisms, the robustness of smart monitoring and control mechanisms, and the adequate maintenance and service upgrade of campus facilities to reduce costs. Finally, attributes of the innovation ecosystem category comprise having an R&D promotion culture of incentives and adequate support, provision of incubators and accelerators for innovation, and the extent of industry engagement and participation in innovation on campus. A total of 36 aspects of the 12 indicators of the smart economy dimension were found to be significant in the pursuit of smart campus assessment at this preliminary stage.

4.2. Smart Society Indicators

Indicators of the smart society dimension category of versatile learning and research comprised having a curriculum that meets changes in the market and employment sector, having robust teaching and learning resources, and having robust living labs for knowledge sharing. In addition, attributes of the university social responsibility category comprised resilient leadership and successful implementation of the social responsibility agenda, success in integrating social responsibility into teaching, and success in integrating social responsibility into research and projects. Moreover, attributes of the quality of campus life category include the presence of a culture of diversity and inclusion on campus; having a comfortable, safe and secure campus community; and the promotion of vibrant social interactions on campus. Finally, the campus community engagement category has attributes comprising means of enabling communication on campus, the campus community becoming connected through some means, and members of the campus community becoming involved in accordance with their social identities. A total of 36 aspects of the 12 indicators of the smart society dimension were found to be significant in the pursuit of smart campus assessment at this preliminary stage.

4.3. Smart Environment Indicators

Indicators of the smart environment dimension category of environmentally friendly services include campus residents having a lifestyle that harmonizes with the natural environment, the suppliers of goods and services to the university conforming to the environmental sustainability agenda, and eco-friendly development practices and endeavours.

In addition, the renewable energy category has attributes including the shift towards positive changes in campus energy, the implementation of systems to improve energy efficiency, and the promotion of good practices in renewable energy use, generation, and storage. Moreover, the attributes the sustainable development category comprise the successful implementation of environmental sustainability policies, the campus citizens' sense of responsibility in terms of social equity, and identifying and engaging parties on the common interest in sustainability. Finally, the zero waste category's attributes include promotion of initiatives to reduce waste in the overall operations of the university, reusing used materials and goods to sustain the operations of the university, and the implementation of incentive programs to promote zero waste. A total of 36 aspects of the 12 indicators of the smart environment dimension were found to be significant in the pursuit of smart campus assessment at this preliminary stage.

4.4. Smart Governance Indicators

Indicators of the smart governance dimension category of cybersecurity comprises the establishment of a select group of people to be responsible for cybersecurity, the establishment of overall guidelines and rules for cybersecurity implementation, and the establishment of means for checking and following up on the implementation of cybersecurity. In addition, the data governance category has attributes including the establishment of overall guidelines for the use of data in governance, the means to deal with the governance of data, and the levels of power and authority to control the governance of data. Moreover, the attributes of the decision-making category comprise a wide inquisitive and interactive campus community, the presence of robust communication avenues throughout the campus community, and the consistent checking and evaluation of campus operations. Finally, the service management category has attributes including the constant updating of product and service stocks and meeting campus stakeholder needs, the means of providing services to campus stakeholders when needed, and resource distribution reaching the whole campus community as required. A total of 36 aspects of the 12 indicators of the smart governance dimension were found to be significant in the pursuit of smart campus assessment at this preliminary stage.

4.5. Other Indicators

Table 2 shows the smart campus models and their number of indicators compared with the research's model. The 'iCampus' has 6 dimensions and 17 indicators, 'IT Adoption' with 6 dimensions and 19 indicators, 'Technically driven' with 4 dimensions and 20 indicators, 'SC2 Framework' with 5 dimensions and 40 dimensions. The 'SC2 Framework' attempted to provide a comprehensive number of indicators. Whereas, the other three models provided the least number from 17 to 20 which may be broad to some extent in their contexts. The research, however, is the latest among the smart campus scholastic pursuits providing the highest number of indicators of 48 advancing the development of smart campus assessment.

Table 2. Smart campus models and indicators.

Smart Campus Models	Number Of Dimensions/Pillars	Number of Indicators	Studies
iCampus	6	17	[168]
IT adoption	6	19	[169]
Technically driven	4	20	[10]
SC2 Framework	5	40	[5]
Smart campus assessment framework	4	48	Study at hand

This study was designed to offer an initial assessment framework. The full attributes of and measures for each indicator require further research with a focus on testing the indicators through expert and stakeholder review. Subsequent research of this nature can help to resolve the limitations of the narrative literature review method, especially subjectivity related to researcher bias in the selection and analysis of the relevant literature.

5. Conclusions

While interest in smart campus development has surged recently, the field is still in its early stages, largely focused on conceptual innovations and framework development. This research builds upon existing conceptual work by introducing the first comprehensive assessment framework to evaluate the smartness of university campuses. Using a narrative literature review approach, the study developed a novel assessment framework called the Smart Campus Assessment Framework, comprising 48 indicators. This framework serves as an invaluable starting point for advancing assessment efforts in smart campus research.

The study offers highly useful insights into the development of smart campuses and their impact on various aspects of campus life. It identifies key indicators that encompass the broader functions of a university, which are enhanced by AI to create a smart and agile campus. This assessment framework serves as a useful tool for smart campus researchers, administrators, and decision-makers, providing them with key indicators for performance assessment and monitoring. However, further research is needed to fully develop the attributes and measures for each indicator, and to test these with input from relevant experts and stakeholders. Such research has the potential to reveal additional insights related to each indicator and to further strengthen their reliability in providing practical evaluations of smart campuses.

Our prospective research will focus on the practical application of the developed smart campus assessment framework in real-world case studies. We aim to implement the framework in various university settings to evaluate the effectiveness of smart campus initiatives and their impact on campus life. By conducting these case studies, we seek to provide valuable insights into the practical implementation of smart campus technologies and strategies, as well as to refine and validate the assessment framework based on real-world data and experiences.

Author Contributions: Conceptualization, T.Y.; methodology, K.P.; formal analysis, K.P.; writing—original draft preparation, K.P.; writing—review and editing, T.Y., T.W. and M.L.; supervision, T.Y., T.W. and M.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Available by request from the corresponding author.

Acknowledgments: The authors thank the anonymous referees for their constructive comments regarding earlier versions of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Polin, K.; Yigitcanlar, T.; Limb, M.; Washington, T. The making of smart campus: A review and conceptual framework. *Buildings* **2023**, *13*, 891. [CrossRef]
2. AbuAlnaaj, K.; Ahmed, V.; Saboor, S. A strategic framework for smart campus. In Proceedings of the International Conference on Industrial Engineering and Operations Management, Dubai, United Arab Emirates, 10–12 March 2020; Volume 22, pp. 790–798.
3. Valks, B.; Arkesteijn, M.; Koutamanis, A.; den Heijer, A. Towards a smart campus: Supporting campus decisions with Internet of Things applications. *Build. Res. Inf.* **2021**, *49*, 1–20. [CrossRef]
4. Nagowah, S.D.; Sta, H.B.; Gobin-Rahimbux, B.A. Towards achieving semantic interoperability in an IoT-enabled smart campus. In Proceedings of the 2019 IEEE International Smart Cities Conference (ISC2), Casablanca, Morocco, 14–17 October 2019; pp. 593–598.
5. Pagliaro, F.; Mattoni, B.; Gugliermenti, F.; Bisegna, F.; Azzaro, B.; Tomei, F.; Catucci, S. A roadmap toward the development of Sapienza Smart Campus. In Proceedings of the 2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), Florence, Italy, 7–10 June 2016.

6. Nan, F.; Suo, Y.; Jia, X.; Wu, Y.; Shan, S. Real-Time Monitoring of Smart Campus and Construction of Weibo Public Opinion Platform. *IEEE Access* **2018**, *6*, 76502–76515. [CrossRef]
7. Ahmad, B.I.; Umar, M.A.; Tanko, M.Y.; Tenuche, S.S.; Sambo, A.A.; Abdulsalami, A.O.; Abdulrahim, A. An IoT Based Smart Campus Architecture for Institutions in Development Countries. *I-Manag. J. Embed. Syst.* **2018**, *7*, 18–25.
8. Fernández-Caramés, T.; Fraga-Lamas, P. Towards Next Generation Teaching, Learning, and Context-Aware Applications for Higher Education: A Review on Blockchain, IoT, Fog and Edge Computing Enabled Smart Campuses and Universities. *Appl. Sci.* **2019**, *9*, 4479. [CrossRef]
9. Villegas-Ch, W.; Palacios-Pacheco, X.; Luján-Mora, S. Application of a Smart City Model to a Traditional University Campus with a Big Data Architecture: A Sustainable Smart Campus. *Sustainability* **2019**, *11*, 2857. [CrossRef]
10. Dong, Z.; Zhang, Y.; Yip, C.; Swift, S.; Beswick, K. Smart campus: Definition, framework, technologies, and services. *IET Smart Cities* **2020**, *2*, 43–54. [CrossRef]
11. Min-Allah, N.; Alrashed, S. Smart campus—A sketch. *Sustain. Cities Soc.* **2020**, *59*, 102231. [CrossRef]
12. Ikirisi, G.; Mazri, T. A Study of Smart Campus Environment and its Security Attacks. In Proceedings of the 5th International Conference on Smart City Applications, Virtual Safranbolu, Turkey, 7–8 October 2020; pp. 255–261.
13. Omotayo, T.; Awuzie, B.; Ajayi, S.; Moghayedi, A.; Oyeyipo, O. A Systems Thinking Model for Transitioning Smart Campuses to Cities Front. *Built. Environ.* **2020**, *7*, 755424.
14. Hidayat, D.S.; Sensuse, D.I. Knowledge Management Model for Smart Campus in Indonesia. *Data* **2022**, *7*, 7. [CrossRef]
15. Almashhour, R.; Samara, F. Evaluating Livability Perceptions: Indicators to Evaluate Livability of a University Campus. *Sustainability* **2022**, *14*, 11872. [CrossRef]
16. Alrashed, S. Key performance indicators for smart campus and microgrid. *Sustain. Cities Soc.* **2020**, *60*, 102264. [CrossRef]
17. Yuan, L.; Du, J. Research on intelligent financial information framework and smarter university campus. *Int. J. Knowl.-Based Dev.* **2022**, *12*, 409. [CrossRef]
18. Rico-Bautista, D.; Medina-Cárdenas, Y.; Maestre-Góngora, G.; Barrientos-Avendaño, E.; Coronel-Rojas, L.; Cuesta-Quintero, F.; García-León, R. Smart university: Strategic map since the adoption of technology. *RISTI-Rev. Iber. Sist. Tecnol. Inf.* **2020**, *E28*, 711–724.
19. Baumeister, R.; Leary, M. Writing narrative literature reviews. *Rev. Gen. Psychol.* **1997**, *1*, 311–320. [CrossRef]
20. Khandpur, N.; Zatz, L.Y.; Bleich, S.N.; Taillie, L.S.; Orr, J.A.; Rimm, E.B.; Moran, A.J. Supermarkets in Cyberspace: A Conceptual Framework to Capture the Influence of Online Food Retail Environments on Consumer Behavior. *Int. J. Environ. Res. Public Health* **2020**, *17*, 8639. [CrossRef] [PubMed]
21. Leach, B.; Parkinson, S.; Gkousis, E.; Abel, G.; Atherton, H.; Campbell, J.; Clark, C.; Cockcrof, E.; Marriott, C.; Pitchforth, E.; et al. Digital Facilitation to Support Patient Access to Web-Based Primary Care Services: Scoping Literature Review. *J. Med. Internet Res.* **2022**, *24*, e33911. [CrossRef]
22. Yigitcanlar, T.; Dodson, J.; Gleeson, B.; Sipe, N. Travel self-containment in master planned estates: Analysis of recent Australian trends. *Urban Policy Res.* **2007**, *25*, 129–149. [CrossRef]
23. Poh, L.Z.; Connie, T.; Ong, T.S.; Goh, M.K.O. Deep Reinforcement Learning-Based Dynamic Pricing for Parking Solutions. *Algorithms* **2023**, *16*, 32. [CrossRef]
24. Lee, S.; Spencer, T.; Hums, M.; Alagaraja, M. Qualitative Examination of International Graduate Students' Experiences with Campus Recreation Services. *Recreat. Sports J.* **2020**, *44*, 51–59. [CrossRef]
25. Noorullah, R.; Singh, N.; Thumma, N.; Varma, C. University Fitness Center Data Analysis Discovers Interesting Patterns and Allows Prediction. *Turk. J. Comput. Math. Educ.* **2021**, *12*, 2242–2248.
26. Wilson, K.; Millar, P. Intramural Sport Participation: An Examination of Participant Benefits, Service Quality, Program Satisfaction, and Student Retention. *Recreat. Sports J.* **2021**, *45*, 149–160. [CrossRef]
27. Harding, C.; Liggett, S.; Lochrie, L. Digital Engagement in a Contemporary Art Gallery: Transforming Audiences. *Arts* **2019**, *8*, 90. [CrossRef]
28. Park, A. Use of Internet-of-Things for Sustainable Art Businesses: Action Research on Smart Omni-Channel Service. *Sustainability* **2023**, *15*, 12035. [CrossRef]
29. Esparza, L.; Fonseca, C.; Wegmann, M. Framing a Gallery Program: Integrating the ACRL Framework into a University Library Art Gallery. *J. Art Libr. Soc. N. Am.* **2021**, *40*, 2. [CrossRef]
30. Yigitcanlar, T.; Dur, F. Making space and place for knowledge communities: Lessons for Australian practice. *Australas. J. Reg. Stud.* **2013**, *19*, 36–63.
31. Salvadorinho, J.; Teixeira, L. Stories Told by Publications about the Relationship between Industry 4.0 and Lean: Systematic Literature Review and Future Research. *Agenda Publ.* **2021**, *9*, 29. [CrossRef]
32. Kupriyanova, V.; Estermann, T.; Sabic, N. Efficiency of Universities: Drivers, Enablers and Limitations. In *European Higher Education Area: The Impact of Past and Future Policies*; Curaj, A., Deca, L., Pricopie, R., Eds.; Springer: Cham, Switzerland, 2021; pp. 603–618.
33. Attanasio, G.; Preghenella, N.; De Toni, A.; Battistella, C. Stakeholder engagement in business models for sustainability: The stakeholder value flow model for sustainable development. *Bus. Strat. Environ.* **2022**, *31*, 860–874. [CrossRef]
34. Bortolini, M.; Faccio, M.; Galizia, F.; Gamberi, M.; Pilati, F. Adaptive Automation Assembly Systems in the Industry 4.0 Era: A Reference Framework and Full–Scale Prototype. *Appl. Sci.* **2021**, *11*, 1256. [CrossRef]

35. Holikova, K.; Matsyura, S.; Radko, V.; Rudenko, N.; Zhukova, D. Criteria Evaluation of the Results of the Implementation of the Business Process Automation System. *SHS Web Conf.* **2021**, *100*, 01019. [CrossRef]
36. Braganzaa, A.; Chena, W.; Canhotoa, A.; Sapb, S. Gigification, job engagement and satisfaction: The moderating role of AI enabled system automation in operations management. *Prod. Plan. Control* **2022**, *33*, 1534–1547. [CrossRef]
37. Ark, B.; Vries, K.; Erumban, A. How to not miss a Productivity Revival once again. *Natl. Inst. Econ. Rev.* **2021**, *255*, 9–24. [CrossRef]
38. Cornwell, C.; Schmutte, I.M.; Scur, D. Building a Productive Workforce: The Role of Structured Management Practices. *Manag. Sci.* **2021**, *67*, 7308–7321. [CrossRef]
39. Ganshina, E. Static and dynamic approaches in industrial metrology in the framework of measuring enterprise productivity. *J. Phys. Conf. Ser.* **2021**, *1889*, 042053. [CrossRef]
40. Liu, L.; Xiong, A.; Yu, P.; Feng, L.; Li, W.; Qiu, X.; Wang, M. Energy-saving Management Mechanism based on Hybrid Energy Supplies in Multi-Operator shared LTE. Networks. In Proceedings of the NOMS 2018-2018 IEEE/IFIP Network Operations and Management Symposium, Taipei, Taiwan, 23–27 April 2018.
41. Wei, Q.; Guoa, A.; Weib, L.; Nia, W. Analysis of the mechanism of renewable energy on energy-saving and environmental protection industry: Empirical evidence from four countries. In Proceedings of the 5th International Conference on Renewable Energy and Environment Engineering (REEE 2022), Brest, France, 24–26 August 2022.
42. Liu, R.; Wang, L. Information Resource Sharing Based on University Dance Big Data Management and Utilization System Design. *Math. Probl. Eng.* **2022**, *2022*, 4325984. [CrossRef]
43. Miki, M.; Nagano, M.; Yoshimi, M.; Yonemoto, H.; Yoshida, K. Intelligent Lighting System with an Additional Energy-Saving Mechanism. In Proceedings of the 2012 IEEE International Conference on Systems, Man, and Cybernetics, COEX, Seoul, Republic of Korea, 14–17 October 2012; pp. 3173–3178.
44. Bin, L.; Shahzad, M.; Javed, H.; Muqeet, H.A.; Akhter, M.N.; Liaqat, R.; Hussain, M.M. Scheduling and Sizing of Campus Microgrid Considering Demand Response and Economic Analysis. *Sensors* **2022**, *22*, 6150. [CrossRef] [PubMed]
45. Nasir, T.; Raza, S.; Abrar, M.; Muqeet, H.A.; Jamil, H.; Qayyum, F.; Cheikhrouhou, O.; Alassery, F.; Hamam, H. Optimal Scheduling of Campus Microgrid Considering the Electric Vehicle Integration in Smart Grid. *Sensors* **2021**, *21*, 7133. [CrossRef]
46. Ullah, H.; Khan, M.; Hussain, I.; Ullah, I.; Uthansakul, P.; Khan, N. An Optimal Energy Management System for University Campus Using the Hybrid Firefly Lion Algorithm (FLA). *Energies* **2021**, *14*, 6028. [CrossRef]
47. Broek, M.; Teunter, R.; Jonge, B.; Veldman, J. Joint condition-based maintenance and condition-based production optimization. *Reliab. Eng. Syst. Saf.* **2021**, *214*, 107743. [CrossRef]
48. Cavalcante, C.; Lopes, R.; Scarf, P. Inspection and replacement policy with a fixed periodic schedule. *Reliab. Eng. Syst. Saf.* **2021**, *208*, 107402. [CrossRef]
49. Dizdaroglu, D.; Yigitcanlar, T.; Dawes, L. A micro-level indexing model for assessing urban ecosystem sustainability. *Smart Sustain. Built Environ.* **2012**, *1*, 291–315. [CrossRef]
50. Gaha, M.; Chabane, B.; Komljenovic, D.; Côté, A.; Hébert, C.; Blancke, O.; Delavari, A.; Abdul-Nour, G. Global Methodology for Electrical Utilities Maintenance Assessment Based on Risk-Informed Decision Making. *Sustainability* **2021**, *13*, 9091. [CrossRef]
51. Granstrand, O.; Holgersson, M. Innovation ecosystems: A conceptual review and a new definition. *Technovation* **2020**, *90–91*, 102098. [CrossRef]
52. Eklund, J. The knowledge-incentive tradeoff: Understanding the relationship between research and development decentralization and innovation. *Strat. Manag. J.* **2022**, *43*, 2478–2509. [CrossRef]
53. Yigitcanlar, T.; Guaralda, M.; Taboada, M.; Pancholi, S. Place making for knowledge generation and innovation: Planning and branding Brisbane's knowledge community precincts. *J. Urban Technol.* **2016**, *23*, 115–146. [CrossRef]
54. Lewis, J.; Mikolajczak, G. Policy on innovation in Australia: Divergence in definitions, problems, and solutions. *Aust. J. Public Adm.* **2023**, *82*, 26–45. [CrossRef]
55. Huerta, H.; Diaz, C.; Avelar, M.; Rosas-Elguera, J. Research, Development and Innovation: An Extracurricular Club Case Study. *IEEE Access* **2022**, *10*, 66625–66633. [CrossRef]
56. Sarimin, M.; Yigitcanlar, T. Towards a comprehensive and integrated knowledge-based urban development model: Status quo and directions. *Int. J. Knowl.-Based Dev.* **2012**, *3*, 175–192. [CrossRef]
57. Bahmani, S.; Farmanesh, P.; Khademolomoom, A. Effects of Green Human Resource Management on Innovation Performance through Green Innovation: Evidence from Northern Cyprus on Small Island Universities. *Sustainability* **2023**, *15*, 4158. [CrossRef]
58. Ali, M.; Kim, Y. Can a University Campus Work as a Public Space in the Metropolis of a Developing Country? The Case of Ain-Shams University, Cairo, Egypt. *Sustainability* **2020**, *12*, 7229. [CrossRef]
59. Bagno, R.; Freitas, J. Setting the three-stage R&D shared portfolio methodology: An innovative approach to industry–university collaboration. *Rev. Gest.* **2023**, *30*, 282–298.
60. Kleiner-Schaefer, T.; Schaefer, K. Barriers to university–industry collaboration in an emerging market: Firm-level evidence from Turkey. *J. Technol. Transf.* **2022**, *47*, 872–905. [CrossRef]
61. Zhang, Y.; Dong, Z.; Yip, C.; Swift, S. Smart campus: A user case study in Hong Kong. *IET Smart Cities* **2020**, *2*, 146–154. [CrossRef]
62. Mgaiwa, S. Fostering Graduate Employability: Rethinking Tanzania's University Practices. *SAGE Open* **2021**, *11*, 21582440211006709. [CrossRef]

63. Pillai, K.; Upadhyaya, P.; Balachandran, A.; Nidadavolu, J. Versatile Learning Ecosystem: A Conceptual Framework. *High. Educ. Future* **2019**, *6*, 85–100. [CrossRef]
64. Lorente-Echeverría, S.; Murillo-Pardo, B.; Canales-Lacruz, I. A Systematic Review of Curriculum Sustainability at University: A Key Challenge for Improving the Professional Development of Teachers of the Future. *Educ. Sci.* **2022**, *12*, 753. [CrossRef]
65. Jana, P.; Ljupco, K. Universities' and Academics' Resources Shaping Satisfaction and Engagement: An Empirical Investigation of the Higher Education System. *Educ. Sci.* **2023**, *13*, 390.
66. Sanchez-Lite, A.; Zulueta, P.; Sampaio, A.Z.; Gonzalez-Gaya, C. BIM for the Realization of Sustainable Digital Models in a University-Business Collaborative Learning Environment: Assessment of Use and Students' Perception. *Buildings* **2022**, *12*, 971. [CrossRef]
67. Wagino, W.; Maksum, A.; Purwanto, W.; Krismadinata, K.; Suhendar, S.; Koto, R. Exploring the Full Potential of Collaborative Learning and E-Learning Environments in Universities: A Systematic Review. *TEM J.* **2023**, *12*, 1772–1785. [CrossRef]
68. Martínez-Bello, N.; Cruz-Prieto, M.; Güemes-Castorena, D.; Mendoza-Domínguez, A. A Methodology for Designing Smart Urban Living Labs from the University for the Cities of the Future. *Sensors* **2021**, *21*, 6712. [CrossRef]
69. Konstantinidis, E.; Petsani, D.; Bamidis, P. Teaching university students co-creation and living lab methodologies through experiential learning activities and preparing them for RRI. *Health Inform. J.* **2021**, *27*, 1460458221991204. [CrossRef]
70. Le, N.; Nguyen, P.; Trieu, H.; Lam, L. Talent management at science parks: Firm-university partnerships as a strategic resource for competitive advantage creation in the information technology sector in Vietnam. *Cogent Bus. Manag.* **2023**, *10*, 2210889. [CrossRef]
71. Tauginiene, L.; Pučėtaitė, R. (Eds.) *Managing Social Responsibility in Universities Organisational Responses to Sustainability*; Springer Nature: Cham, Switzerland, 2021.
72. Chen, S.; Nasongkhla, J.; Donaldson, J. University Social Responsibility (USR): Identifying an Ethical Foundation within Higher Education Institutions. *Turk. Online J. Educ. Technol.* **2015**, *14*, 165–172.
73. Ali, M.; Mustapha, I.; Osman, S.; Hassan, U. University social responsibility: A review of conceptual evolution and its thematic analysis. *J. Clean. Prod.* **2021**, *286*, 124931. [CrossRef]
74. Schimperna, F.; Nappo, F.; Collaretti, F. Universities and CSR Teaching: New Challenges and Trends. *Adm. Sci.* **2022**, *12*, 55. [CrossRef]
75. Nicholson, C.; DeMoss, M. Teaching Ethics and Social Responsibility: An Evaluation of Undergraduate Business Education at the Discipline Level. *J. Educ. Bus.* **2010**, *84*, 213–218. [CrossRef]
76. Goldbach, A.; Hauser, M.; Schuppener, S.; Leonhardt, N.; van Ledden, H.; Bergelt, D. Social responsibility in the context of inclusive higher education development—Experiences and insights from the perspective of participatory teaching. *Int. J. Sustain. High. Educ.* **2022**, *23*, 799–814. [CrossRef]
77. Meseguer-Sánchez, V.; Abad-Segura, E.; Belmonte-Ureña, L.; Molina-Moreno, V. Examining the Research Evolution on the Socio-Economic and Environmental Dimensions on University Social Responsibility. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4729. [CrossRef] [PubMed]
78. Chou, W.; Liang, Y.; Lin, F. Integrating STEAM into picture book creation to the action research of practicing university social responsibility. In Proceedings of the 4th International Annual Meeting on STEM Education. *AIP Conf. Proc.* **2021**, *2685*, 030025.
79. Ferrández-Berrueco, R.; Sales, A.; Sánchez-Tarazaga, L.; Ruiz, P. A snapshot of university research through the lens of university social responsibility. *Rev. Investig. Educ.* **2023**, *41*, 455–477. [CrossRef]
80. Tonon, G. Student's Quality of Life at the University: A Qualitative Study. *Appl. Res. Qual. Life* **2021**, *16*, 1517–1535. [CrossRef]
81. Rankin, J.; Pearl, A.; de St Jorre, T.; McGrath, M.; Dyer, S.; Sheriff, S.; Armitage, R.; Ruediger, K.; Jere, A.; Zafar, S.; et al. Delving into Institutional Diversity Messaging: A Cross-Institutional Analysis of Student and Faculty Interpretations of Undergraduate Experiences of Equity, Diversity, and Inclusion in University Websites. *Teach. Learn. Inq.* **2022**, *10*, 1–15. [CrossRef]
82. Chambers, C.; King, B.; Myers, K.; Millea, M.; Klein, A. Beyond the Kumbaya: A Reflective Case Study of One University's Diversity, Equity, and Inclusion Journey. *J. Res. Adm.* **2023**, *54*, 54–82.
83. Sendall, M.; Fox, L.; Wraith, D. University Staff and Students' Attitudes towards a Completely Smoke-Free Campus: Shifting Social Norms and Organisational Culture for Health Promotion. *Int. J. Environ. Res. Public Health* **2021**, *18*, 7104. [CrossRef]
84. Stepansky, K.; Delbert, T.; Bucey, J. Active student engagement within a university's therapeutic sensory garden green space: Pilot study of utilization and student perceived quality of life. *Urban For. Urban Green.* **2022**, *67*, 127452. [CrossRef]
85. Coveney, M.; Oosterveen, M. What drives ability peer effects? *Eur. Econ. Rev.* **2021**, *136*, 103763. [CrossRef]
86. Jansz, S.; Mobach, M.; van Dijk, T. The 5-Minute Campus. *Int. J. Environ. Res. Public Health* **2023**, *20*, 1274. [CrossRef]
87. Temple, P. The University Couloir: Exploring Physical and Intellectual Connectivity. *High. Educ. Policy* **2023**, *36*, 213–229. [CrossRef]
88. Gow, G.; McGee, T.; Townsend, D.; Anderson, P.; Varnhagen, S. Communication Technology, Emergency Alerts, and Campus Safety. *IEEE Technol. Soc. Mag.* **2009**, *28*, 34–41. [CrossRef]
89. Bollenbach, K.; Powell, E.; Moore, S.; Groves, J. Building A Healthy Online Student Community through Education Environment Design. In Proceedings of the 2014 ASEE Annual Conference & Exposition, Indianapolis, IN, USA, 15–18 June 2014; pp. 1–15. [CrossRef]
90. Rose, S.; Fandel, D.; Saraeva, A.; Dibley, A. Sharing is the name of the game: Exploring the role of social media communication practices on B2B customer relationships in the life sciences industry. *Ind. Mark. Manag.* **2021**, *93*, 52–62. [CrossRef]

91. Zheng, W.; Pan, H.; Pengi, Y. Explore the Ubiquitous Learning on Campus: A Friendship-Based Knowledge Diffusion Approach. *IEEE Access* **2018**, *6*, 56238–56245. [CrossRef]
92. Deraman, N.; Buja, A.G.; Samah, K.; Jono, M.; Isa, M. I-Campus: Towards the Information Integration for Uitm Cawangan Melaka Implementation of Smart Campus. *Turk. J. Comp. Math. Educ.* **2021**, *12*, 1699–1709.
93. Erck, R.; Sriram, R. Connecting on Campus: Exploring How Different Interactions Predict Thriving for College Students of Color. *J. Coll. Stud. Dev.* **2022**, *63*, 555–571. [CrossRef]
94. Chen, C.; Vanclay, F. Transnational universities, host communities and local residents: Social impacts, university social responsibility and campus sustainability. *Int. J. Sustain. High. Educ.* **2021**, *22*, 88–107. [CrossRef]
95. Roux, A.; Groenewald, E. The elusiveness of a sense of place-belonging: One student's struggle on a diverse South African campus. *Issues Educ. Res.* **2021**, *31*, 854–870.
96. Yigitcanlar, T.; Edvardsson, I.; Johannesson, H.; Kamruzzaman, M.; Ioppolo, G.; Pancholi, S. Knowledge-based development dynamics in less favoured regions. *Eur. Plan. Stud.* **2017**, *25*, 2272–2292. [CrossRef]
97. Baer, H.; Gallois, A. How Committed Are Australian Universities to Environmental Sustainability? A Perspective on and from the University of Melbourne. *Crit. Sociol.* **2018**, *44*, 357–373. [CrossRef]
98. Dimitrova, A.; Vaishar, A.; Šťastná, M. Preparedness of Young People for a Sustainable Lifestyle: Awareness and Willingness. *Sustainability* **2021**, *13*, 7204. [CrossRef]
99. Liao, C.; Lin, J.; Chen, T. Research on a Framework for Sustainable Campus Eco-Architecture Selection: Taking a Taiwan High School as an Example. *Sustainability* **2022**, *14*, 6265. [CrossRef]
100. Afrasiabi, A.; Tavana, M.; Di Caprio, D. An extended hybrid fuzzy multi-criteria decision model for sustainable and resilient supplier selection. *Environ. Sci. Pollut. Res.* **2022**, *29*, 37291–37314. [CrossRef] [PubMed]
101. Nureen, N.; Liu, D.; Ahmad, B.; Irfan, M. Exploring the technical and behavioral dimensions of green supply chain management: A roadmap toward environmental sustainability. *Environ. Sci. Pollut. Res.* **2022**, *29*, 63444–63457. [CrossRef]
102. Asadabadi, M.; Ahmadi, H.; Gupta, H.; Liou, J. Supplier selection to support environmental sustainability: The stratified BWM TOPSIS method. *Ann. Oper. Res.* **2023**, *322*, 321–344. [CrossRef]
103. Sugiarto, A.; Lee, C.; Huruta, A. A Systematic Review of the Sustainable Campus Concept. *Behav. Sci.* **2022**, *12*, 130. [CrossRef]
104. Yigitcanlar, T.; Fabian, L.; Coiacetto, E. Challenges to urban transport sustainability and smart transport in a tourist city: The Gold Coast, Australia. *Open Transp. J.* **2008**, *2*, 29–46. [CrossRef]
105. Natalia, M.; Ullah, W.; Khan, A.; Wahid, A.; Mehmood, M.; Naz, M. Investigation among students' and teachers' perception of climate health awareness regarding low carbon ecofriendly practices. *Front. Environ. Sci.* **2023**, *11*, 1177952. [CrossRef]
106. Sondhia, S.; Chawlaa, U.; Iqbalb, H. Relationship between Social Cause, Environment Conservation and Environmental Attitude, towards Promoting Green Purchasing Behaviour. *Serbian J. Manag.* **2023**, *18*, 27–43.
107. Hernandez, A.; Prakoso, Y. The Learning Activation Approach—Understanding Indonesia's Energy Transition by Teaching It. *Energies* **2021**, *14*, 5224. [CrossRef]
108. Gatto, A. The energy futures we want: A research and policy agenda for energy transitions. *Energy Res. Soc. Sci.* **2022**, *89*, 102639. [CrossRef]
109. Newman, J.; Mills, S.; Soderstrom, S. Training Leaders to Facilitate an Energy Transition: Retrospective Evaluation of Course Design. *Sustainability* **2023**, *15*, 9910. [CrossRef]
110. Kourgiozou, V.; Commin, A.; Dowson, M.; Rovas, D.; Mumovic, D. Scalable pathways to net zero carbon in the UK higher education sector: A systematic review of smart energy systems in university campuses. *Renew. Sustain. Energy Rev.* **2021**, *147*, 111234. [CrossRef]
111. Kerem, A. Assessing the electricity energy efficiency of university campus exterior lighting system and proposing energy-saving strategies for carbon emission reduction. *Microsyst. Technol.* **2022**, *28*, 2623–2640. [CrossRef] [PubMed]
112. Muqeet, H.; Javed, H.; Akhter, M.; Shahzad, M.; Munir, H.; Nadeem, M.; Bukhari, S.; Huba, M. Sustainable Solutions for Advanced Energy Management System of Campus Microgrids: Model Opportunities and Future Challenges. *Sensors* **2022**, *22*, 2345. [CrossRef] [PubMed]
113. Fatima, Z.; Vacha, T.; Swamygowda, K.; Qubailat, R. Getting Started with Positive Energy Districts: Experience until Now from Maia, Reykjavik, Kifissia, Kladno and Lviv. *Sustainability* **2022**, *14*, 5799. [CrossRef]
114. Paspatis, A.; Fiorentzis, K.; Katsigiannis, Y.; Karapidakis, E. Smart Campus Microgrids towards a Sustainable Energy Transition—The Case Study of the Hellenic Mediterranean University in Crete. *Mathematics* **2022**, *10*, 1065. [CrossRef]
115. Mortoja, M.; Yigitcanlar, T.; Mayere, S. What is the most suitable methodological approach to demarcate peri-urban areas? A systematic review of the literature. *Land Use Policy* **2020**, *95*, 104601. [CrossRef]
116. Moretti, E.; Stamponi, E. The Renewable Energy Communities in Italy and the Role of Public Administrations: The Experience of the Municipality of Assisi between Challenges and Opportunities. *Sustainability* **2023**, *15*, 11869. [CrossRef]
117. Atici, K.; Yasayacak, G.; Yildiz, Y.; Ulucan, A. Green University and academic performance: An empirical study on UI GreenMetric and World University Rankings. *J. Clean. Prod.* **2021**, *291*, 125289. [CrossRef]
118. O'Neill, K.; Sinden, C. Universities, Sustainability, and Neoliberalism: Contradictions of the Climate Emergency Declarations. *Politics Gov.* **2021**, *9*, 29–40. [CrossRef]

119. Gaitán-Angulo, M.; Gómez-Caicedo, M.; Torres-Samuel, M.; Correa-Guimaraes, A.; Navas-Gracia, L.; Vásquez-Stanescu, C.; Ramírez-Pisco, R.; Luna-Cardozo, M. Sustainability as an Emerging Paradigm in Universities. *Sustainability* **2022**, *14*, 2582. [CrossRef]
120. Hess, D.; McKane, R. Making sustainability plans more equitable: An analysis of 50 U.S. Cities. *Local Environ.* **2021**, *26*, 461–476. [CrossRef]
121. Reames, T.; Wright, N. The Three E's Revisited: How Do Community-Based Organizations Define Sustainable Communities and Their Role in Pursuit of? *Sustainability* **2021**, *13*, 8825. [CrossRef]
122. Yeeles, A.; Sosalla-Bahr, K.; Ninete, J.; Wittmann, M.; Jimenez, F.; Brittin, B. Social equity in sustainability certification systems for the built environment: Understanding concepts, value, and practice implications. *Environ. Res. Infrastruct. Sustain.* **2023**, *3*, 015001. [CrossRef]
123. Budowle, R.; Krszjzaniek, E.; Taylor, C. Students as Change Agents for Community–University Sustainability Transition Partnerships. *Sustainability* **2021**, *13*, 6036. [CrossRef]
124. Caughman, L.; Beaudoin, F.; Keeler, L.W. The project-partnership cycle: Managing city-university partnerships for urban sustainability and resilience transformations. *Urban Transform.* **2023**, *5*, 10. [CrossRef]
125. Mohammadi, Y.; Monavvarifard, F.; Salehi, L.; Movahedi, R.; Karimi, S.; Liobikiene, G. Explaining the Sustainability of Universities through the Contribution of Students' Pro-Environmental Behavior and the Management System. *Sustainability* **2023**, *15*, 1562. [CrossRef]
126. Haas, R.; Aşan, H.; Doğan, O.; Michalek, C.; Akkan, Ö.; Bulut, Z. Designing and Implementing the MySusCof App—A Mobile App to Support Food Waste Reduction. *Foods* **2022**, *11*, 2222. [CrossRef]
127. Singh, P.; Ambika, X. Solid waste management through the concept of zero waste. In *Emerging Trends to Approaching Zero Waste Environmental and Social Perspectives*; Hussain, C.M., Singh, S., Goswami, L., Eds.; Elsevia Inc.: Amsterdam, The Netherlands, 2022; pp. 293–318.
128. Baba-Nalikant, M.; Syed-Mohamad, S.; Husin, M.; Abdullah, N.; Mohamad Saleh, M.; Abdul Rahim, A. A Zero-Waste Campus Framework: Perceptions and Practices of University Campus Community in Malaysia. *Recycling* **2023**, *8*, 21. [CrossRef]
129. Mbama, C.; Otegbulu, A.; Beverland, I.; Beattie, T. Solid waste recycling within higher education in developing countries: A case study of the University of Lagos. *J. Mater. Cycles Waste Manag.* **2023**, *25*, 886–898. [CrossRef]
130. Helmefalk, M.; Palmquist, A.; Rosenlund, J. Understanding the mechanisms of household and stakeholder engagement in a recycling ecosystem: The SDL perspective. *Waste Manag.* **2023**, *160*, 1–11. [CrossRef] [PubMed]
131. Tsimnadis, K.; Kyriakopoulos, G.; Arabatzis, G.; Leontopoulos, S.; Zervas, E. An Innovative and Alternative Waste Collection Recycling Program Based on Source Separation of Municipal Solid Wastes (MSW) and Operating with Mobile Green Points (MGPs). *Sustainability* **2023**, *15*, 3106. [CrossRef]
132. Authelet, M.; Subervie, J.; Meyfroidt, P.; Asquith, N.; Ezzine-de-Blas, D. Economic, pro-social and pro-environmental factors influencing participation in an incentive-based conservation program in Bolivia. *World Dev.* **2021**, *145*, 105487. [CrossRef]
133. Haksevenler, B.; Kavak, F.; Akpinar, A. Separate waste collection in higher education institutions with its technical and social aspects: A case study for a university campus. *J. Clean. Prod.* **2022**, *367*, 133022. [CrossRef]
134. Kern, M.; Smutko, S. Collaborative governance: The role of university centers, institutes, and programs. *Confl. Resolut. Q.* **2021**, *39*, 29–50. [CrossRef]
135. Parent, M.; Reich, B. Governing Information Technology Risk. *Calif. Manag. Rev.* **2009**, *51*, 134–152. [CrossRef]
136. Gale, M.; Bongiovanni, I.; Slapnicar, S. Governing cybersecurity from the boardroom: Challenges, drivers, and ways ahead. *Comput. Secur.* **2022**, *121*, 102840. [CrossRef]
137. Tian, J.; Xu, H.; Tian, J. DCCP: A dependable committee consensus protocol for permissionless blockchain. *J. Supercomput.* **2023**, *79*, 4021–4047. [CrossRef]
138. Snider, K.; Shandler, R.; Zandani, S.; Canetti, D. Cyberattacks, cyber threats, and attitudes toward cybersecurity policies. *J. Cybersecur.* **2021**, *7*, tyab019. [CrossRef]
139. Bondarenko, S.; Makeieva, O.; Usachenko, O.; Veklych, V.; Arifkhodzhaieva, T.; Lernyk, S. The Legal Mechanisms for Information Security in the context of Digitalization. *J. Inf. Technol. Manag.* **2022**, *14*, 25–58.
140. Csenkey, K.; Bindel, N. Post-quantum cryptographic assemblages and the governance of the quantum threat. *J. Cybersecur.* **2023**, *9*, tyad001. [CrossRef]
141. Melaku, H. A Dynamic and Adaptive Cybersecurity Governance Framework. *J. Cybersecur. Priv.* **2023**, *3*, 327–350. [CrossRef]
142. Repetto, M.; Striccoli, D.; Piro, G.; Carrega, A.; Boggia, G.; Bolla, R. An Autonomous Cybersecurity Framework for Next-generation Digital Service Chains. *J. Netw. Syst. Manag.* **2021**, *29*, 37. [CrossRef]
143. Martinez, S.; Gransart, C.; Stienne, O.; Deniau, V.; Bon, P. SoREn, How Dynamic Software Update Tools Can HelpCybersecurity Systems to Improve Monitoring and Actions. *J. Univers. Comput. Sci.* **2022**, *28*, 27–53. [CrossRef]
144. Chatterjee, S.; Sreenivasulu, N. Impact of AI regulation and governance on online personal data sharing: From sociolegal, technology and policy perspective. *J. Sci. Technol. Policy Manag.* **2023**, *14*, 157–180. [CrossRef]
145. Kuzio, J.; Ahmadi, M.; Kim, K.; Migaud, M.; Wang, Y.; Bullock, J. Building better global data governance. *Data Policy* **2022**, *4*, e25. [CrossRef]
146. Marcucci, S.; Alarcón, N.; Verhulst, S.; Wüllhorst, E. Informing the Global Data Future: Benchmarking Data Governance Frameworks. *Data Policy* **2023**, *5*, e30. [CrossRef]

147. Castro, A.; Villagra, V.; Garcia, P.; Rivera, A.; Toledo, D. An Ontological-Based Model to Data Governance for Big Data. *IEEE Access* **2021**, *9*, 109943–109959. [CrossRef]
148. Wong, J.; Henderson, T.; Ball, K. Data protection for the common good: Developing a framework for a data protection-focused data commons. *Data Policy* **2022**, *4*, e3. [CrossRef]
149. Nadal, S.; Jovanovic, P.; Bilalli, B.; Romero, O. Operationalizing and automating Data Governance. *J. Big Data* **2022**, *9*, 117. [CrossRef] [PubMed]
150. Graef, I.; Prüfer, J. Governance of data sharing: A law & economics proposal. *Res. Policy* **2021**, *50*, 104330.
151. Osu, T.; Navarra, D. Development of a Data Governance Framework for Smart Cities. In Proceedings of the 7th International Conference on Smart Data and Smart Cities (SDSC), Sydney, Australia, 19–21 October 2022.
152. Ferrer-Conill, R.; Sjøvaag, H.; Olsen, R.K. Datafied Societies: Digital Infrastructures, Data Power, and Regulations. *Media Commun.* **2023**, *11*, 291–295. [CrossRef]
153. Jongbloed, B.; Kaiser, F.; van Vught, F.; Westerheijden, D. Performance Agreements in Higher Education: A New Approach to Higher Education Funding. In *European Higher Education Area: The Impact of Past and Future Policies*; Curaj, A., Deca, L., Pricopie, R., Eds.; Springer: Cham, Switzerland, 2021; pp. 671–688.
154. Pruvot, E.; Estermann, T. University Governance: Autonomy, Structures and Inclusiveness. In *European Higher Education Area: The Impact of Past and Future Policies*; Curaj, A., Deca, L., Pricopie, R., Eds.; Springer Open: Cham, Switzerland, 2021; pp. 619–638.
155. Toderas, T.; Stăvaru, A. The Impact of the Bologna Process on the Governance of Higher Education Systems in Eastern Partnership Countries. In *European Higher Education Area: The Impact of Past and Future Policies*; Curaj, A., Deca, L., Pricopie, R., Eds.; Springer Open: Cham, Switzerland, 2021; pp. 707–721.
156. Drooge, L.; Spaapen, J. Evaluation and monitoring of transdisciplinary collaborations. *J. Technol. Transf.* **2022**, *47*, 747–761. [CrossRef]
157. Nkonki-Mandleni, B. Monitoring and Evaluation for University-Community Impact in Driving Transformation Agenda. *S. Afr. J. High. Educ.* **2023**, *37*, 151–165. [CrossRef]
158. Konyana, S.; Onwubu, S.; Makgobole, M. Masters and doctorate student experiences of service delivery at public universities in Kwazulu-Natal, South Africa. *Int. J. Res. Bus. Soc.* **2022**, *11*, 265–277. [CrossRef]
159. Tao, M.; Jiang, J.; Wang, X.; Zhou, J.; Xie, J. A Decision Support Framework for Curriculum Planning in Undergraduate Supply Chain Management Program: An Integrated Approach. *Math. Probl. Eng.* **2022**, *2022*, 3494431. [CrossRef]
160. Odasco, B.; Saong, M. Analysis of the Inventory Management System Towards Enhanced University Service Delivery. *Int. J. Sci. Technol. Eng. Math.* **2023**, *3*, 103–132. [CrossRef]
161. Latif, K.; Bunce, L.; Ahmad, M. How can universities improve student loyalty? The roles of university social responsibility, service quality, and "customer" satisfaction and trust. *Int. J. Educ. Manag.* **2021**, *35*, 815–829. [CrossRef]
162. Alghamdi, W.; Alkhamash, R.; Alsufyani, A.; Alsuwat, R.; Alharthi, A.; Algethami, R.; Alazwari, S. Software Smart Agent for Taif University Services. In Proceedings of the 14th International Conference on Ambient Systems, Networks and Technologies (ANT), Leuven, Belgium, 15–17 March 2023.
163. VanDerSchaaf, H.; Daim, T.; Basoglu, N. Factors Influencing Student Information Technology Adoption. *IEEE Trans. Eng. Manag.* **2023**, *70*, 631–643. [CrossRef]
164. Baum, S.; Yigitcanlar, T.; Horton, S.; Velibeyoglu, K.; Gleeson, B. *The Role of Community and Lifestyle in the Making of a Knowledge City*; Griffith University: Brisbane, Australia, 2007.
165. Górska, A.; Pikos, A.; Dobija, D.; Grossi, G. Autonomy Without Accountability in Resource Allocation Reforms: Blending Old and New Logic in Universities. *Cent. Eur. Manag. J.* **2022**, *30*, 43–82. [CrossRef]
166. Lozano, S.; Contreras, I. Centralised resource allocation using Lexicographic Goal Programming. Application to the Spanish public university system. *Socio-Econ. Plann Sci.* **2022**, *84*, 101419. [CrossRef]
167. Qiu, M. Balanced Allocation of Educational Resources Based on Parallel Genetic Algorithm. *Math. Probl. Eng* **2022**, *2022*, 7517267. [CrossRef]
168. Aion, N.; Helmandollar, L.; Wang, M.; Ng, J.W.P. Intelligent campus (iCampus) impact study. In Proceedings of the 2012 IEEE/WIC/ACM International Conferences on Web Intelligence and Intelligent Agent Technology, Macau, China, 4–7 December 2012; pp. 291–295.
169. Luckyardi, S.; Jurriyati, R.; Disman, D.; Dirgantari, P.D. A Systematic Review of the IoT in Smart University: Model and Contribution. *Indones. J. Sci. Technol.* **2022**, *7*, 529–550. [CrossRef]