Organizational Resilience in the Context of Higher Education Institutions: A Systematic Literature Review

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Abstract

This study is a continuation of a previous work-in-progress extended abstract from ASEE 2023[19]. This is a Systematic Literature Review (SLR) of Organizational Resilience (OR) in Higher Education Institutions (HEIs) context. The previous extended abstract study showed a gap in the literature; most work related to resilience in educational contexts was focused on an individual perspective. However, this is a rapidly evolving knowledge area, and literature published after the data collection for that initial study has shown that after COVID-19, there has been an increase in the role played by Organizational Resilience in educational contexts. Moreover, the current study's bibliometric information shows that OR analysis in HEIs is becoming a trend of which researchers and HEI employees should be aware. This study follows the same methodology of Tranfield and colleagues[1] as used before. The findings were refined from the previous work, by enlarging the inclusion and exclusion criteria (i.e., including 2022 and half of 2023 years), while expanding the pool of databases used. Implications for engineering education relate to survivability experiences, unexpected shocks, and decisions taken from other universities and educational institutions in general. Although not all literature explores engineering-focused cases, the analysis of these experiences and decisions taken from literature can guide the survivability of engineering education institutions, and the potential impacts of considering OR theories for engineering education.

Introduction

Resilience is a complex concept analyzed by the literature and can be defined as the "ability to recover from or adjust easily to misfortune or change"[2]. Since the COVID-19 pandemic shocked the world, various research has been developed to understand and reflect on this phenomenon. One scope of this research analyzes the educational context, and how higher education institutions responded in their practices while learning about external shocks. While some universities suffered from this unexpected disastrous scenario, some were sufficiently prepared to smoothly pivot to the obligated online modality to learn and teach. This study analyzes literature focusing on the organizational level of resilience (Organizational Resilience), for the context of Higher Education Institutions (HEIs). The motivation thrives from the differences in capabilities that multiple HEIs demonstrated during the pandemic, and what are the principal ideas that should guide professors, students, managers, leaders, and decision-makers to face disruptive events.

Resilience was introduced in the English language in the early 17th Century from the Latin verb *resilire*, which means to rebound or recoil[3]. The first approach used for a resilient systems analysis was from the ecological perspective and was introduced by Holling in 1973[4]. He defined the resilience of an ecosystem as the measure of its ability to absorb changes and still exist[4]. Later, in 1996 he contrasted how ecological resilience and engineering resilience can be related by analyzing this systemic characteristic[5]. This was the first time that complex human-made systems (such as organizations) were faced with understanding their adaptation capability, and how this could be influenced by the engineering world.

Organizational Resilience (OR) presents multiple definitions in current literature. Since the motivation for this research is to explore how HEIs' OR is understood, we will use the

definition of OR developed by Dr. Annarelli and Dr. Nonino, which describes OR as the organization's capability to face disruptions and unexpected events, considering its nature as static when analyzed with respect to the preparedness of the organization of these events, and as dynamic when focusing on the ability to manage disruptions and unexpected events[6]. Other definitions of OR were possible, but the one proposed in 2016 by those authors is the broadest incorporating those from multiple other references [7–9]. Higher Education Institutions (HEIs) are "educational institutions in any State that admits as regular students only persons having a certificate of graduation from a school providing secondary education, or the recognized equivalent of such a certificate"[10]. While this definition was developed for US-HEIs, the focus of this work will include similar institutions outside the US since OR research on HEIs has had an impact worldwide[11–13] When examining previous work, there is still no clear consensus in the literature about where to go in the application of OR concepts for HEI contexts. Some studies compare and contrast the impact of Organizational factors on OR in HEI and non-HEI contexts[11,14], other studies take results from business-based research about OR to analyze if similar conclusions are drawn for HEI contexts[15,16], and just a few try to empirically corroborate theoretical frameworks[17,18]. While the lack of clarity was a main topic for the previous work developed in 2023[19], this study will mainly focus on the potential impact that resilient capabilities present for HEIs as the literature shows. While this study is being published, the only proposed SLR for the scope of OR in HEI contexts is the one previously published as Work-in-process[19].

Methodology

The SLR methodology used for this study considers the same used previously[19], which was developed by Tranfield and colleagues in 2003[1]. This methodology considers three different stages with multiple phases on each. First, planning the review, where the main goal is to identify the need for a review, the respective preparation, and the development of the review protocol. The second stage of conducting a review considers the identification of research, selection of studies, their quality assessment, data extraction, and progress monitoring, to end with the data synthesis. Finally, the third stage considers the report and recommendations, and getting evidence into practice. The details of the methodology are shown in Figure 1.

Stage I - Planning the review	
Phase 0	Identification of the need for a review
Phase 1	Preparation of a proposal for a review
Phase 2	Development of a review protocol
Stage II - Conducting a review	
Phase 3	Identification of research
Phase 4	Selection of studies
Phase 5	Study quality assessment
Phase 6	Data extraction and monitoring progress
Phase 7	Data synthesis
Stage III - Reporting and dissemination	

Phase 8	The report and recommendations
Phase 9	Getting evidence into practice

Figure 1. Stages and phases of SLR methodology[1].

In stage one, the need for a review was identified by performing a quick search on Google Scholar, which is the search engine that will provide the greatest number of results of all. The search was made using the phrase "Organizational Resilience in Higher Education Institutions" without the quotation marks for a broader search. Total results show 715,000 studies, which had an increase of 203,000 from the previous study. Therefore, with this vast number of results, the interest is high in the topic, and thus, the need for a review is validated.

The first phase prepared a proposal for a review. The proposal included two steps: the creation of a scoping set, and the computation of the capture rate for databases included in the protocol. The scoping set was built by selecting suitable studies from the first 10 pages of the Google Scholar search, utilizing the default settings of 10 results per page and sorting by relevance. The logic behind the utilization of the first 10 pages will be further discussed below but a major determinant was the observed drop-off in the relevance of results (applicable studies retrieved) after the first few pages of results and the cost-benefit of manually reviewing a larger number of results. Further, given the large number of results from this non-narrowed search, manually reviewing all 715,000 was infeasible for this phase. A study was suitable if it appeared in the results of the search and the scope was for HEIs contexts or if it took data from these institutions.

Phase two considered the creation of the review protocol. The protocol includes the same items as utilized in the previous work[19], with one difference in the scope. The scope of the current study focused on studies between 1959 and June of 2023. 1959 was selected because Emerald did not present work before 1959, and thus utilizing the same cutoff across all platforms promoted consistency. June of 2023 is an increase of time from the previous SLR developed which had 2021 as the limit. The engineering librarian assistant suggested the same platforms used in the previous work and also suggested the inclusion of educational and engineering-focused platforms. These platforms were peer-reviewed focused-based databases in EBSCOhost, JSTOR, ProQuest, Web of Science, SpringerLink, and ASTS. The purpose of the SLR is to analyze as many databases as possible, to enhance the search done in the previous work. The summary of the review protocol is shown in Figure 3.

Knowing the platforms to be used, and the search phrase, the missing step from the first phase comprised calculating the capture rate for the platforms selected (Figure 3), using the scoping set. The capture rate is a percentage that represents the ability to retrieve publications that actually exist on the platforms, using the search terms[19] (Figure 3) That is, it provides one measure of the quality of the search terms selected. This value is obtained by using the equations in Figure 2. This follows the same analysis as the previous work. When a study is found using both the title and the search phrase, it adds 1 to the numerator. Alternately, if a study is not found by either title or search phrase (because it does not exist in that particular platform), it also adds 1 to the numerator. Both of these are consistent (desirable) results. Meanwhile, if the result is inconsistent – i.e., the study is found using the title but not by using the search phrase, it adds 0 to the numerator. (Note: the other inconsistent option – that a study is found by search phrase but

not by title is considered but would not occur unless there is some sort of issue with the way the article title is indexed in the selected platform). The final capture rate for a platform is the sum of consistent articles (e.g., simultaneously found by title and by the search phrase) from the scoping set, divided by the sum of articles in the same scoping set.

$$Capture\ Rate = \frac{\sum_{i=1}^{n} Article\ i\ is\ consistent}{\sum_{i=1}^{n} Article\ i}$$

$$Article\ a\ is\ consistent = \begin{cases} 1\ ; if\ found\ by\ title = found\ by\ using\ search\ phrase \\ 0;\ otherwise. \end{cases}$$

Figure 2. Equations to calculate capture rate.

Purpose	To understand the research trends of Organizational Resilience in the context of Higher Education Institutions
Scope	Using an established SLR method (Tranfield et al., 2003), cover research trends of Organizational Resilience in the context of Higher Education Institutions. The review will identify research publications and their different analysis scope between 1959 and June of 2023.
Search phrases	("Higher Education" OR "University" OR "College") AND ("Organizational Resilience" OR "Organisational Resilience")
Platforms	Emerald, Web of Science, ProQuest ABI INFORM GLOBAL, ScienceDirect, Scopus, and ERIC. Other educational databases: EBSCOhost with 7 databases (Academic Search Complete, Educational Administration Abstracts, Education Source, Professional development collection, Psychology and behavioral sciences collection, SocINDEX with Full Text, Teacher Reference Center), JSTOR and ProQuest (Sociological Abstracts). Other Engineering databases (4): EBSCOhost (Applied Science & Technology Source), Web of Science (Current Content Connect), Springerlink, and ASTS.
Exclusion criteria	English language only Only papers that present the full text Publications between 1959- June 2023 Only peer-reviewed publications From the first 10 pages (200-300 results) if results are more than 1,000. Publication context should focus on Higher Education Contexts (Below HEIs, or non-educational contexts were automatically excluded). Remove duplicates

Figure 3. Review protocol for the study.

In stage two, similarly as done previously, there were five phases. The identification of research was made considering the search phrase used from the review protocol. This phrase was taken from the previous study and is the one that provides the most results to search for studies relating to OR in HEIs contexts. The phrase considers two options for Organizational concept (with z and with s), as well as three options for HEIs (Higher Education, University, and College). The phrase was used searching in the "all fields" option for each database. The selection of studies was made by checking the first 10 pages (whenever possible) of each database results shown using the search phrase and selecting those studies that met the exclusion criteria from the protocol. However, the exclusion criteria were applied in two steps. This 10-page exclusion criteria were made considering that some databases presented a thousand results or more (i.e., Emerald, Scopus, ScienceDirect, and ProQuest). Databases with more than a thousand results were also shown to diverge around study numbers 100^{th} to 150^{th} (fourth or fifth page of search considering 20 to 25 results per page). This exclusion responds to practical purposes for the researcher to save time by not checking studies not in the scope of the SLR. This is validated by considering the final results from the work-in-process paper this study is based on[19] and also the Law of Diminishing Returns mentioned by Dr. Haig and Dr. Dozier[20]. In their study, they analyze the good practices for constructing SLRs related to sources of information, including websites. They state that "Ultimately one does have to decide when to stop searching", alluding to the logic of the law where if one factor of production is increased while the others remain constant, the overall returns will relatively decrease after a certain point[20]. Another point to help this last idea is the grey literature found in Google Scholar; this non-orthodox way to publish research appears near the result 200 and 300 in Google Scholar, and for purposes of simplifying and expediting the methodology, can be taken into consideration as a good practice[21]. In this case the returns are accurate studies for the scope of research, and the changing factor are the pages.

The other exclusion criteria included studies if they were in English only, not considering the full-text limit, published between 1959 and June of 2023, and they were only peer-reviewed publications. The second step focused on meeting the criteria of the HEI context needed for the study and removing duplicates. A study had an HEI context when the study used an HEI context as the scope or analyzed OR factors for managerial positions of HEIs (e.g., studies that analyzed a case study that happened in an HEI, data taken involved experiences from decision-makers in HEIs, an experiment was done using two classes for control and treatment group, or the analysis of managerial factors involved the analysis to be in the context of HEIs). It is noted that, even though search terms related to the HEI context were utilized, as the "all fields" option was utilized, the retrieved studies did not necessarily focus on HEIs – the connection could have been mentioned in passing; hence, the need for the aforementioned exclusion criteria.

When phase four is finished, phase five examines the study quality assessment. The quality of each study was verified by using a modified version of the CASP Randomised Controlled Trial Standard Checklist[22]. The items consider the validation of the study (*"Did the study address a clearly focused research question?")*, methodology procedure (*"Does the methodology use proper procedure and state why it is using that methodology?"*), results visualization (*"Are the results shown comprehensively?"*), results evaluation (*"The results provided help to answer the research question(s)?"*), and conclusion evaluation (*"Does the conclusion address the research question winding up the study?"*). Only two studies in the entire dataset were taken into consideration for another review[12,23]. After checking with a second evaluator, both of them were categorized as high-quality studies to be considered in this review.

Phase six emphasized the data extraction and monitoring process. For this matter, a new dataset was created, where all studies accepted from previous steps were added. In Excel, information was extracted from their bibliographic and content data. Finally, phase seven of data synthesis changed from the previous work. In this case, all the studies were divided into four categories according to their purpose and content. The four categories were "Managerial and College factors establishing a link with OR at any level", "Empirical Analysis of Theoretical Frameworks", "Emergent OR capabilities from the case study", and "Integration of OR concepts into the curriculum". These categories were inductively developed based on analysis of the literature by one researcher but were verified through discussion with a second researcher. More information regarding this division will be shown in the Analysis section. Finally, in stage three, phases eight and nine will be discussed in detail in the implications for engineering education and conclusion sections.

Results

Capture rate results (for databases and papers in the scoping set)

Capture rates were rated at 100% for almost all databases. Only two databases showed discrepancies while searching for the title versus the search phrase. ProQuest (ABI INFORM Global) and Scopus were the two databases with less than 100% (87% and 93% respectively). ProQuest had discrepancies with two studies[24,25], while Scopus had discrepancies with only one[26]. Of all the databases, only three presented five or more studies considered initially in the scoping set. Scopus was the database with the most studies found (8) followed by Eric and Web of Science (5 each). From the scoping set of studies, the three studies most mentioned were [14,17,27]. The scoping set paper are noted in Appendix A.

Results related to new papers (beyond the scoping set)

Although the databases were expanded from the initial study presented, not all of them contributed any new papers beyond the scoping set. Interestingly, ProQuest ABI INFORM Global, JSTOR, EBSCOhost SocINDEX with Full Text, ProQuest Sociological Abstracts, and SpringerLink did not have any new studies to add (the only papers found there were in the scoping set). However, from the databases that presented new studies, there are a few repeated more than others. The details of the new papers added to the dataset are shown in Figure 4. In terms of quality assessment, all of the studies were proposing something different and relevant for literature of OR in HEIs contexts. All studies considered in Figure 4 were added to the dataset.

Title	Authors	Year	Number of databases where the study was found from
Leading in the eye of a storm: how one team of administrators exercised disaster resilience [12,28]	Fernandez, F; Coulson, H; Zou, YL	2022	9
Support for doctoral candidates in Australia during the pandemic: the case of the University of Melbourne [12]	Le, AT	2021	7

Relational-based resilience of a public university: a case study on losing a library by Mzuzu University in Malawi [29]	Kanyangale, M; Njoloma, E	2020	4
The Value of Centralized IT in Building Resilience during Crises: Evidence from U.S. Higher Education's transition to Emergency Remote Teaching. [30]	Jiyong Park; Woonseock Son; Angst, Corey M.	2023 (March)	3
Preparing for RAE 2020 in Hong Kong: academics' research, writing and publishing trajectories in a neoliberal governance landscape. [31]	Li, Danling; Li, Yongyan	2022	3
Resilience in Higher Education: A Complex Perspective to Lecturers' Adaptive Processes in Response to the COVID-19 Pandemic [32]	Bento, F; Bottino, AG; Pereira, FC; de Almeida, JF; Rodrigues, FG	2021	2
Towards Resilient Educational System and Governance: Measuring Effectiveness and Competitiveness of Private HEIs. [33]	Delgado-Abad, Jocelyn	2022	2
Assessing the mediating effect of leadership capabilities on the relationship between organisational resilience and organisational performance [15]	Afzal Izzaz Zahari, Norhayati Mohamed, Jamaliah Said, Fauziah Yusof	2022	1
Capacity Building for Organizational Resilience: Integrating Standards on Risk, Disruption and Continuity in the Curriculum [34]	Greenwood, Lisa L.; Hess, Dawn; Abraham, Yewande; Schneider, Jennifer	2023	1
E-Learning, Resilience and Change in Higher Education: Helping a University Cope after a Natural Disaster [18]	Ayebi-Arthur, Kofi	2017	1

Educating Future Managers for Developing Resilient Organizations: The Role of Scenario Planning [13]	Hillmann, Julia; Duchek, Stephanie; Meyr, Julian; Guenther, Edeltraud	2018	1
Resilience in the context of multiple adverse circumstances? Leadership capacity and teachers' practice during COVID-19 at schools serving disadvantaged communities. [35]	Beckmann, Laura	2022	1

Figure 4. New papers (beyond the initial scoping set) included in the final dataset.

Bibliographical results

From the methodology, phase three searched across all databases selected in the protocol. With a total of 16,414 studies, the identification of research was finalized. Phase four first step excluded studies for one portion of the exclusion criteria in the protocol. A total of 3,006 studies were excluded, leaving the first step with 13,408 total studies. The second step of the process included the addition of new papers as discussed above. In this step, most studies were excluded (13,386) leaving the final database with 26 studies. Studies that did not focus on Higher Education contexts for their study (most studies were focusing on business contexts and only briefly mentioned HEI), or that did not analyze OR from a managerial standpoint for HEIs (i.e., took data from managers in HEIs, analyzed managerial theories with OR in HEIs contexts, or analyzed OR in HEIs applied experiments) were automatically excluded for the final dataset. Of these, 14 were from the initial scoping set, and 12 were obtained as new papers. The details of this process are shown in Figure 5, and the final dataset is shown in Appendix A.

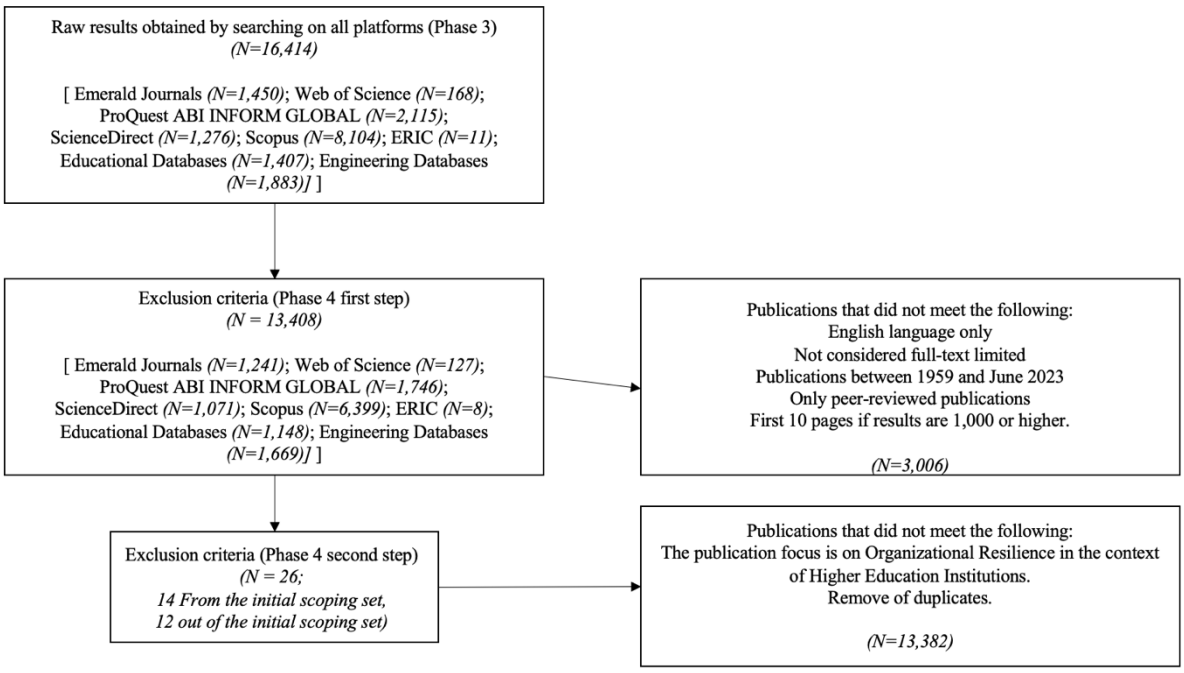

Figure 5. Prisma diagram of the process obtained from stage two of the methodology.

As Figure 6 indicated, the first OR in HEI publication appeared quite recently, in 2016. Over the years, the publications decreased but later increased considerably. In 2016 only two publications were made, in 2017 the same happened, in 2018 only one publication was made until 2019, a year when no publications were seen. However, this trend changed because 2020 presented 6 publications, 2021 had three publications, 2022 had the highest number of publications (10) and 2023 before June had two. Details can be seen in Figure 6. This trend of research related to resilience most probably was affected by the pandemic hitting worldwide, but this is clearer if we consider that in the final dataset, there are 5 studies out of 26 with the "COVID-19" phrase in their titles[17,23,32,35,36]. Furthermore, included in those studies there were several others from 2020 and 2021 with the COVID-19 pandemic as their motivation[14,26,29,30,34,37].

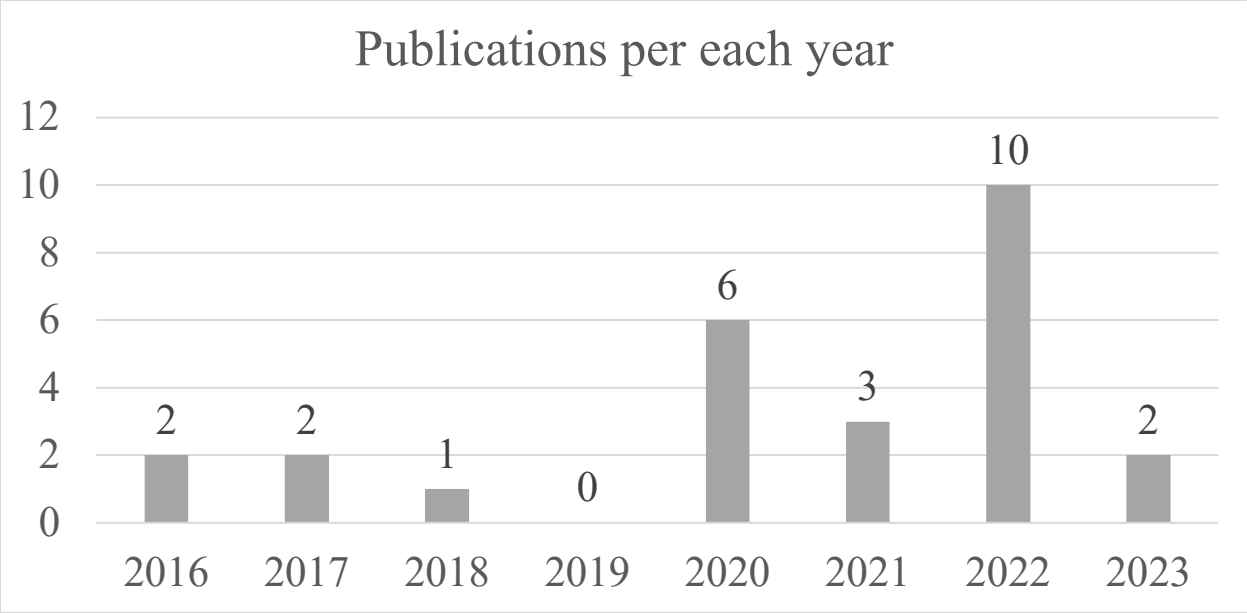

Figure 6. Years and their number of publications.

Publication impact was measured by calculating the average citation per year. The citations were taken from Google Scholar searching by title during January of 2024. From the 22 studies present in the final dataset, only 9 had values near or above 10. We use this number because according to Dr. Van Noorden and colleagues, having 10 or more citations means the study is in the top 24% of the most cited work worldwide[38]. In order, these nine studies are shown in Figure 7. The most impactful study was [18], with second place [17], and third place [12].

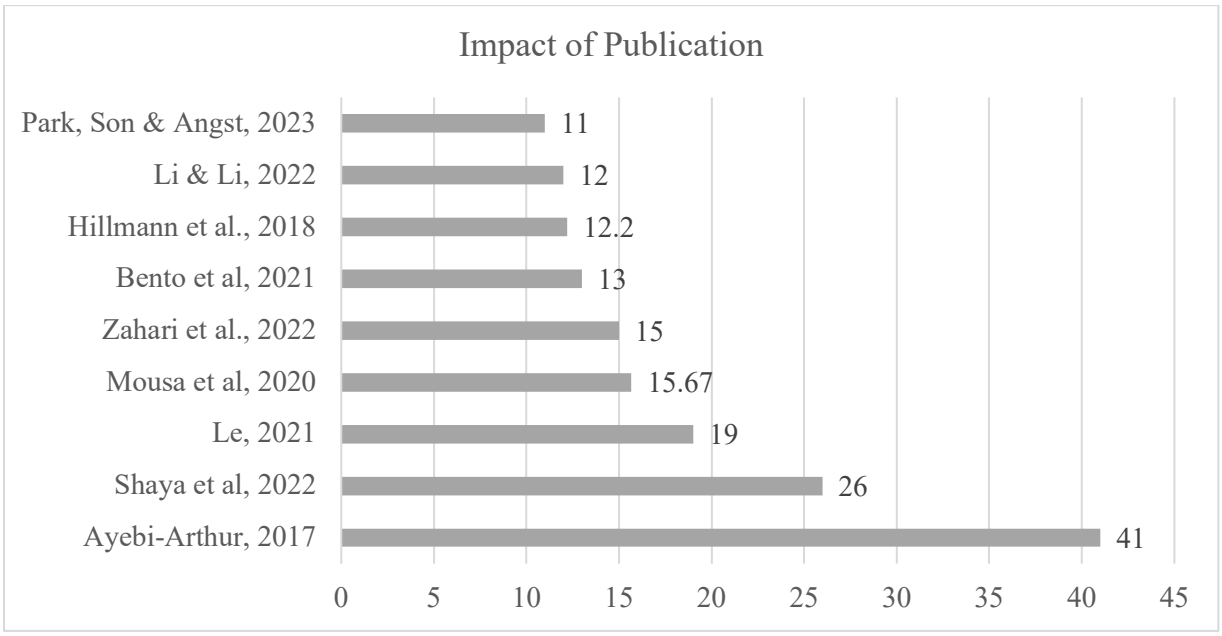

Figure 7. Publication impact for studies above 10 in average citations per year.

Finally, for thematic analysis purposes, the studies in the dataset were divided into four types of research. The categories were determined by extracting the data and specifically the goal

of the research. One researcher analyzed all 26 studies and found different patterns of goals, which were discussed with and verified by a second researcher. The majority of the studies were divided into managerial and individual factors establishing a relationship with OR and emergent capabilities of OR from case studies. Thus, the first category is "Managerial and Individual Factors Establishing a Link with Organizational Resilience at any Level", which are studies that analyze Managerial concepts (e.g., organizational response, organizational sustainability, organizational myopia, institutional effectiveness) and Individual factors (e.g., self-efficacy, personal resilience, leadership style) evaluating the potential relationship with OR. This category centers on the goal of linking OR with other managerial theories and concepts. Second, "Emergent OR capabilities from the case study", which are studies analyzing the emergent behaviors and capabilities exhibited at an organizational level related to OR nature in HEIs. This category's studies center on which are the factors present in organizations and individuals, when a disruption or a shocking event happens, utilizing case studies research. Third, "Empirical Analysis of Theoretical Frameworks", which are studies analyzing how conceptual frameworks related to OR concepts can be validated by using empirical analysis (e.g., previous experiences analysis). The two studies in this category focus on analyzing from an empirical standpoint the theoretical frameworks proposed by the same authors previously. Fourth, "Integration of OR concepts into the curriculum", whose studies analyze the impact of OR factors when added to the curriculum for study experimental cases. The goal of the two studies in this category is to analyze the impact of an intervention on future managers and the curriculum for better learning of OR. Figure 8 shows the number of studies for each type of research.

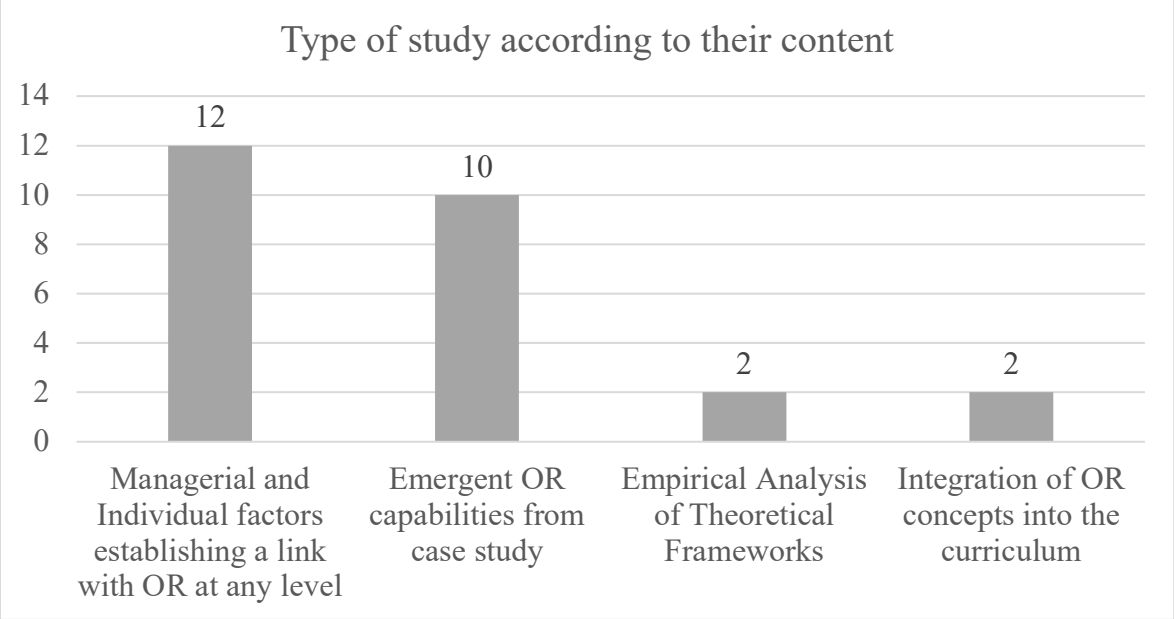

Figure 8. Number of studies in each category of research type.

Discussion of Results

From capture rate results

Across all databases, the ones that provided the most results for studies analyzing OR in HEIs contexts are Web of Science, Scopus, and ERIC. Also, three studies were most frequently retrieved when searching across all databases. The first study in [17] focuses on the empirical

analysis of [8] conceptual framework for understanding OR. The most important finding is that the conceptual framework proposed by [8] is reliable and should be used in the future. This framework proposes the analysis of OR in terms of a timeline analysis, with three steps to follow before-during-and after an event and one input before it happens. The three steps are Anticipation (before the unexpected event), Coping (during the unexpected event), and Adaptation (after the unexpected event), with an external factor working as input for this response which is the Prior knowledge base[8]. However, Dr. Shaya and colleagues' work states that the conceptualization of resilience as a complex variable has not been achieved, which is a problem of current OR literature. Further, they expand on the proposed framework by finding that Crisis Leadership Traits and Employee Resilience are crucial for better Organizational Resilience in the process of Anticipation, Coping, and Adaptation[17]. This paper falls in the "Empirical Analysis of Theoretical Frameworks" category.

The second most frequently retrieved study was the one developed by Mousa and colleagues in 2020. They aim to explore the influence of Organizational Learning on the level of OR shown by academics with the mediating effect of a multi-stakeholder network. The findings show a statistically significant influence of Organizational Learning on academics' level of OR, with also a significant role played by the multi-stakeholder network effect[14]. The multi-stakeholder network effect comes from the Multi-stakeholder Governance, which is the will or acceptance by the public or private associates of a broad framework into which they manage their business and consider a process of negotiation and power balance[39]. Thus, the multi-stakeholder effect is understood as the process of negotiation and power balance where multiple stakeholders are linked to work as a team, in this case for their respective HEIs. This study falls in the first category of "Managerial and Individual Factors Establishing a Link with Organizational Resilience at any Level".

The third publication retrieved most frequently was developed by Fernandez and Burnett in 2020. In their study, they evaluate how structures and practices can support OR across different types of Hispanic Serving Institutions (HSIs)[27]. HSIs are one type of Minority-Serving Institution (MSI), with a focus on Hispanic participants or in this case, Hispanic students. They state that HSIs are one of the multiple MSI that often come under undue public scrutiny when policymakers evaluate MSI using the same standards that they use for non-MSIs[27]. After the data was taken from administrators of multiple universities in the U.S. with interviews, and the coding process was analyzed using NVivo, they found that OR had an impact from an adaptative process[27]. OR worked well to avert maladaptive tendencies and positively cope with the unexpected. Also, they found that OR can emerge when leaders learn from prior mistakes or failures, also understood as a "strategy of small losses"[27]. This study also falls in the first category of "Managerial and Individual Factors Establishing a Link with Organizational Resilience at any Level".

Findings from New Papers Results

The first paper, and the most frequently found in the databases that was not in the initial scoping set was "Leading in the Eye of a Storm: How One Team of Administrators Exercised Disaster Resilience" by Fernandez, Coulson, and Zou in 2022. In their work, the authors analyzed how administrators support OR in responding to natural disasters, with a focus on climate change[28]. The main framework used for this analysis was the one developed by Sutcliffe and Vogus in 2003, which suggests that during a crisis a good leader can support OR when she "fosters belief in the group's conjoint capabilities"[40]. The findings show that it is important to

learn from previous experiences, the processing of information and in general structure build-up needs to be positive, the resources need to be redirected and not adhere to normal assumptions about how funds should be spent, there is a need to use emotional or relational resources to help students, and always "you can do better"[28].

The study in [12] was found to be the second most cross-indexed, being present in seven different databases. Their objective was to reflect the observations of the author regarding the pandemic's impacts on the HEI sector in Australia in 2020. Dr. Le analyzed data from Melbourne University during the pandemic period and found multiple issues related to the support at Melbourne University. These issues relate to doing business as usual (e.g., doing the same as if the pandemic was not there), bureaucratic burdens, and putting the University's priorities versus (or before) students' needs[12]. The author does an insightful analysis of Melbourne University's struggles to face the pandemic, and this research is one of multiple regarding COVID-19 issues.

Findings from Bibliographical Results

As specified in the Prisma diagram in Figure 5, the exclusion criteria were applied in two steps. This decision was made because, in the past work, it was shown to be more accurate in terms of describing which criteria were the ones that filtered more studies overall. Similarly, as expected from the previous work, the second step of phase four was the one that filtered more studies. This was done because the scope is at a Higher Educational Institution level. However, most studies filtered in this second step focus on Business or non-HEIs scope to evaluate the Organizational Resilience of participants. This is a consistent pattern found in databases that presented business-focused work; although the search terms specified Universities, Colleges, and HEIs, as the search allowed this term to be expressed in any field (the "all fields" search criteria), the results mostly show studies from other contexts with the HEI context only mentioned briefly in the paper. Since the scope is not the same (HEIs can be compared but differ significantly from the industry environment), most studies about Organizational Resilience in Industry contexts were left out for not having the HEIs scope characteristic.

In terms of publications made per year, is easy to see that there is a pattern. Starting from 2016 until 2019, the publications implying OR in HEIs were decreasing, to the point of having two years (2018, and 2019) with no research published in this matter. From 2020 the publications on this topic increased substantially. This increase appears to be attributed to the COVID-19 pandemic affecting worldwide during 2020. One of the diverse sectors affected by the pandemic was the educational sector. Therefore, research developed in the area was expected to increase as a product of the impact of this event.

Publication impact showed nine interesting studies. The studies in [12,14,17] were already discussed in a previous section, but there were others with high publication impact that have not been discussed yet. One is [32], whose objective was to investigate the experience of lecturers at a University in Brazil during the initial months of the COVID-19 pandemic. With a socio-ecological approach to analyze OR, the authors took information from lecturers and analyzed it using NVivo according to three aspects of socio-ecological resilience[32]. Findings related to the emergence of solutions and new practices while faculty were facing challenges derived from the pandemic. Other findings related to the analysis of factors regarding anticipation and preparedness, the emergence of exploration, informal feedback systems, and the awareness of the students' socio-economic environments. Future research suggests the benefits of understanding

the evolution of emerging networks of interaction in complex systems, by taking experiences from other contexts but also sources in higher education (e.g., students, managers, and policymakers)[32]. The most mentioned study was [18] with an average of 41 citations per year since the time of publication. This study aimed to analyze using a case study approach, an earthquake that happened in New Zealand. The study illustrates how e-learning assisted a college to remain open and even improve learning and teaching as it recovered from three seismic events in two years. By using information provided from the period of shock, and interview, the authors constructed an analysis providing a better understanding of how e-learning can help during disasters. The importance is even heightened when we consider that this study was published in 2017, just three years before the COVID-19 shocking experience. Another study with a high publication impact was [15] with 15 citations per year. The study examines the role of leadership capabilities and OR in regaining organizational success among higher private learning institutions in Malaysia. By using structural equation modeling with partial squares, the authors conclude that OR and leadership capabilities contribute significantly to the performance of private higher learning institutions. This finding also supports the mediation role of leadership capabilities to promote performance.

The study in [31] examines how the effects of RAE 2020 operate within HEIs and working academics in Hong Kong. RAE 2020 is the Research Assessment Exercise, which is part of the University Grants Committee's commitment to assessing the performance of UGC-funded universities and is intended to encourage world-class research and drive excellence[41]. With an interview-based study on lecturers and researchers from Hong Kong University, the authors develop a qualitative analysis using NVivo software for analysis. Findings show that the RAE 2020 impact on academics relies on the quality of research because RAE 2020 asks for multiple research products, which is a neoliberal perspective[31].

On the other hand, [30] examines digital resilience in HEIs through the conceptual lens of disaster response management, by assessing the role played by centralized governance of IT investments. In their study, the authors use the difference-in-difference framework, and a regression equation to analyze the impacts of centralized governance IT investment. Difference-in-differences is a statistical technique used in social sciences research, which calculates the effect of a treatment on an outcome similar to an experimental research design[42]. Although focuses on digital resilience, IT and the complex networking related to its governing clearly relates to organizational resilience. The findings show that HEIs are more successful in maintaining their students' ratings during the crisis if centralized IT investments per student increase[30].

Findings from Thematic Analysis Results

As described, the studies in the final dataset were divided into four categories. The first category of “Managerial and Individual factors establishing a link with OR at any level” uses multiple frameworks as foundations for analyses as well as multiple methods. Examples of these frameworks include: the conceptual framework for understanding effective leadership in OR from [40], Organizational Sustainability, Resilience, and Myopia Scales for assessing those factors, the 2019 AIDA model, and the Resilience Metatheory developed by [43]. These studies also presented a high preponderance of Quantitative methods such as regression equations, structural equation modeling (SEM), quantitative correlational design, and difference-in-difference for social research. A few qualitative methods were used, most commonly thematic analysis (typically with the help of NVivo software to analyze interview responses and open-ended

questions from surveys). In general terms, findings converge on the positive relationship of proposed factors with OR capabilities (e.g., Organizational response, Institutional effectiveness, Organizational sustainability, Product innovation, Organizational Learning, and Digital resilience). Most of the future research focused on further empirically validating the ideas or findings from each study (e.g., test in real life the hypothesis and the proposed model to see if the same conclusion is reached or following the research path using the theory from the study in real-life cases). These in general are valuable papers, particularly if we consider the extensive theoretical content, they lack extensive empirical evidence and application in real life. Although the data taken has some level of initial empirical validation, the ideas proposed require additional empirical validation and expansion within the complex research of OR in HEI.

The second category listed was "Emergent OR capabilities from case study". Studies in this category use frameworks such as: [44] conceptualization of resilience and crisis, a proposal of an integrative framework of proactive OR, a socio-ecological approach to analyze OR, and the concepts from [40] about leadership impact in OR. Methodologies focus on qualitative approaches, such as analyzing qualitative data using Duchek's 2020 conceptual framework, the qualitative analysis of a case study, exploratory qualitative methods, and qualitative analysis considering a snowballing sampling approach. Methods used to analyze data consider coding and theme analysis, such as thematic analysis, ethnographic content analysis, theme analysis with coding procedure, and text analysis. The tool most used in this category was NVivo for qualitative analysis. Findings show the emergent factors related to OR from the examined case studies (e.g., relationship and communication between members, training provided to mid-level managers, political influence, surprise element to demonstrate lack of knowledge to know how to respond, or how neoliberal nature affects the quality of research). Future research mainly focuses on practical implications regarding the analysis of case studies. The suggestion is for administrators to consider the findings of these studies to make future decisions.

The third category was "Empirical Analysis of Theoretical Frameworks". This category contains two studies: one paper and one book chapter. The frameworks used were conceptualization of OR as a process[8], [45,46] including a focus on four concepts of resilient capacities (adoptive, adaptive, anticipative, and transformative). While the paper uses a qualitative survey to gather data, the book chapter employs a theoretical foundation to comprehend the South African Higher Education situation. Their organizational focus is at an executive level, and the data analysis was done with a qualitative and quantitative focus. Findings show that the conceptual framework of [8] is reliable and that universities in South Africa have weaknesses when analyzed through resilient organizations lenses. Future results emphasize the expansion of both studies in the empirical field and applying them to real life.

Finally, the fourth category was "Integration of OR concepts into the curriculum". This category only considered two studies [13,34]. From these, the one developed by Dr. Hillmann and colleagues (including Dr. Duchek mentioned previously in another study) aims to contrast students' OR capabilities when exposed to a scenario planning lecture before a case study exercise versus when not. This included evaluating the two groups' (lectured versus non-lectured) processes using video-based analysis, and two surveys, one before and one after the exercise. The findings show that the learning intervention positively influences the dynamics of the strategy development process, and the results of the group work in terms of their strategies, individual learning, anticipation capabilities, collective sensemaking, and individual sensemaking[13].

Comparison from previous work

When this study's results are compared to the previous work done in [19], there are multiple observations to make. First, the increase in studies from the last SLR analysis is understandably due to the inclusion of 2022 and half of 2023 in the current study. However, although more research has been developed on the topic, there is still a consistent pattern between the two studies in that research on resilience made for business purposes still vastly outnumbers research on resilience in the context of HEIs. Second, the previous research from 2023 did not propose a pattern related to the study's purpose. Since this study presented a larger dataset, the pattern was easier to understand. From the previous study, most analysis of the dataset was made by counting how many studies presented processes, methods, or approaches. In this study, this counting changed to analyze as a unit the four categories, as well as highlighting the most impactful studies. Third, the previous work shows that more than half of the papers did not present any type of future research agenda. This research shows that almost all papers presented future research or at least recommendations for real-life purposes. However, almost all papers lack theoretical future research to help future researchers find a gap in current literature, and thus, conclude their research with only practical implications.

Implications for Engineering Education

From the Prisma Diagram in Figure 5, there is a clear filter when the scope is for HEIs. This filtering also affects Engineering Education. The fact that more research is done in the industry but not in HEI contexts affects the development of theories and frameworks when compared from business scopes to educational scopes. Furthermore, OR research with an industrial context can provide insights that may not be suitable for HEI contexts. Most engineering students' goal is to work in the industry; according to the National Science Board, there has been a decline in the academic sector's share of all Science and Engineering doctorates, from 55% in the early 1970s to just 50% in the 1990s to about 40% in 2013[47]. This decrease can impact Engineering Education design to shift from the knowledge perspective to a more experiential design, negatively affecting the space of theorization from classrooms for those future Ph.D. Engineers.

Among studies analyzing impacts on Engineering Education, is possible to find [25] which analyze the OR factors that can impact enrollment trends. These factors analyzed the responses from leaders of the universities. Factors such as avoidance of skepticism and crucial understanding are important to consider when checking enrollment trends in Engineering Education[25]. In [27] there is an analysis of the impact of non-specific policy decisions on MSIs, specifically HSIs. According to SHPE, in 2023, Latinos represented nearly 10% of the total Engineering Workforce, and their presence in undergraduate engineering education was 15.8%[48]. Since the Latino community represents a tenth of the total engineering workforce, it is important to analyze how decisions taken for HSIs can hinder the engineering sector in the future. Engineering education needs to know these types of topics of diversity and their impact in general among other topics for HEIs. MSIs include HSIs, and HEIs include MSIs; although researchers know the difference between these and the potential impacts on their students, decision-makers and politicians should also be aware of these differences to better interpret the findings from the studies mentioned.

As antecedents from this study, there are multiple factors affecting OR in HEIs, which means that Engineering Education can be affected by these as well. Factors such as

Organizational Sustainability[11], Academic Leadership[28], or the effect of a multi-stakeholder network[14] can improve OR in HEIs, and thus, impact Engineering Education in those HEIs.

Limitations

This study presented a few limitations. First, as seen in Figure 5, the scope of analysis is highly detailed (i.e., Higher Education Institutions). This detailed scope prevented the inclusion of potentially interesting studies in non-HEI contexts, , meaning that the HEIs context was the biggest filtering exclusion criteria. Second, since the research focuses on the OR complex concept inclusively, thus the studies found present multiple differences between each other. The objective of the division into the three categories is to find similarities for all studies labeled in the same category. However, only one researcher participated directly in the coding of these studies into categories which is a related limitation. Third, similar to the previous work, the search was done using a university library's database. All the studies found are related to databases accessible through that institution and this may affect the numbers shown in this research. Fourth, this study has several limitations common to SLR including those related to the selection of platforms, search terms, and inclusion/exclusion criteria (beyond the two previously mentioned at the beginning of this section). One key limitation related to this comes from the use of the first 10 pages only of search results; although this was done as a way to limit the time the researcher spent manually reviewing large numbers of likely irrelevant results, and has support from some SLR literature (as discussed previously), it is not yet common SLR practice.

Another limitation can be related to new technologies related to AI tools. The current study does not explore the potential of these tools such as Semantic Scholar. This last mentioned is a free AI-powered research tool with more than 200 million papers in its literature[49]. The tool is developed by the Allen Institute for AI. The inclusion of tools similar to the one mentioned to search for research, or to enhance the parameters about what is searching is something that can enhance future work in the scope of the study.

Conclusion

This study's goal was to provide the reader with the current trends of research analyzing OR in the context of HEIs. The starting number of studies found was 715,000 for the first Google Scholar search, and the final dataset presented a total of 26 studies. The methodology was followed as in [1] with the use of the Capture rate as the validating measurement for the search terms selected. The most relevant databases for the scope of this Systematic Literature Review were found to be Scopus, Web of Science, and Eric. The most impactful studies were [12,14,17,28]. The Prisma diagram shows that the biggest filter applied to the numerous studies was the HEIs context exclusion criteria. This criterion excluded around 13,000 studies from the first step of phase four. In general, the publication trends show that after 2020 studies about OR in HEIs context increased, and this may be attributed to the COVID-19 pandemic.

The studies from the database present foundational frameworks. Studies such as [8,40,43,44] were the baseline for understanding the conceptualization of OR. In this matter, OR conceptualization is still being discussed in the literature[33], and depending on the scope of analysis some definitions may work better than others. This research provided three different categories that emerged: 1) Managerial and Individual factors establishing a link with Organizational Resilience at any level, 2) Emergent OR capabilities from case study, and 3) Empirical Analysis of Theoretical Frameworks. The three categories conceptualized OR as a capability that HEIs present in specific moments (e.g., disasters, or events). This capability can

be analyzed from different perspectives. It can provide emergent behaviors (e.g., in case studies of disasters), can be linked with other managerial theories (e.g., institutional effectiveness linked to OR), and can be empirically tested for its validity and effectiveness (e.g., use of Duchek's 2020 for COVID-19). Methodologies related to qualitative data analysis and most of the analysis were made using NVivo software. It is important to highlight the NVivo use because it is one of the best tools for thematic analysis when the researchers are not experts in how to apply the method[50]; this can support the entry of new researchers in the field aiming to apply these methods in follow-on work. Although the future research agenda was shown to improve from the initial research done[19], future work found in the final dataset was mainly focused on empirical proof and applications for administrators or decision-makers.

Future research regarding this study centers on the inclusion of studies after June of 2023. Compared to the previous work done, studies centered on OR for HEI contexts have clearer foundations and patterns to understand OR. OR is a complex concept, and if research develops more in OR, their respective scope for HEIs will benefit from it. In this sense, the future research that may impact this scope is to have a convergent conceptualization of OR. Since this SLR's scope is very detailed (only HEIs) OR should be conceptualized accordingly. Future research focusing on how OR can be conceptualized, summarized, and divided into categories will help future researchers in OR know how to take the current status of literature and create more knowledge. Another suggestion will be regarding administrative staff, decision-makers, and professors. Multiple studies from this SLR state the benefits of reading the research, and this study encourages them to consider these as a potential knowledge foundation for their work. The majority of studies converge in the sense of applying empirically the theories discussed in them.

References

1. Tranfield, D., Denyer, D. & Smart, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management* **14**, 207–222 (2003).
2. Merriam-Webster. Resilience Definition. https://www.merriam-webster.com/dictionary/resilience (2022).
3. Pearsal, J. *Concise Oxford Dictionary*. (1999).
4. Holling, C. S. *RESILIENCE AND STABILITY OF ECOLOGICAL SYSTEMS*. www.annualreviews.org (1973).
5. Holling, C. S. Engineering Resilience versus Ecological Resilience. (1996).
6. Annarelli, A. & Nonino, F. Strategic and operational management of organizational resilience: Current state of research and future directions. *Omega (United Kingdom)* vol. 62 1–18 Preprint at https://doi.org/10.1016/j.omega.2015.08.004 (2016).
7. Xiao, L. & Cao, H. Organizational Resilience : The Theoretical Model and Research Implication 2 The concept of Organizational Resilience 3 The Factors of Organizational Resilience The Theoretical Organizational Resilience Model of. **04021**, 10–13 (2017).
8. Duchek, S. Organizational resilience: a capability-based conceptualization. *Business Research* **13**, 215–246 (2020).
9. Sevilla, J., Ruiz-Martín, C., Nebro, J. J. & López-Paredes, A. WHY CAN ORGANIZATIONAL RESILIENCE NOT BE MEASURED? *Journal of Business Economics and Management* **24**, 199–220 (2023).
10. Office of the Law Revision Counsel of the U.S. House of Representatives. Title 20 U.S. Code § 1001 - General definition of institution of higher education.

https://uscode.house.gov/view.xhtml?req=(title:20%20section:1001%20edition:prelim) (2023).
11. Sezen-Gültekin, G., Argon, T. & Abant, B. *Examination of the Relationship between Organizational Resilience and Organizational Sustainability at Higher Education Institution* Conditions of the Creative Commons Attribution License (CC BY-NC-ND)*. *International Journal of Curriculum and Instruction* vol. 12 (2020).
12. Le, A. T. Support for doctoral candidates in Australia during the pandemic: the case of the University of Melbourne. *Studies in Higher Education* **46**, 133–145 (2021).
13. Hillmann, J., Duchek, S., Meyr, J. & Guenther, E. Educating Future Managers for Developing Resilient Organizations: The Role of Scenario Planning. *Journal of Management Education* **42**, 461–495 (2018).
14. Mousa, M., Abdelgaffar, H. A., Chaouali, W. & Aboramadan, M. Organizational learning, organizational resilience and the mediating role of multi-stakeholder networks: A study of Egyptian academics. *Journal of Workplace Learning* **32**, 161–181 (2020).
15. Zahari, A. I., Mohamed, N., Said, J. & Yusof, F. Assessing the mediating effect of leadership capabilities on the relationship between organisational resilience and organisational performance. *Int J Soc Econ* **49**, 280–295 (2022).
16. Teng-Calleja, M., Hechanova, M. R. M., Sabile, P. R. & Villasanta, A. P. V. P. Building organization and employee resilience in disaster contexts. *Int J Workplace Health Manag* **13**, 393–411 (2020).
17. Shaya, N., Abukhait, R., Madani, R. & Khattak, M. N. Organizational Resilience of Higher Education Institutions: An Empirical Study during Covid-19 Pandemic. *Higher Education Policy* (2023) doi:10.1057/s41307-022-00272-2.
18. Ayebi-Arthur, K. E-learning, resilience and change in higher education: Helping a university cope after a natural disaster. *E-Learning and Digital Media* **14**, 259–274 (2017).
19. Polanco-Lahoz, D. A. & Cross, J. A. *Board 99: Systematic Literature Review on Organizational Resilience in the Context of Higher Education Institutions*. (2023).
20. Haig, A. & Dozier, M. BEME Guide No 3: Systematic searching for evidence in medical education--Part 1: Sources of information. *Med Teach* **25**, 352–363 (2003).
21. Haddaway, N. R., Collins, A. M., Coughlin, D. & Kirk, S. The role of google scholar in evidence reviews and its applicability to grey literature searching. *PLoS One* **10**, (2015).
22. CASP Randomised Controlled Trial Standard Checklist [online]. CASP recommends using the Harvard style, i.e., Critical Appraisal Skills Programme. https://casp-uk.net/checklists/casp-rct-randomised-controlled-trial-checklist.pdf (2021).
23. Chiramba Otilia and Maringe, F. Organisational Resilience as an Urgent Strategic Goal in Post-COVID-19 Higher Education in South Africa. in *Re-imagining Educational Futures in Developing Countries: Lessons from Global Health Crises* (ed. Mogaji Emmanuel and Jain, V. and M. F. and H. R. E.) 39–63 (Springer International Publishing, Cham, 2022). doi:10.1007/978-3-030-88234-1_3.
24. Moran, K. A. Organizational resilience: Sustained institutional effectiveness among smaller, private, non-profit US higher education institutions experiencing organizational decline. *Work* **54**, 267–281 (2016).
25. Frisbie, K. & Converso, J. Organizational resilience and enrollment trends of independent, for-profit higher education institutions. *Work* **54**, 295–308 (2016).

26. Chin, C. *ORGANIZATIONAL RESILIENCE AT A PRIVATE, NON-PROFIT INSTITUTION OF HIGHER EDUCATION*. (2022).
27. Fernandez, F. & Burnett, C. A. Considering the need for organizational resilience at hispanic serving institutions: a study of how administrators navigate institutional accreditation in Southern states. *International Journal of Qualitative Studies in Education* **33**, 855–871 (2020).
28. Fernandez, F., Coulson, H. & Zou, Y. Leading in the eye of a storm: how one team of administrators exercised disaster resilience. *High Educ (Dordr)* **83**, 929–944 (2022).
29. Kanyangale, M. & Njoloma, E. Relational-based Resilience of a Public University: A Case study on Losing a Library by Mzuzu University in Malawi. *South African Journal of Libraries and Information Science* **86**, (2020).
30. Park, J., Son, Y. & Angst, C. The Value of Centralized IT in Building Resilience During Crises: Evidence from U.S. Higher Education's Transition to Emergency Remote Teaching. *MIS Quarterly* **47**, 451–482 (2023).
31. Li, D. & Li, Y. Preparing for RAE 2020 in Hong Kong: academics' research, writing and publishing trajectories in a neoliberal governance landscape. *Studies in Higher Education* **47**, 1410–1422 (2022).
32. Bento, F., Giglio Bottino, A., Cerchiareto Pereira, F., Forastieri de Almeida, J. & Gomes Rodrigues, F. Resilience in higher education: A complex perspective to lecturers' adaptive processes in response to the covid-19 pandemic. *Educ Sci (Basel)* **11**, (2021).
33. Delgado-Abad, J. *Towards Resilient Educational System and Governance: Measuring Effectiveness and Competitiveness of Private HEIs*. (2022).
34. Greenwood, L., Schneider, J., Hess, D. & Abraham, Y. *Capacity Building for Organizational Resilience: Integrating Standards on Risk, Disruption and Business Continuity in the Curriculum In*. www.istes.orghttps://orcid.org/0000-0002-7928-4733www.istes.orgwww.iconses.net (2022).
35. Beckmann, L. & Klein, E. D. Resilience in the context of multiple adverse circumstances? Leadership capacity and teachers' practice during COVID-19 at schools serving disadvantaged communities. *School Leadership and Management* **43**, 145–166 (2023).
36. Hawkins, M. *Impacts of COVID-19 on Health Promotion Within Higher Impacts of COVID-19 on HealthImpacts of COVID-19 on Health Promotion Within Higher Education: Exploring Organizational Resilience*. https://stars.library.ucf.edu/etd2020/1023 (2022).
37. Kusumaputri, E. S., Muslimah, H. L., Ahmad, A. & Nurwardani, M. Positioning indonesian islamic higher-education vis-a-vis globalisation: Organisational-resilience dynamics. *Cakrawala Pendidikan* **40**, 413–427 (2021).
38. Van Noorden, R., Maher, B. & Nuzzo, R. The top 100 papers. *Nature* (2014).
39. Vallejo, N. & Hauselmann, P. Multi-stakeholder Governance: A Brief Guide. (2005).
40. Sutcliffe, K. M. & Vogus, T. J. *Organizing for Resilience. Positive Organizational Scholarship: Foundations of a New Discipline*. https://www.researchgate.net/publication/235792901 (2003).
41. The Hong Kong University of Science and Technology. Research Assessment Exercise 2020 . https://rae2020.ust.hk/#:~:text=Background%20of%20RAE%202020,class%20research%20and%20drive%20excellence (2017).

42. Angrist, J. D. & Pischke, J.-S. *Mostly Harmless Econometrics: An Empiricist's Companion*. (2008).
43. Richardson, G. E. The Metatheory of Resilience and Resiliency. (2002).
44. Williams, T. A., Gruber, D. A., Sutcliffe, K. M., Shepherd, D. A. & Zhao, E. Y. Organizational Response to Adversity: Fusing Crisis Management and Resilience Research Streams. *Academy of Management Annals* **11**, 733–769 (2017).
45. Jeans, H., Castillo, G. E. & Thomas, S. *Absorb, Adapt, Transform Capacities*. (2017).
46. Bahadur, A. V *et al. THE 3 AS: TRACKING RESILIENCE ACROSS BRACED Working Paper*. (2015).
47. NSB Editors. Doctoral Scientists and Engineers in Academia. https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-5/doctoral-scientists-and-engineers-in-academia (2016).
48. SHPE. 2023 SHPE-LDC U.S. Latinos in Engineering and Tech Report. (2023).
49. Semantic Scholar website editors. About Semantic Scholar. https://www.semanticscholar.org/about (2024).
50. Elliott-Mainwaring, H. Exploring using NVivo software to facilitate inductive coding for thematic narrative synthesis. *Br J Midwifery* **29**, 628–632 (2021).
51. Uche, L. & Continue, A. *Product Innovation and Organizational Resilience in Public Universities in South-South Nigeria*. *European Journal of Business and Management www.iiste.org ISSN* vol. 7 www.iiste.org (2015).
52. McCluney, C. L., Wooten, L. P. & James, E. H. Chapter 13: The unfolding process of organizational resilience in a diversity crisis: a case study of racial incidents at the University of Missouri. in *Research Handbook on Organizational Resilience* (Edward Elgar Publishing, Cheltenham, UK, 2020). doi:10.4337/9781788112215.00020.
53. Besuner, P. & Riedel, E. Leadership Attributes and Behaviors as Predictors of Organizational Resilience in Academic Health Care Systems. *Health Services Faculty Dr. Manoj Sharma, University Reviewer* (2016).
54. Sezen-Gültekin, G. & Argon, T. *THE RELATIONSHIP AMONG ORGANIZATIONAL MYOPIA, ORGANIZATIONAL RESILIENCE AND ORGANIZATIONAL SUSTAINABILITY AT A HIGHER EDUCATION INSTITUTION IN TURKEY: A STRUCTURAL EQUATION MODELLING. International Online Journal of Education and Teaching (IOJET)* vol. 7 http://iojet.org/index.php/IOJET/article/view/955 (2020).

Appendix

Title	Authors	Year	This study was part of the scoping set?
Organizational Resilience of Higher Education Institutions: An Empirical Study during Covid-19 Pandemic [17]	N Shaya, R Abukhait, R Madani, MN Khattak	2022	Yes

Organizational resilience: Sustained institutional effectiveness among smaller, private, non-profit US higher education institutions experiencing organizational decline [24]	KA Moran	2016	Yes
Organisational resilience as an urgent strategic goal in post-COVID-19 higher education in South Africa [23]	O Chiramba & F Maringe	2022	Yes
Examination of the Relationship between Organizational Resilience and Organizational Sustainability at Higher Education Institution [11]	G Sezen-Gültekin & T Argon	2020	Yes
Product innovation and organizational resilience in public universities in south-south Nigeria [51]	LU Ahiauzu & A Eketu	2015	Yes
Organizational resilience and enrollment trends of independent, for-profit higher education institutions [25]	K Frisbie & J Converso	2016	Yes
Impacts of COVID-19 on Health Promotion Within Higher Education: Exploring Organizational Resilience [36]	M Hawkins	2022	Yes
The unfolding process of organizational resilience in a diversity crisis: a case study of racial incidents at the University of Missouri. [52]	CL McCluney, LP Wooten, & EH James	2020	Yes
Organizational learning, organizational resilience and the mediating role of multi-stakeholder networks: A study of Egyptian academics. [14]	M Mousa, HA Abdelgaffar, W Chaouali & M Aboramadan	2020	Yes
Positioning Indonesian Islamic Higher-Education vis-à-vis Globalisation: Organisational-Resilience Dynamics [37]	ES Kusumaputri, HL Muslimah, A Ahmad	2021	Yes
Leadership attributes and behaviors as predictors of organizational resilience in academic health care systems [53]	PL Besuner	2017	Yes
Organizational Resilience at a Private, Non-Profit Institution of Higher Education [26]	CC Levine	2022	Yes
The Relationship among Organizational Myopia, Organizational Resilience and Organizational Sustainability at a Higher Education Institution in Turkey: A Structural Equation Modelling [54]	G Sezen-Gültekin & T Argon	2020	Yes
Considering the need for organizational resilience at hispanic serving institutions: a study of how administrators navigate institutional accreditation in Southern states [27]	F Fernandez & CA Burnett	2020	Yes
Relational-based resilience of a public university: a case study on losing a library by Mzuzu University in Malawi [29]	Kanyangale, M; Njoloma, E	2020	No

Resilience in Higher Education: A Complex Perspective to Lecturers' Adaptive Processes in Response to the COVID-19 Pandemic [32]	Bento, F; Bottino, AG; Pereira, FC; de Almeida, JF; Rodrigues, FG	2021	No
Support for doctoral candidates in Australia during the pandemic: the case of the University of Melbourne [12]	Le, AT	2021	No
Leading in the eye of a storm: how one team of administrators exercised disaster resilience [28]	Fernandez, F; Coulson, H; Zou, YL	2022	No
THE VALUE OF CENTRALIZED IT IN BUILDING RESILIENCE DURING CRISES: EVIDENCE FROM U.S. HIGHER EDUCATION'S TRANSITION TO EMERGENCY REMOTE TEACHING. [30]	Jiyong Park; Woonseock Son; Angst, Corey M.	2023	No
Preparing for RAE 2020 in Hong Kong: academics' research, writing and publishing trajectories in a neoliberal governance landscape. [31]	Li, Danling; Li, Yongyan	2022	No
Towards Resilient Educational System and Governance: Measuring Effectiveness and Competitiveness of Private HEIs. [33]	Delgado-Abad, Jocelyn	2022	No
Assessing the mediating effect of leadership capabilities on the relationship between organisational resilience and organisational performance [15]	Afzal Izzaz Zahari, Norhayati Mohamed, Jamaliah Said, Fauziah Yusof	2022	No
Capacity Building for Organizational Resilience: Integrating Standards on Risk, Disruption and Continuity in the Curriculum [34]	Greenwood, Lisa L.; Hess, Dawn; Abraham, Yewande; Schneider, Jennifer	2023	No
E-Learning, Resilience and Change in Higher Education: Helping a University Cope after a Natural Disaster [18]	Ayebi-Arthur, Kofi	2017	No
Educating Future Managers for Developing Resilient Organizations: The Role of Scenario Planning [13]	Hillmann, Julia; Duchek, Stephanie; Meyr, Julian; Guenther, Edeltraud	2018	No
Resilience in the context of multiple adverse circumstances? Leadership capacity and teachers' practice during COVID-19 at schools serving disadvantaged communities. [35]	Beckmann, Laura	2022	No

Appendix A. Final dataset with detailed publication information and inclusion in the initial scoping set.