Reimagining Resources Policy: Synergizing Mining Waste Utilization for Sustainable Construction Practices

Haoxuan Yu [1,2,*], Izni Zahidi [1,2,*], Chow Ming Fai [1,2], Dongfang Liang [3], Dag Øivind Madsen [4]

1. Department of Civil Engineering, School of Engineering, Monash University Malaysia, Jalan Lagoon Selatan, 47500 Bandar Sunway, Selangor, Malaysia.
2. Monash Climate-Resilient Infrastructure Research Hub (M-CRInfra), School of Engineering, Monash University Malaysia, Jalan Lagoon Selatan, 47500 Bandar Sunway, Selangor, Malaysia.
3. Department of Engineering, University of Cambridge, Trumpington Street, Cambridge CB2 1PZ, United Kingdom.
4. Department of Business, Marketing and Law, USN School of Business, University of South-Eastern Norway, Hønefoss, Norway.

* Corresponding Authors. Haoxuan.Yu@monash.edu (H.Y.); Izni.Mohdzahidi@monash.edu (I.Z.)

Abstract: To address the urgent need for sustainability, this paper provides a critical discussion and serves as a pivotal resource for stakeholders in the mining and construction sectors. It advocates repurposing mining waste into concrete aggregate, promoting eco-friendly practices. The paper conducts a thorough review of recent developments, technological innovations, and methodologies to showcase mining waste's potential as a sustainable construction material. Highlighting more than a decade of research, our analysis reveals significant environmental, economic, and practical benefits, such as reduced ecological footprints through waste minimization and resource conservation, alongside cost-effective material alternatives. This investigation offers an in-depth look at these advantages and sparks essential discussions about incorporating advanced recycling technologies into conventional construction workflows. Promoting circular economy principles, the study underscores the dual gains: lessening environmental impact and progressing towards resource efficiency. Aiming to alter industry perceptions and practices, the work encourages a shift towards environmental stewardship and innovation. Ultimately, this paper aims not only to disseminate knowledge but also to motivate action. It provides readers with the necessary insights to lead a transition towards more sustainable industry norms, thus establishing a new benchmark for addressing sustainability challenges with creativity and collective effort.

Keywords: resource recycle; mining waste; construction engineering; materials technology.

Highlights:

- ✓ This paper enhances construction sustainability by repurposing mining waste effectively.
- ✓ This paper advocates for integrating recycling and circular economy principles in construction.
- ✓ This paper promotes an industry-wide sustainability shift by leveraging mining waste's potential.

I. Introduction and Background

The growth of modern civilisation is deeply intertwined with the mining industry [1]. As society has progressed, our demand for minerals, metals, and other subterranean resources has significantly increased [2]. However, with the benefits of mining come several environmental challenges. One major problem is the uncontrolled buildup and dumping of mining waste [3]. This waste, often a mix of water and finely ground rock or ore, is typically stored in large dams or ponds close to the mining site. Such storage areas can be dangerous and risk causing harm to the environment [4,5]. This growing issue does not just stand in the way of making mining truly sustainable but also adds to environmental and natural disturbances [6]. Mining wastes, traditionally viewed as an undesirable byproduct, poses significant environmental threats beyond merely detracting from green mining practices. These materials can release major pollutants, including heavy metals and chemical contaminants, into ecosystems, critically endangering local flora and encroaching upon pristine land areas [7]. Pollutants from mining waste disrupt ecological balance and pose health risks to local communities. This highlights the urgent need for sustainable waste management solutions in the mining industry to mitigate these environmental impacts. Moving forward, in a world where sustainability is essential, addressing the issues caused by mining waste becomes crucial (Figure 1A).

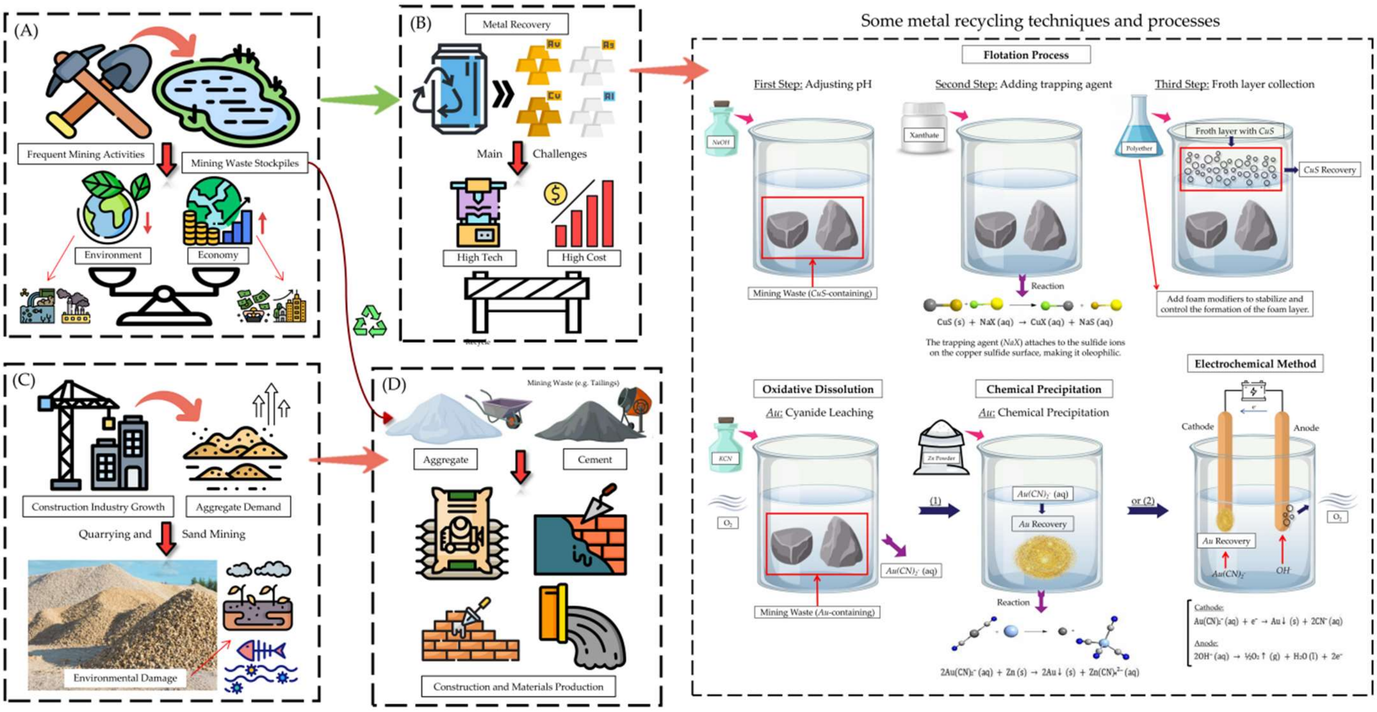

Figure 1. (A) The risk of mining waste discharge; **(B)** Metal recycling from mining waste; **(C)** The development of construction industry; **(D)** Materials recycling from mining waste into construction.

Currently, a widely endorsed approach to attaining sustainability in the mining sector hinges on the recycling of mining wastes [8]. This strategy tackles both the safety hazards of accumulating mining residues and the environmental concerns arising from these stockpiles. Additionally, recycling aligns with the increasing demand for materials in various industrial domains, bridging the gap between resource scarcity and sustainable waste management [9]. Numerous domain experts advocate that mining waste is not merely an environmental liability but, in fact, a substantial reservoir of valuable resources. Experts emphasize that these waste materials, often perceived as worthless and problematic, actually encapsulate a plethora of untapped potentials. For instance, certain mining residues contain precious metals, rare earth elements, or other minerals that remain in significant quantities, overlooked during the initial extraction processes [10,11]. Recent advancements in beneficiation technology now allow the extraction of essential metals like gold, copper, and aluminum from mining by-products, especially tailings [11-13] (Figure 1B). Despite an increasing trend toward leveraging this approach, several challenges persist. A primary concern is economic viability, as extraction costs often exceed potential returns [14,15]. Furthermore, post-extraction, the residual components, predominantly silica-based waste rock, remain largely unutilised. The continuous discharge and subsequent accumulation of such residues can result in significant environmental challenges, with land occupation being a principal concern [16]. Beyond traditional recycling, mining wastes offer potential in areas like soil amendment, which improves soil fertility and structure but faces challenges such as potential heavy metal leaching, affecting soil and water quality. Using them in eco-friendly products, such as low-impact building materials, faces hurdles in consistency, performance standards, and market acceptance [17]. Moreover, innovative applications in carbon sequestration present opportunities to mitigate climate change, yet the scalability and long-term efficacy of such technologies remain uncertain. Thus, while leveraging mining waste presents a promising approach to sustainability, it introduces economic and environmental concerns that necessitate careful consideration. Recognizing mining waste as a valuable resource paves the way for innovative applications beyond conventional recycling, addressing environmental issues and contributing to the circular economy.

The construction sector, currently grappling with an intensified demand for concrete aggregates (Figure 1C). This situation creates a fortuitous window to repurpose mining wastes in a more uncomplicated manner. Incorporating mining wastes into the construction realm, particularly as aggregates, offers a straightforward and cost-efficient solution devoid of intricate technical demands [18,19]. Beyond mere economic advantages, this approach carries broader environmental ramifications. Shifting to mining wastes reduces reliance on conventional sand and gravel, alleviating the environmental impact of these extractions [20]. Moreover, specific mining by-products, such as copper slag, when used as concrete aggregates, can bolster the structural integrity and longevity of construction materials [21] (Figure 1D). Thus, integrating mining waste into construction practices not only addresses the issue of waste accumulation but also charts a sustainable path for the industry.

Repurposing of mining waste for the construction sector is gaining significant attention, often seen as more pragmatic than solely extracting specific usable components. This evolving view is rooted in the comprehensive advantages the construction industry presents over the narrow focus of extracting singular elements. Several reasons underpin this shift in mindset. To begin with, the vast amounts of mining waste produced worldwide suggest that its integration into expansive sectors like construction is not only feasible but also environmentally prudent [22]. Utilising this waste in construction materials can significantly cut down our dependency on untapped resources, which often come at a substantial environmental price [23,24]. Additionally, the inherent characteristics of many mining wastes dovetail with the demands of construction materials. As an illustration, some mining residues have granular dimensions and textures akin to industry-standard sand, rendering them apt for concrete formulations [25,26]. Economic considerations also play a central role in this discussion. Converting mining waste into construction materials fit for construction often proves to be more economically viable than complex beneficiation methods focused on singular resource extraction [27-29]. Such cost-effectiveness is attributed to streamlined processing, reduced energy consumption, and sidestepping the expenses related to waste management or extended storage. From a broader perspective, the environmental impact is hard to ignore. With the construction industry veering towards greener methodologies, the case for incorporating mining waste strengthens. This approach not only provides a mechanism to diminish the environmental repercussions associated with construction, but it also furnishes a cohesive response to the quandaries of mining waste stewardship [30].

This paper is strategically designed to serve as both a discussion piece and a pivotal information resource for professionals and stakeholders in the mining and construction industries. It delves into the innovative repurposing of mining waste as aggregate in concrete production, advocating for a shift towards sustainable and eco-friendly practices. Through a comprehensive examination of the latest trends, technologies, and methodologies, the paper aims to shed light on the untapped potential of mining waste, transforming it from a by-product into a valuable resource for sustainable construction. By presenting a thorough analysis of the environmental, economic, and practical implications of such repurposing efforts, this document seeks to inspire a paradigm shift in how industry professionals perceive and utilize mining waste. It underscores the critical importance of adopting circular economy principles, which not only mitigate environmental impacts but also contribute to a more resource-efficient and sustainable future. Beyond merely presenting data, this endeavor seeks to spark a dialogue on the necessity of integrating innovative recycling techniques into mainstream construction practices. The ultimate goal is to equip readers with the knowledge and inspiration to drive the transition towards more sustainable industry standards, setting a new precedent for environmental stewardship and innovation in the face of global sustainability challenges.

II. Research Methodology and Significance

The methodology of this study is meticulously designed to analyze and clarify the complex relationship between the reuse of mining waste in construction and its evolving impact on industry practices and sustainability. The journey begins with an exhaustive gathering and examination of literature spanning from 2010 to 2022. This timeline is pivotal as it encapsulates a period marked by heightened awareness and action towards sustainability, particularly in the domains of mining and construction.

Central to the study are two pressing questions that drive the research narrative. The first question (Q1) delves into the historical integration of mining waste into the construction industry, examining how this integration has evolved and what rich insights a detailed overview of past and current practices can offer. The second question (Q2) casts an eye towards the future, contemplating how the trajectory of sustainable practices in mining and construction will inform and shape the strategies for mining waste repurposing. Together, these questions anchor the research in historical context and propel it forward, bridging past practices with future possibilities.

Utilizing a specialized search query within the Web of Science (WoS) database, accessed on 2023/08/31, the research initiative successfully compiled 298 pertinent academic articles. The choice to utilize the WoS database was grounded in its reputation for comprehensive coverage and high-quality, peer-reviewed publications. These articles intricately connect the domains of mining waste and the construction industry, adhering to a meticulously formulated Search Strategy:

- ✓ Search Formula: ("mining waste" OR "mine waste" OR "mining waste rock" OR "tailings" OR "red mud" OR "coal gangue") AND (recycle* OR reuse* OR reclaim*) AND ("construction materials" OR "construction engineering" OR "concrete materials" OR "cement" OR "cementitious material") Filter used: 2010/01/01-2023/08/31

With 298 relevant academic papers in hand, the study does not merely skim through these works but engages with them deeply, employing the sophisticated analytical capabilities of Citespace V6.1 R6 [31]. This premier visualization software is not just a tool but a lens that magnifies, dissects, and illuminates the nuanced interplays and intricate patterns woven throughout the collated papers. It aids in unearthing underlying trends, pinpointing regional contributions, and spotlighting the seminal works that have punctuated this research domain [32].

The ambition of this research transcends the realms of mere quantitative or qualitative analysis. It is a quest to distill the very essence of each paper, to extract those groundbreaking discoveries, pivotal contributions, and innovative solutions that collectively form the rich tapestry of this field. Each insight is carefully woven into a cohesive and informed narrative, a tapestry that narrates the journey of mining waste from being a by-product to becoming a cornerstone in the edifice of sustainable construction.

This study, building on the meticulously designed methodology, not only bridges significant research gaps but also marks a seminal stride in sustainable construction through the repurposing of mining waste. This thorough investigation highlights mining waste's potential in fostering environmental, economic, and regulatory advancements and catalyzes a transformative shift in industry perceptions. Recognizing mining waste as a resource paves the way for groundbreaking sustainability practices, intertwining environmental conservation with resource efficiency. This paradigm shift, far from being merely theoretical, proposes tangible strategies and best practices, aligning with global sustainability ambitions and potentially revolutionizing construction methodologies. Thus, the study is poised to substantially influence both practical applications and policy frameworks, propelling the construction industry towards a more sustainable and resource-efficient future.

III. Bibliometric Analysis

3.1 Co-occurrence Analysis

Through the lens of keyword co-occurrence analysis (Figure 2), we pinpointed several predominant keywords that have consistently resonated in studies concerning the recycling of mining wastes within the construction sector from

2010 to 2023. Notably, these pivotal terms include categories: characterisation "Mechanical property/Behavior/Compressive strength/Performance", waste type "Red mud/Fly ash/(Mine) tailing/Coal gangue/Slag", and waste destination "Concrete/Cement/Brick/Backfill". These significant keywords maintain a synergistic and inseparable connection with each other.

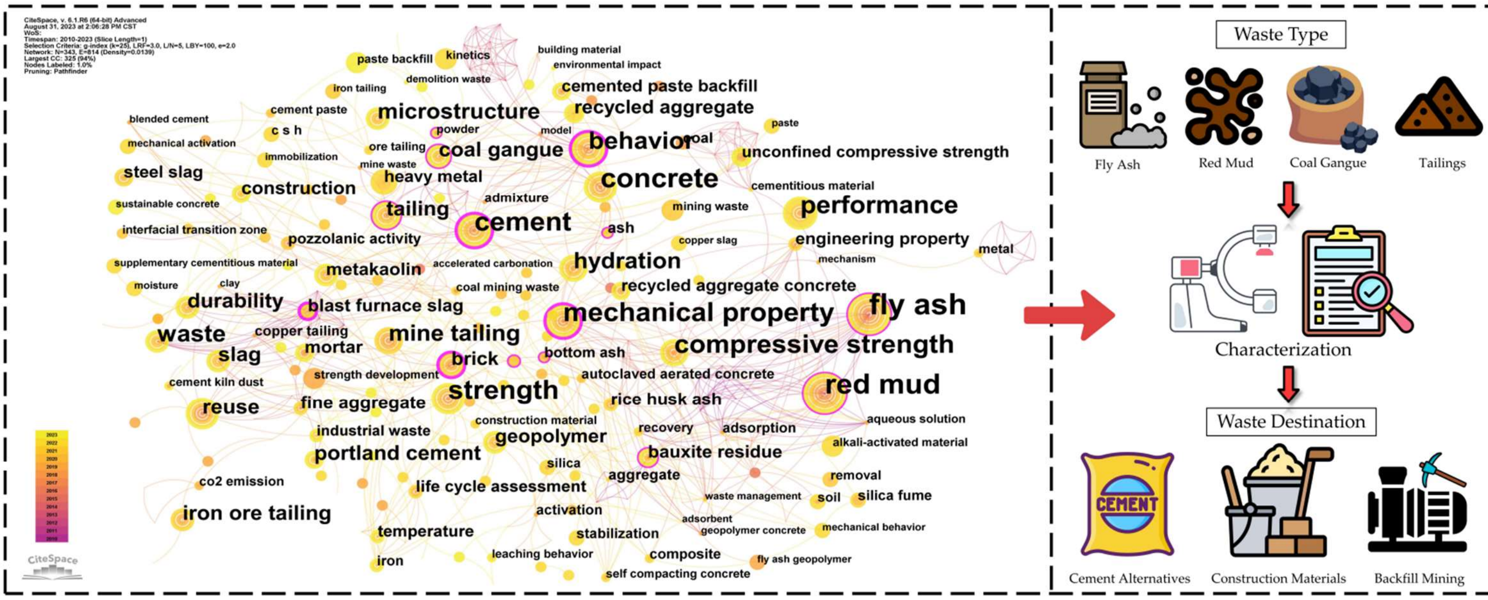

Figure 2. Keyword co-occurrence analysis graph.

Mining wastes are repurposed extensively as cementitious, construction, or backfill materials, amplifying their inherent characteristics. Generally viewed similarly, construction materials and backfill materials are often seen through a similar lens, where backfill materials specifically cater to replenishing voids left from mining operations. Mining waste, based on its potential for reuse, is classified into three distinct categories. The first category includes materials like fly ash, utilized primarily as raw materials for cementitious substances but not typically as aggregates for construction or backfill due to their fine particle size and specific chemical properties, which lend them a pozzolanic activity beneficial for cement. The second category comprises materials such as tailings, coal gangue, and slag, favored as aggregates rather than cementitious materials, given their larger particle size which doesn't suit cement production. However, their specific compositions can enhance the strength of the final construction materials. The third category, exemplified by red mud, is versatile, acting both as a raw material for cementitious products and as an aggregate, owing to similar properties to fly ash and its ability to contribute to the strength of concrete mixtures when combined with cement.

This classification stems from a straightforward rationale: the physical and chemical characteristics of these materials, such as particle size and reactivity, dictate their most suitable applications in construction, guiding sustainable and efficient reuse strategies. Specifically, fly ash, characterized by its fine granularity and pozzolanic behavior, interacts with calcium hydroxide to forge compounds crucial for the cement's resilience and longevity. Tailings, coal gangue, and slag, notable for their coarser textures, find their niche not within the realm of cement but as superior aggregates, where their unique mineralogy can significantly bolster the structural integrity of various construction endeavors. Like fly ash, red mud is versatile and enhances concrete through its alumina content, thus improving the composite's mechanical strength.

Keyword co-occurrence analysis from our in-depth examination of recent studies indicates a growing prominence of red mud, increasingly cited for its potential as a sustainable alternative to traditional cement [33-38]. This highlights its role in reducing costs and enhancing the sustainability of construction materials [39,40], particularly in backfill applications where its similarity to conventional concrete aids underground stability [35,41]. Additionally, the combination of coal gangue used as aggregate and fly ash as a cementitious material has shown promising strength in construction and backfill materials [42-44]. Also, coal gangue's widespread reuse in concrete brick production due to its abundance further underscores its utility [45,46]. While tailings and slag appear less frequently in such analyses, their long-standing application as aggregates in construction and backfilling showcases the maturity of these technologies [47-50].

Overall, red mud is the preeminent focus in mining waste studies, holding a substantial share in the analysed literature with 95 of the surveyed articles spotlighting its reuse. Upon delving deeper into regional co-occurrence analysis (Figure 3), it emerges that China stands at the forefront in research efforts dedicated to mining waste reuse, maintaining a sustained focus over an extensive period. Additionally, China has fostered robust collaborations and synergies with regions such as Turkey, United States, Australia, and Canada, spearheading advancements in mining waste recycling research. Remarkably, a significant fraction of the literature concerning red mud reuse originates from China, with 48 of the 95 relevant studies being Chinese contributions, which can be attributed to a number of factors. Primarily, China grapples with the scarcity of high-quality bauxite resources coupled with low ore grades [51,52]. Consequently, red mud, a by-product of bauxite processing, becomes a focal point of research. Recycling red mud not only addresses environmental concerns stemming from its disposal but also paves the way for innovation in ancillary industries, prominently the construction sector. This concerted effort mirrors China's commitment to mitigating environmental impacts while catalysing industrial growth and development.

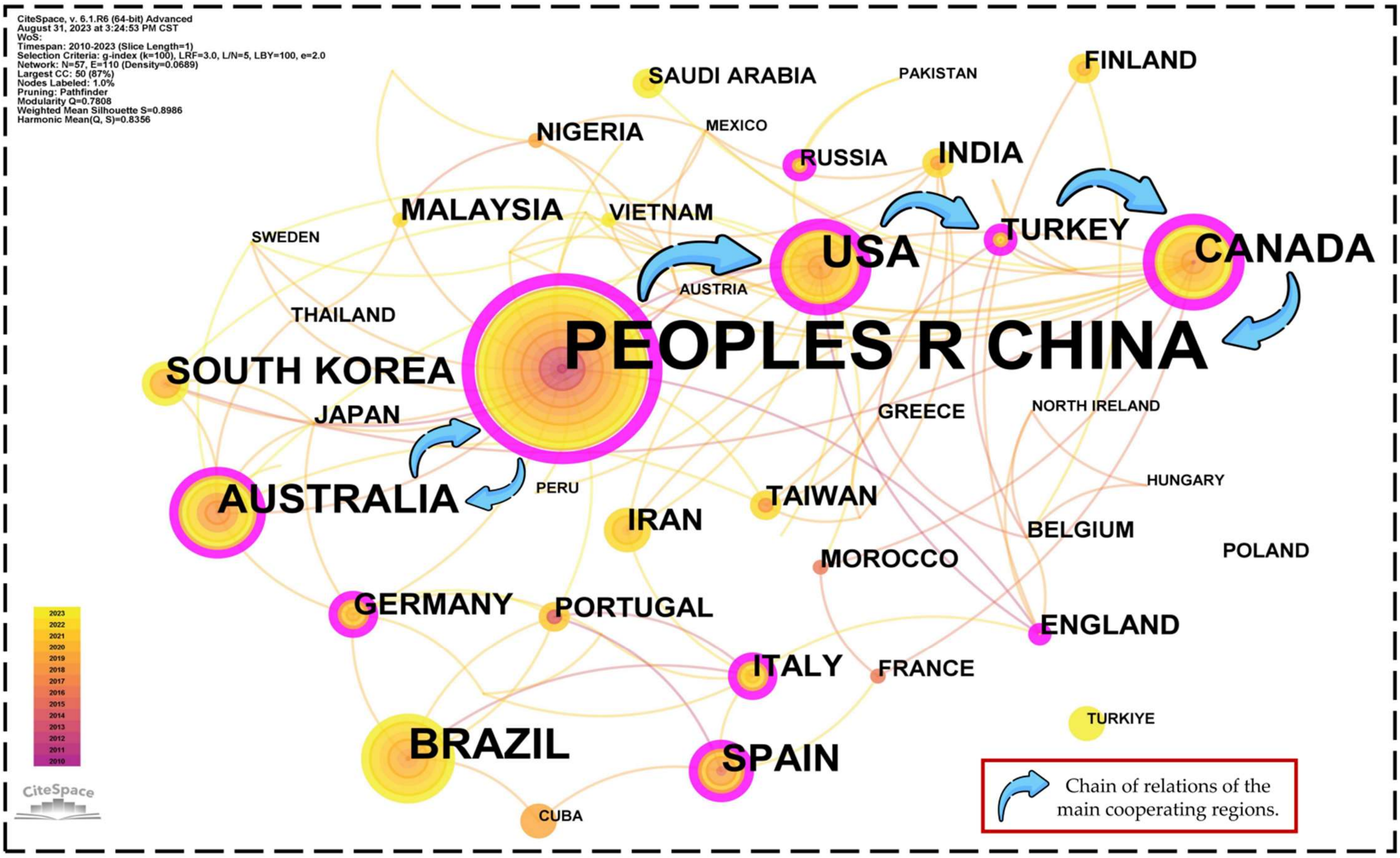

Figure 3. Regional co-occurrence analysis graph.

The detailed keyword co-occurrence analysis delineates a vibrant and evolving research landscape where the repurposing of mining waste, particularly red mud, has emerged as a focal area of investigation, catalyzing innovative applications within the construction sector. The surge in research, especially prominent in China, underscores a global commitment to sustainable practices that align environmental stewardship with industrial advancement. Moving forward, this momentum is anticipated to spur further collaborations and breakthroughs, steering the industry towards a future marked by sustainability and resource optimization. The burgeoning developments hint at a future where the intertwined fate of the mining and construction sectors unfolds synergistically, heralding a new era of eco-conscious and economically viable advancements.

3.2 Keyword Temporal Analysis

In harnessing the analytical capabilities of Citespace V6.1 R6 software, a detailed temporal analysis was carried out to unravel the intricate patterns and trends prevalent in the mining waste recycling research spanning from 2010 to 2023. Initially, a substantial dataset comprising relevant academic papers from the specified timeframe served as the foundation for this in-depth analysis. Utilising Citespace software, a temporal visualisation was crafted, vividly illustrating the shifts and evolutions in research focus and methodologies over the years (Figure 4).

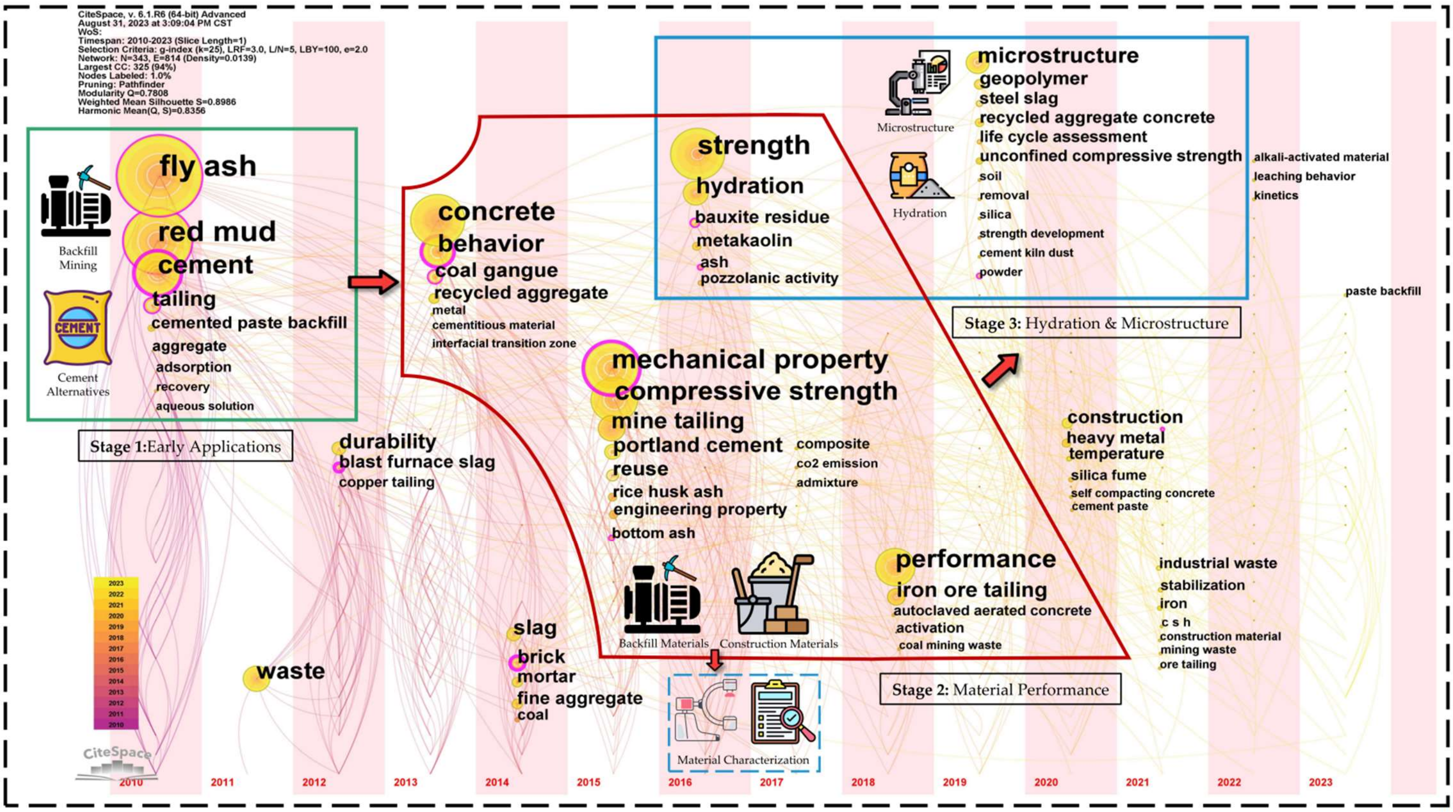

Figure 4. Keyword temporal analysis graph.

The keywords "Fly ash", "Red mud", and "Cement" emerged as the foremost and most consistently mentioned keywords throughout the period from 2010 to 2023. This trend underscores the longstanding efforts, dating back even before 2010, to recycle mining waste as a resource for preparing alternatives to traditional cement [53]. Furthermore, the persistence of keywords such as "Tailings", "Aggregates", and "backfill" from 2010 to 2023 highlights two distinct yet converging trajectories in the recycling of mining waste within the construction sector. The first trajectory emphasises the utilisation of tailings as aggregates in creating cementitious materials designated for backfill purposes in mining activities. Concurrently, another trajectory focuses on exploring these tailings' use as vital components in crafting materials suitable for broader construction applications. While the integration of tailings in backfill materials has been a prevalent practice [54-56], harnessing their potential in general construction materials has notably gained momentum in the recent decade, paving the way for more sustainable and innovative construction solutions [57,58]. Besides tailings, various other forms of mining waste are progressively harnessed in developing construction materials. They delineate into two main streams: some serve as raw materials in crafting cement substitutes [59,60], while others function as aggregates in formulating concrete materials and associated products [61-63]. This shift is underscored by the prominent keywords of 2013: "Cementitious materials" and "Concrete", and further affirmed by 2014's notable keywords, "Brick" and "Fine aggregate".

After 2015, research focus shifted noticeably towards an in-depth exploration of material characteristics, with "Performance" and "Strength" emerging as key terms. For alternatives to cement, the post-2015 inquiries have largely delved into the nuanced composition [64], elemental constituents [65], and reactivity of these burgeoning cementitious materials [43,66]; when it comes to construction concrete materials and backfill materials, sophisticated analytical techniques like XRD (X-Ray diffraction analysis) and XRF (X-ray fluorescence analysis) have become instrumental in characterisation processes, highlighting both the material's structural intricacies and their performance capabilities. Yet, amidst these developments, the assessment of strength maintains a pivotal role, standing as a primary criterion in evaluating the viability of these materials in construction applications [67-69]. During the same timeframe, there has been a discernible upward trend in the attention paid to the hydration reactions and microstructure of mining wastes repurposed in construction materials. Understanding hydration reactions is crucial for construction materials developed from mining waste. Researchers are keen to ascertain whether these reactions parallel those seen in traditional cement, specifically in terms of generating strength-conferring structures like C-S-H (Calcium-Silicate-Hydrate), observing under the electron microscope [70,71]. Simultaneously, using mining waste as an aggregate has spurred considerable investigative efforts to discern how its composition might influence the cement's hydration dynamics, and how the interplay between aggregate ratios and environmental conditions can potentially modulate the formation of hydration products, including structures akin to those found in cement, such as ettringite and C-S-H [72].

Since 2015, the environmental attributes of recycling mining waste have increasingly come under scrutiny, with a growing focus on "Life Cycle Assessment" and "Heavy Metal" frequencies in academic discourse. This shift highlights a critical understanding of the importance of evaluating the long-term environmental impacts of utilizing mining waste, particularly assessing the leaching behavior of heavy metals from derived products. These evaluations are essential for ensuring the applications of these materials are safe and environmentally sound, marking a pivotal step towards sustainable mining practices. A notable study in China has showcased the environmental benefits and regulatory advancements resulting from recycling mining waste [39]. The study discovered that mixing red mud with cementitious materials significantly reduces the emission of hazardous substances, such as heavy metals and organic pollutants. This reduction is achieved by immobilizing these contaminants within the cement matrix, thus preventing their leakage. Moreover, toxicity leaching tests on cement-based materials using red mud as aggregate nearly met domestic water standards in China, leading to a gradual acceptance of these materials under environmental policies. China's "Green Mine Construction" initiative exemplifies this acceptance, highlighting a significant shift towards embracing materials derived from mining waste for sustainable construction practices.

The trajectory from 2010 to 2023 manifests a discerning shift in the research focused on repurposing mining waste in the construction sector, navigating through three pronounced phases of exploration. Initially, the use of mining wastes such as red mud and fly ash (by-product from incinerators) as raw materials in creating new cementitious substances was a prominent and widespread strategy, establishing a foundational footprint in the literature before 2010. Subsequently, mining waste recycling expanded its horizons, rigorously exploring the utilisation of tailings not just as aggregates in backfill operations but also as fundamental elements in broader construction projects. This phase witnessed a significant surge in inventive approaches to construction, harnessing a diverse spectrum of mining wastes, a shift markedly echoed in the focal studies around 2013 and 2014. Transitioning post-2015, a deeper dive into the material characteristics became the epicentre of research, reflecting a keen interest in understanding the intricate compositional details and reactivity of emerging cementitious materials. This phase embodied a convergence of scientific rigour and technological advancements, utilising tools like XRD, XRF and electron microscope for comprehensive material analysis. Furthermore, an amplified focus on understanding the hydration reactions and microstructural dynamics has set the stage for future innovations in the field. Moreover, since 2015, there's a growing focus on the environmental benefits of products derived from recycling efforts. This trend indicates an increasing awareness and commitment to assessing and enhancing the ecological impact of recycled materials, emphasizing the need for sustainable practices in waste management and material production. Collectively, these phases portray a thriving and evolving research landscape, steering towards more sustainable and innovative solutions in the construction industry, fostering a future that harmonises scientific insights with environmentally conscientious practices.

3.3 Cluster Analysis, Cluster Timeline Analysis, and Keyword Burst Analysis

In the cluster analysis, keywords and topics are categorised based on their similarity and frequency of occurrence, establishing "clusters" that spotlight the intricate relationships and interdependence among them. From a set of ten clusters, we discerned the predominant research themes within the surveyed literature (Figure 5A). This analysis unveiled that, beyond the solid waste categories and prevalent research methodologies (such as LCA) [73,74], there is a marked emphasis on aggregate recycling, properties (mechanical and frost) [75,76], and compressive strength. These findings underscore the significance of construction material destination and in-depth material characterisation within the domain. By engaging deeply with the cluster timeline analysis (Figure 5B), we have carefully traced the development of these clusters across several years, offering a temporal perspective to witness the shifts and transformations in research focal points. It is noteworthy to mention that the cluster timeline analysis bears a resemblance to the keyword temporal analysis, wherein it encapsulates the analysis of keyword evolution within each respective cluster over a designated time span. Consequently, the insights derived from the cluster timeline analysis often align with those discerned from the keyword temporal analysis, thus affirming the intricate interrelations and concurrent trajectories discernible in the research trends pertaining to the reuse of mining waste in construction materials. It is evident that, over the years, the scope of research has expanded beyond just exploring the basic engineering applications of recycling mining waste. Instead, it has ventured into a more nuanced exploration, delving deep into the intricate characterisation, chemistry, and microstructure of construction materials developed from mining waste as a foundational element. This transition underscores an escalating acknowledgement of the rich potential harboured by mining waste in spearheading sustainable initiatives within the construction industry, championing both environmental stewardship and economic efficacy.

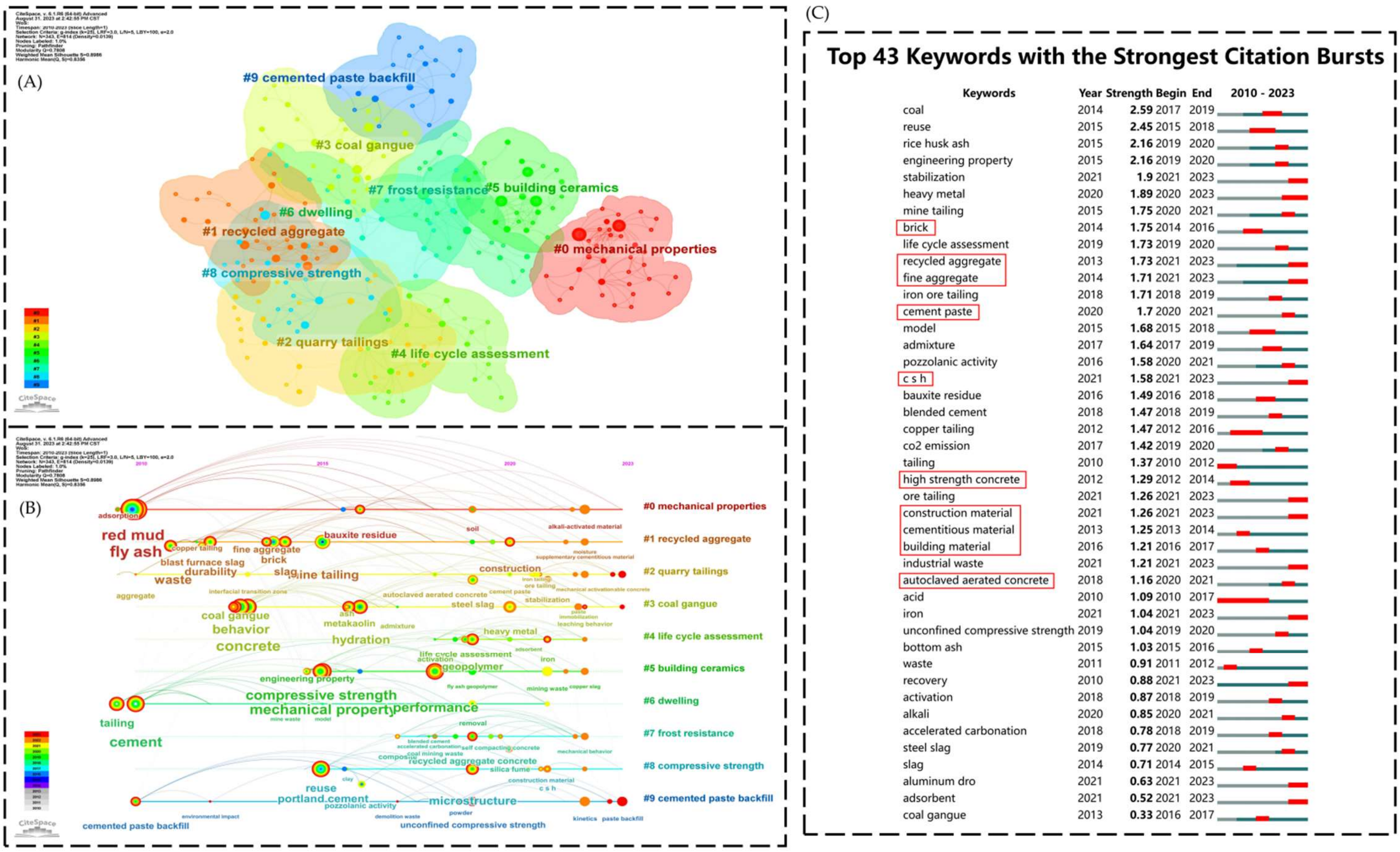

Figure 5. **(A)** Cluster analysis; **(B)** Cluster timeline analysis; **(C)** Keyword Burst analysis.

Significantly, through the synergistic application of Cluster Analysis (Figure 5A), Cluster Timeline Analysis (Figure 5B), and Keyword Burst Analysis (Figure 5C), it becomes apparent that the primary reuse application of mining waste has been progressively steering towards the recycling of aggregate in the formulation of high-performance or specialised-performance concrete materials. Within the Keyword Burst Analysis, there is a notable surge in keywords related to aggregate recycling, high-performance concrete, and other construction materials, commanding prominent rankings among the strongest citation bursts. Indeed, the journey of research and innovation in utilising mining waste is an ongoing endeavour, encompassing avenues such as the development of mining waste as a viable alternative to traditional cement. Nevertheless, the central trajectory in recycling mining waste is distinctly shifting towards the domain of aggregate recycling, specifically in the formulation of high-performance or speciality concrete materials. We outline our hypotheses regarding this trend as follows:

- ✓ The process of cement preparation is steeped in a rich history spanning hundreds of years, boasting a level of maturity and refinement [77,78]. The initiative to transform mining waste into a novel cementitious material, thereby replacing traditional cement, aligns well with the principles of sustainable development. However, from a technical standpoint, this venture is still in its nascent stages, facing a path brimming with challenges and discoveries yet to be made [79].

- ✓ Repurposing mining waste as aggregate for cement-based construction materials (or backfill applications) [80,81] presents a more immediate and practical solution to the burgeoning issue of waste accumulation. This approach not only facilitates a swift and extensive resolution to waste management concerns but also capitalises on certain inherent properties of mining waste. These attributes can be harnessed to craft high-performance [82] or specialised building materials [83], transforming a problem into an opportunity for innovation and sustainability in the construction sector.

The analysis vividly outlines the evolving trends in mining waste application within the construction sector. Through cluster analysis, we highlight critical connections and dominant themes, emphasizing innovative recycling strategies and a deeper focus on material characterization, mechanical properties, and environmental impacts. The timeline analysis further delineates these trends, offering a dynamic perspective on the shifts and expansions in research focal points over the years. The collaborative insights from cluster analysis, cluster timeline analysis, and keyword burst analysis indicate a significant shift towards utilising mining waste in creating high-performance construction materials, corroborated by a recent surge in pertinent keywords. This trajectory signifies a sustained commitment to harnessing the sustainable potentials of mining waste, foreseeing a promising path where innovation and sustainable solutions take the lead, transforming mining waste from a challenge to a valuable asset, enhancing environmental sustainability and economic viability in the construction industry [84,85].

3.4 Further Discussion

Over time, the amalgamation of mining waste and the construction sector has traversed a remarkable journey (Figure 6), marked by significant advancements and innovations.

The initial integration of mining waste into the construction sector began with simple recycling methods, predominantly using such waste as aggregates for backfill materials to stabilise mining underground infrastructures. Early studies also identified red mud and fly ash (by-product from incinerators) as viable alternatives for cement production, paving the way for in-depth research and broader applications. As the field developed, the focus transitioned from basic reuse to exploring the multifaceted applications of mining waste, particularly as aggregates in various construction projects. Around 2013 and 2014, the sector witnessed a burgeoning tide of innovation, venturing into an expansive realm of mining waste potentials while accentuating material characterization. Although analytical techniques like XRD and XRF aren't at the cutting edge anymore, they found renewed prominence around 2015, remaining crucial tools for the in-depth analysis of properties inherent to materials derived from mining waste. This era underscored an intensified curiosity towards the exploration of hydration reactions and the microstructures of building materials crafted from mining waste. Researchers were keen on drawing comparisons with conventional cement foundations, delving deeply into the genesis of structures that enhance strength, such as C-S-H (Calcium Silicate Hydrate), thereby heralding prospective sustainable developments within the industry.

Regarding waste destination, the trajectory of mining waste utilisation has progressed remarkably from its rudimentary stages, where it found usage as a component for backfill materials and as potential constituents in cement substitutes, expanding eventually to encompass more comprehensive roles within the construction sector such as in the fabrication of building concrete and road foundation materials. Currently, the predominant avenues for repurposing mining wastes hinge significantly on recycling them as aggregates to craft high-performance or specialised concrete and backfill constituents. This method not only presents a viable solution to the growing issue of mining waste accumulation but also ingeniously leverages the intrinsic properties of these wastes. Also, this approach enhances environmental protection by potentially encapsulating harmful pollutants, thus preventing their release into the environment.

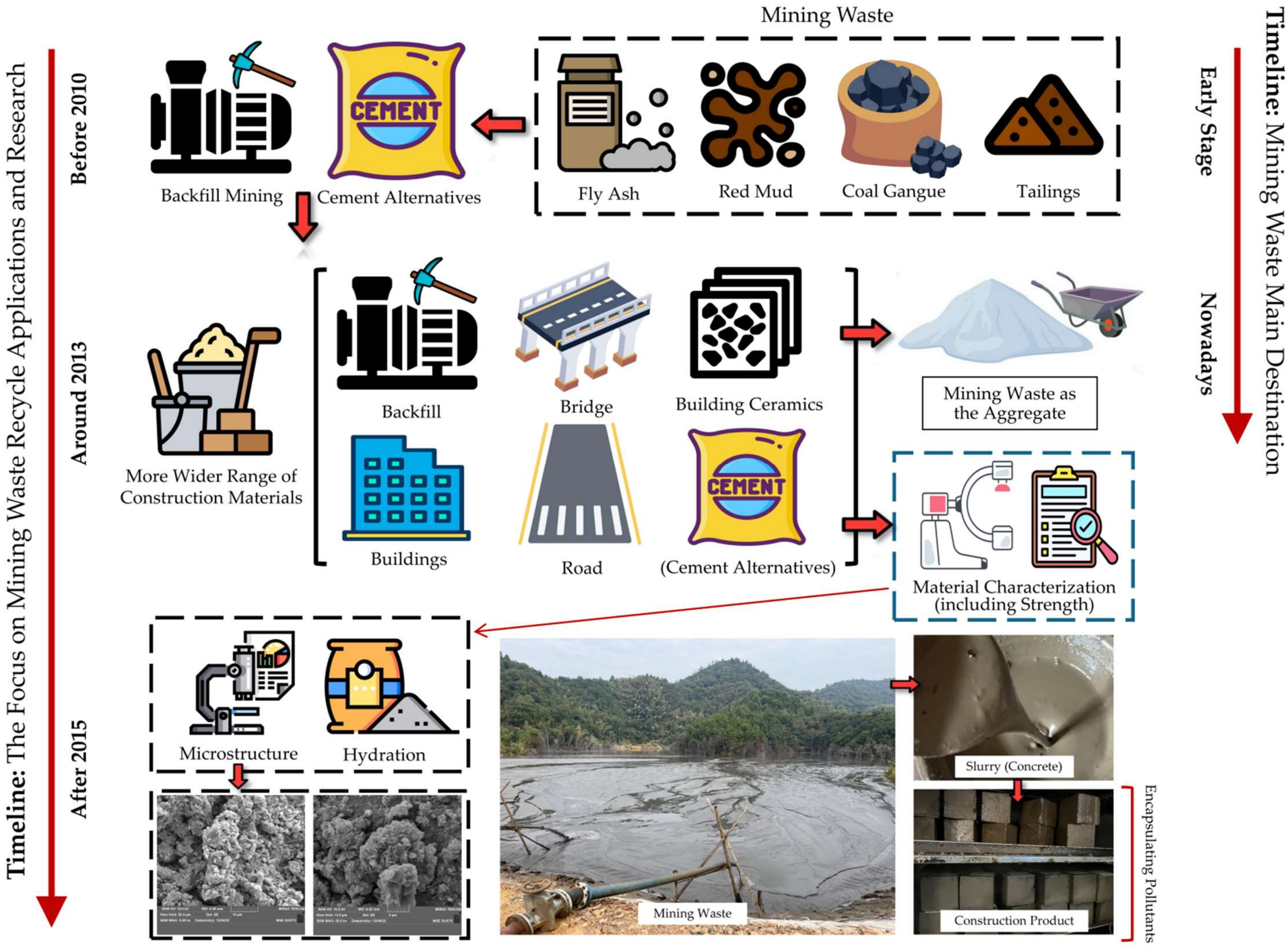

Figure 6. The Integration Journey of Mining Waste with the Construction Industry.

The symbiosis between mining waste and the construction sector has undergone profound transformations over time. Initially confined to rudimentary applications, the integration now showcases nuanced and multifaceted strategies. In the present scenario, it seems the sector has pinpointed an optimal utilisation path for mining waste, predominantly as backfill substances or constituents in construction materials. This evolution stands as a beacon of the escalating dedication towards unearthing the sustainable potentials of mining waste, fostering innovative and environmentally sustainable avenues. These initiatives project a promising future, pivoting the perspective on mining waste from a challenging concern to a significant catalyst for fostering economic and environmental advancements within the construction realm.

IV. Further Literature Analysis and Prospects

The convergence of sustainable approaches within the mining and construction sectors signals a transformative shift, intertwining environmental responsibility with economic ingenuity within evolving frameworks. The trajectory these sectors are on is clear: a promising future marked by innovative strategies for repurposing mining waste, born from enhanced collaborations between these intertwined industries. Over the past decade, the intertwined dynamics between mining and construction have become increasingly apparent, largely attributed to their shared dependence on natural resources and material flow. Looking ahead, an even tighter integration of these sectors is expected, driven by shared goals for sustainable development and collaborative efforts that leverage the unique strengths of each field to advance pioneering initiatives for the reuse of mining waste.

Technological Advancements in Waste Management: Firstly, the technological evolution, notably the advent of intelligent systems, is set to play a pivotal role in advancing the utilisation of mining waste in the construction sector. This potential fusion with burgeoning technologies like artificial intelligence, data analytics, and the Internet of Things (IoT) is gradually transcending from a concept to an established reality. Illustratively, since 2018, research endeavours such as those led by Qi et al. [86-89], have been at the forefront in developing various intelligent models to predict the strength of cementitious materials using mining waste as aggregate, providing vital insights at different stages of preparation. These developments aim to significantly enhance decision-making and optimisation models concerning the strength of cementitious materials. Looking ahead, we anticipate not merely the emergence of sophisticated intelligent decision-making systems but also the integration of this technology with advanced construction equipment. This synergy is expected to revolutionise the sector by autonomously controlling the proportion of mining waste utilised in creating construction materials, thereby paving the way for more informed, efficient, and intelligent construction processes.

Sustainable Waste Management Policy: Secondly, the successful case studies illustrating both environmental and economic dividends stemming from the integration of mining waste in the construction sector pave the way for broader policy adaptations. It is anticipated that in the near future, governments and global entities will forge policies fostering sustainable initiatives [90]. Besides bolstering the ongoing endeavours to reincorporate mining waste in the construction sphere, these policies are expected to encompass a wider range of applications, including facilitating the creation of other chemical products. Furthermore, these strategies are slated to catalyse the formulation of green building standards

[91], thereby endorsing the utilisation of materials regenerated from mining waste. This active advocacy and incentivisation from policy quarters are poised to synchronise efforts and foster collaboration, consequently amplifying the efficacy of reuse strategies. This is seen as a harbinger of a new phase of sustainable development, where industrial functions align symbiotically with environmental norms, fostering a landscape that promotes harmonious growth and ecological conservation [91].

Circular Economy and Waste Classification Framework: Finally, spurred by the successful endeavours in reincorporating mining waste within the construction sector, which have culminated in both environmental and economic boons, the circular economy's principles are set to be embraced extensively as a central element in future strategies pertaining to mining waste management and sustainability [92]. This economic paradigm accentuates the prudent management of resources through initiatives that encompass reducing, reusing, and recycling materials. As we navigate the foreseeable future, we anticipate the emergence of an augmented array of frameworks dedicated to the stratification and reintroduction of mining waste. These frameworks are poised to delineate blueprints for formulating strategies that aim to mitigate waste and augment resource utilisation, thus amplifying the advantages of a circular economy [83,93]. Consequently, this progression promises to foster a mutually beneficial relationship bridging the mining and construction sectors, with the potential to extend its positive influences to various other industries, thereby fostering an interconnected and synergistic industrial ecosystem.

The integration of cutting-edge technology with forward-thinking policies marks the beginning of a new era for the mining and construction sectors. Focusing on a future underscored by resource optimisation, embracing circular economy tenets represents a profound metamorphosis in resource stewardship, engendering interconnected industrial synergies. As we embark on this luminous journey, the emphasis on fostering collaborations and spearheading innovations in tandem with global sustainability benchmarks cannot be overstated. The forthcoming era encapsulates a vision of harmonious integration between technological evolution and environmental guardianship, laying down a foundation for enduring growth and comprehensive progress. Our path forward is shaped by the collaboration of the mining and construction industries, supporting a new paradigm of environmental commitment and economic wisdom.

4.1 Technological Advancements

Recognizing the transformative role that the technological evolution is slated to play in reshaping the utilization of mining waste within the construction sector is imperative. This forthcoming synthesis with rapidly emerging technologies - including artificial intelligence, data analytics, and the Internet of Things (IoT) - is no longer just an ambitious vision, but is progressively becoming an established reality that holds the potential to redefine industry standards. This transition marks the beginning of a promising journey where technology and sustainability converge to foster a new paradigm in construction and waste management, laying a firm foundation for advancements that are both intelligent and environmentally responsible.

Cutting-edge technologies have already begun to illuminate prospects within the domain, particularly in leveraging artificial intelligence (AI) for predicting critical aspects associated with the reincorporation of mining waste in the construction sector. Initially, AI found a significant application in waste management endeavours, aiding in the precise forecasting of annual solid waste emissions originating from specific mining sites [94]. However, the focal point gradually transitioned towards enhancing the sustainability of the construction industry, with a surge in research efforts utilizing AI techniques to predict the efficacy of cementitious materials fortified with mining waste aggregates, accurately estimating vital attributes like 3-day, 7-day, and 28-day strengths [95,96]. Within this burgeoning field, the contributions of Qi et al [86-89], previously acknowledged, stand as a beacon of expertise and innovation, spearheading the progressive development and substantiating the promising potential this approach harbours. Furthermore, the incorporation of data analytics has become an indispensable component in this venture, complementing the predictive proficiencies of AI to forge a research trajectory that is both robust and forward-thinking [97], as corroborated by Qi et al [98] in their seminal works. (Figure 7A)

Initially, the incorporation of the Internet of Things (IoT) in mining waste management primarily served to synchronize with sensor technologies for safety and environmental surveillance of tailings storage facilities, such as ponds or dams [99]. This technological synergy was instrumental in scrutinizing potential safety hazards at sites earmarked for mining waste deposition, and in monitoring the environmental health of the adjoining soil and water bodies, which are perennially at risk of contamination due to waste discharge. As the narrative pivoted towards a rising emphasis on repurposing mining waste within the construction sector, a noteworthy shift was observed in the application of IoT technology. Nowadays, it often interfaces synergistically with blockchain technology, facilitating meticulous monitoring of the origin of raw materials designated for construction usage [100,101]. This collaboration is particularly pivotal in tracing mining waste back to its source, a step that ensures compliance with established criteria essential for its incorporation in the formulation of construction materials, thereby fostering a sustainable and accountable materials pipeline. (Figure 7B)

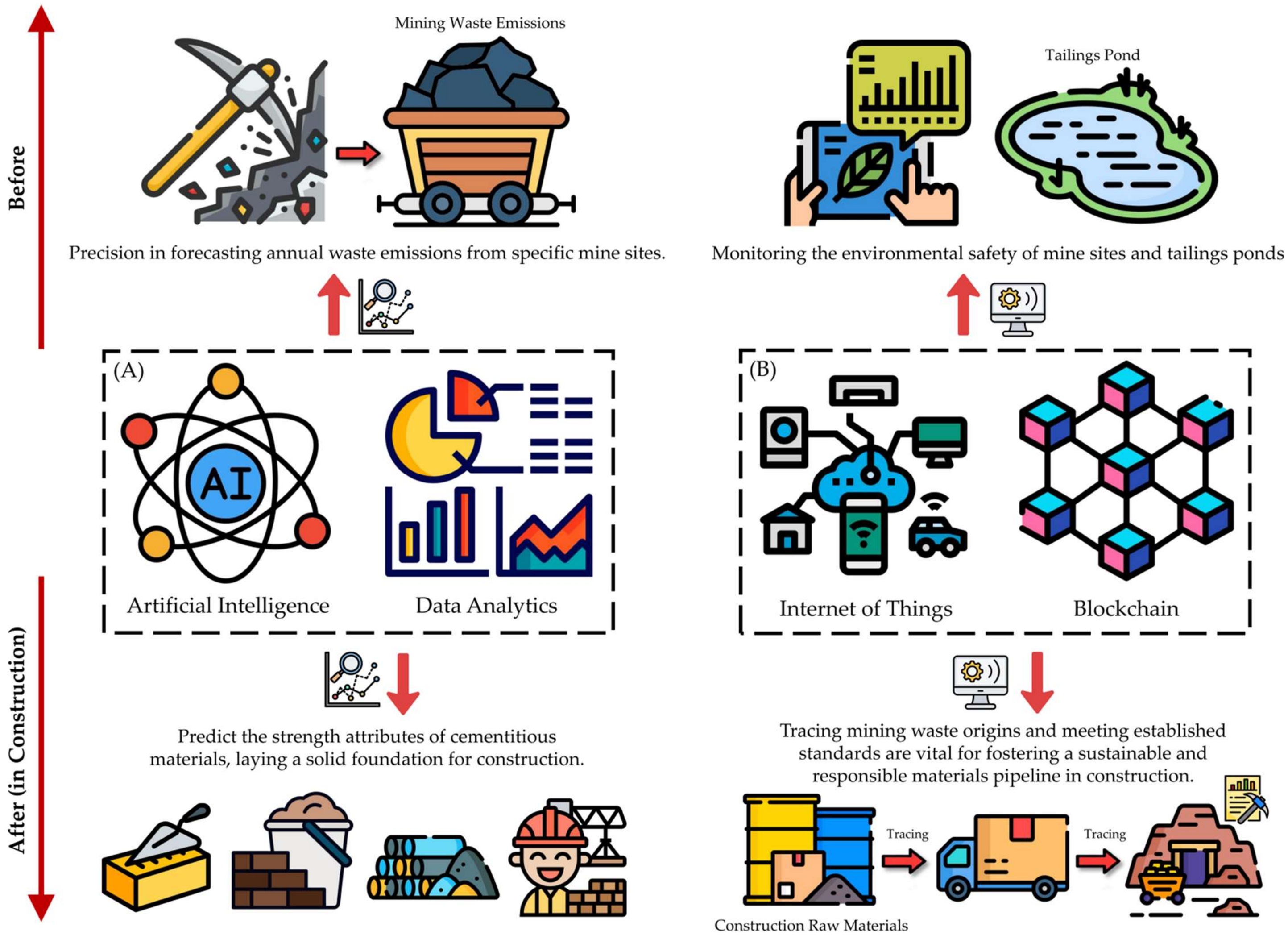

Figure 7. (A) Leveraging AI technology and data analytics for optimized management and reuse of mining waste in construction; **(B)** Leveraging IoT technology and Blockchain for optimized management and reuse of mining waste in construction.

We stand at the dawn of a revolutionary era in the construction sector, characterized by the burgeoning integration of technologies like artificial intelligence, data analytics, the Internet of Things (IoT), and blockchain in the realm of mining waste re-utilization. Despite promising strides, it is crucial to recognize that this is merely the inception of a technological convergence that still harbours substantial untapped potential. The path ahead is long and laden with opportunities for groundbreaking research and refinement, necessitating a focused approach towards further development and integration of these high-end technologies. The industry stakeholders are at a juncture where collaboration and innovation are vital in navigating the complexities that lie ahead, pushing the boundaries of what is currently achievable and fostering a future where technological advancements align seamlessly with environmental responsibility.

4.2 Waste Management Policy

Standing at the nexus of environmental responsibility and industrial growth, there is a burgeoning realization of the profound dividends, both environmental and economic, that emerge from integrating mining waste into the construction sector. Governments and global entities are gradually gearing towards policies that not only strengthen the sustainable reincorporation of mining waste but also foster a broader spectrum of applications, even reaching as far as the formulation of green building standards. This alignment with policy directives heralds a new era where industrial practices align with ecological standards, promoting both economic growth and environmental preservation.

Undoubtedly, we are witnessing the rise of several sustainability concepts concerning the recycling of mining waste, with "Green Mining" concept standing out as the most significant catalyst [102,103]. This concept, heralded by authoritative institutions like the Massachusetts Institute of Technology (MIT) [104,105], embodies the mining industry's refreshed dedication to sustainable practices, particularly emphasizing the innovative reuse of mining waste in areas such as backfill mining. This shift towards sustainability has not only fostered a surge in environmentally responsible mining initiatives but also inspired the formulation of corresponding policies globally. A prime example of this is China's proactive implementation of the "Green Mine Construction" resource development strategy [106-108]. This initiative advocates for systematic and scientific mining processes, concentrating on curtailing ecological disruptions throughout the mineral resource development stages. Moreover, it actively promotes the recycling of mining waste, envisioning the construction sector as a significant recipient of these reused materials. Researchers [106,107] aligned with this initiative posit that utilizing mining waste as a base material in constructing backfill structures or formulating cementitious materials can significantly reduce aggregate mining activities like sand and gravel extraction. This approach not only diminishes the accumulation of mining waste but also alleviates environmental stress, paving the way for a more sustainable and environmentally conscious mining industry. Moreover, Malaysia's Green Building Index [109] notably emphasizes the sustainability of building materials, championing the integration of solid waste, like mining waste, into the construction sector as potential aggregates. This progressive approach underscores Malaysia's commitment to ecological responsibility and offers a model for other nations to consider sustainable construction practices more deeply. (Figure 8A)

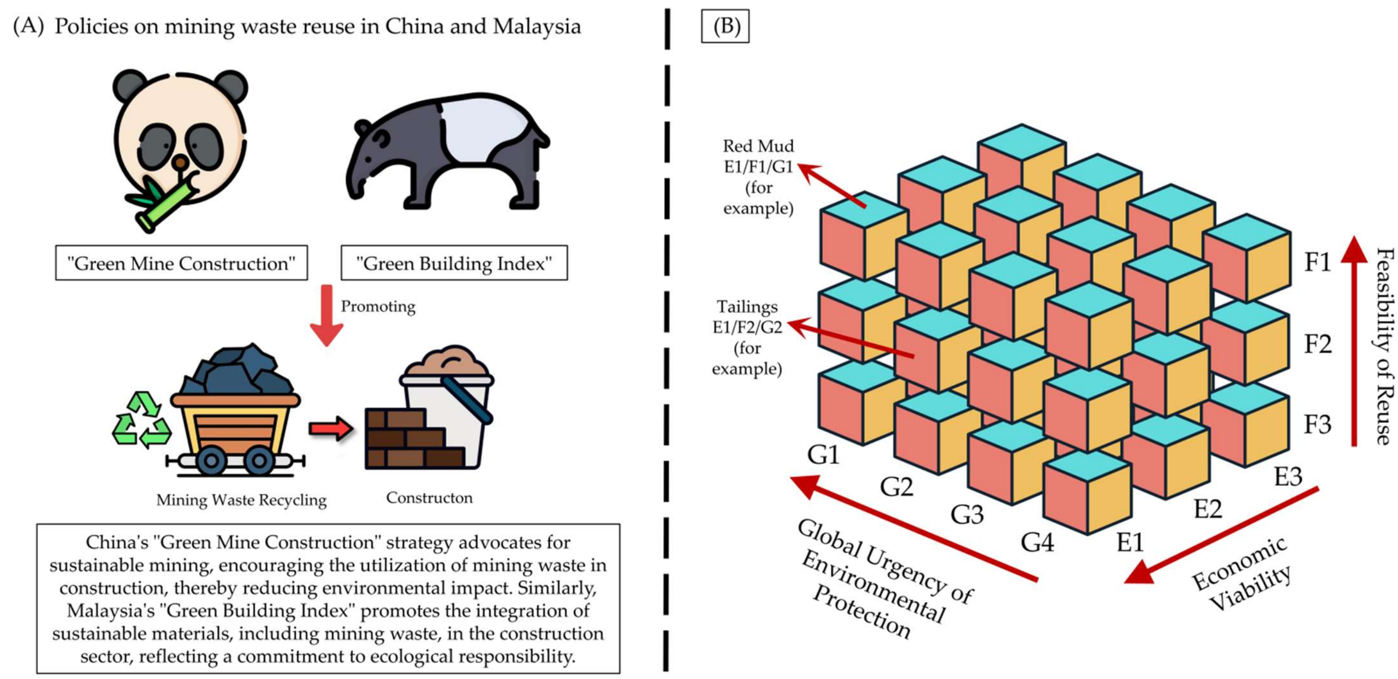

Figure 8. (A) Policies on mining waste reuse in China and Malaysia; **(B)** UNFC-based framework for the classification of mining waste in the construction sector.

Furthermore, there's a growing momentum among researchers focusing on policies related to the management and repurposing of mining waste [110,111]. While strides have been made in several sectors, a significant policy void remains in the construction industry, indicating the substantial journey still ahead. A pivotal 2012 Science article emphasized the multifaceted potential of mining waste. Beyond the obvious mineral extraction, it can be leveraged as a supplementary fuel source for power plants, utilized in the repair of geological formations, and innovatively integrated into construction materials [112]. However, realizing these potentials hinges on comprehensive policy frameworks and unwavering support. Together, these efforts will signify a promising transition towards a sustainable and eco-conscious future where industrial development coexists harmoniously with environmental conservation.

We find ourselves at a critical juncture where environmental stewardship and industrial advancement intertwine, underpinned largely by the developing landscape of policies encouraging the reuse of mining waste. As the "Green Mining" concept gains prominence, spearheaded by reputable institutions like MIT, there is an emerging global shift towards more responsible mining practices. Notable strides have been made, particularly in China with the initiation of the "Green Mine Construction" resource development strategy, highlighting a proactive approach in policy formulation. Yet, the journey is far from over; a substantial gap still exists, especially in the construction sector. Future policies need to address this by fostering a broader spectrum of applications, potentially leading to the formulation of green building standards. This endeavor promises not only a surge in sustainable mining initiatives but also a harmonious future where industries thrive alongside preserved and cherished environments.

4.3 Waste Classification Framework

As policies continue to evolve, the promotion of mining waste reuse is poised to escalate, heralding a surge in case studies and actual instances of mining waste reincorporation within the construction industry. Consequently, as global awareness heightens regarding the substantial benefits derived from mining waste integration within the construction sphere, there emerges a pressing necessity for a comprehensive framework to facilitate the classification of mining waste. This framework should facilitate the categorization of diverse mining wastes based on distinct characteristics including potential economic value upon reuse, contribution to the enhancement of the strength within building materials, and other pertinent aspects. Subsequently, this classification will enable the informed redirection of various mining wastes into appropriate avenues within the construction domain, thereby fostering optimized utilization and fostering a sustainable cycle of resource management.

Currently, the classification framework for mining waste remains unclear, largely because the characteristics of these wastes are not fully understood. This lack of clarity is partly due to the diverse nature of waste generated from different minerals, which varies significantly based on the type of ore and mining methods employed. Furthermore, the potential directions for recycling mining waste, especially within the construction sector, have not been thoroughly explored. Ideally, each type of mining waste should have an optimal recycling pathway that maximizes reuse efficiency in specific areas, yet current research has not fully elucidated these pathways. Comprehensive future studies are needed to explore these aspects. Additionally, the significance of mining waste recycling was not always a focus, but as we delve deeper into the strategies surrounding sustainable waste management, the UNFC's (United Nations Framework Classification) categorization framework for anthropogenic resources comes to the fore as a beacon of clarity and direction [113,114].

This framework, acknowledged globally, underscores the potential of anthropogenic resources, a category to which mining waste unequivocally belongs, according to United Nations definitions. The UNFC serves as a prominent classification instrument, traditionally employed for delineating the categories and potentials of minerals, oil, and other natural resources. In contrast, the sector of anthropogenic resources, particularly mining waste, finds itself in the nascent stages of developing a globally standardized classification and reporting framework, an essential stride in advancing sustainable management and utilization strategies [115]. Despite the absence of a universal guideline, a considerable number of contemporary case studies have ventured into pioneering efforts to categorize mining waste through the lens of the UNFC [116-119]. These initiatives leverage the critical dimensions embodied by the UNFC: "E", "F", and "G" factors. In the UNFC schema, the economic aspect is predominantly represented by the "E" dimension, which serves as a vital conduit where the tenets of the circular economy are intricately infused, accentuating both resource efficiency and the retention of value. Concurrently, the "F" dimension typically signifies the feasibility or flexibility in implementing various resource management strategies, embodying a multifaceted approach to resource utilization and sustainable development. Meanwhile, the "G" dimension is usually employed to express the degree of certainty in resource estimations, serving as a gauge of reliability and assurance in the projection analyses. Moreover, there has been a growing trend among researchers to reinterpret the "G" dimension from a more ecological perspective, aligning it with the Global Urgency of Environmental Protection [83]. This innovative approach aligns seamlessly with the pressing necessity to incorporate environmental safeguards in resource management strategies, highlighting a proactive commitment to fostering global environmental stewardship. This interpretation not only enriches the conceptual depth of the UNFC framework but also potentially guides it towards becoming an instrument that harmonizes economic prospects with ecological imperatives, fostering a sustainable and balanced approach to resource management in the future.

To enhance the effective reuse of mining waste in construction, we propose a refined UNFC-based classification framework with three key dimensions: Economic Viability (E), Recycling Flexibility (F), and Environmental Urgency (G). Here, "E" assesses the potential economic returns of recycling specific mining waste in construction, categorized as high to low (E1, E2, E3). "F" measures the flexibility or scope of recycling this waste, also ranked from high to low (F1, F2, F3) and considers various end uses. The "G" dimension evaluates the urgency of environmental protection needed due to the stockpiling of certain waste types, with four levels (G1 to G4) that reflect the severity of potential environmental impacts. By employing this framework (Figure 8B), various types of mining waste, such as tailings and red mud, can be effectively classified with designations like "E1/F2/G2" and "E1/F1/G1", respectively. This method facilitates their strategic redistribution within the construction industry and supports the integration of additional analytical methods. This tiered approach not only optimizes resource utilization but also drives forward a sustainable management cycle. However, to refine this process and validate its effectiveness, extensive case studies are required. Future considerations could include the broader economic impact of mining waste on communities within the "E" dimension [120-125], the feasibility of combining mining waste with other waste types [126] in "F", and a more comprehensive analysis of mining waste's environmental behaviors [127-129] and public health impacts [130,131] in "G".

V. Conclusion

Environmental sustainability has transcended buzzword status to become a critical mandate, and our comprehensive review underscores the synergistic potential between the mining and construction sectors for sustainable development. We have identified that innovative repurposing of mining waste, particularly as aggregates in construction projects, not only addresses environmental concerns but also paves the way for economic and practical advancements. Key conclusions from our analysis include:

✓ **Historical Evolution:** The progression from rudimentary reuse to strategic incorporation of mining waste highlights a growing recognition of its value. This evolution underscores a significant shift towards sustainability in construction practices, evidencing a maturation of techniques and approaches over time.

✓ **Technological and Policy Synergy:** Leveraging advanced technologies alongside supportive policies has been pivotal in enhancing the utility of mining waste for construction. This synergy not only facilitates the efficient management and application of mining waste but also sets a precedent for sustainable industry standards.

✓ **Strategic Frameworks for Waste Management:** The adoption of comprehensive frameworks, such as the UNFC classification, signifies a methodical approach to mining waste reuse. By identifying and categorizing waste for specific construction applications, these frameworks bolster systematic sustainability efforts.

- ✓ **Future Directions and Collaborative Innovation:** The path forward necessitates a collaborative industry approach, integrating technological advancements, policy reform, and sustainability principles. The continuous exploration of mining waste's potential will drive innovative solutions, fostering a sustainable construction ecosystem that valorizes waste as a resource.

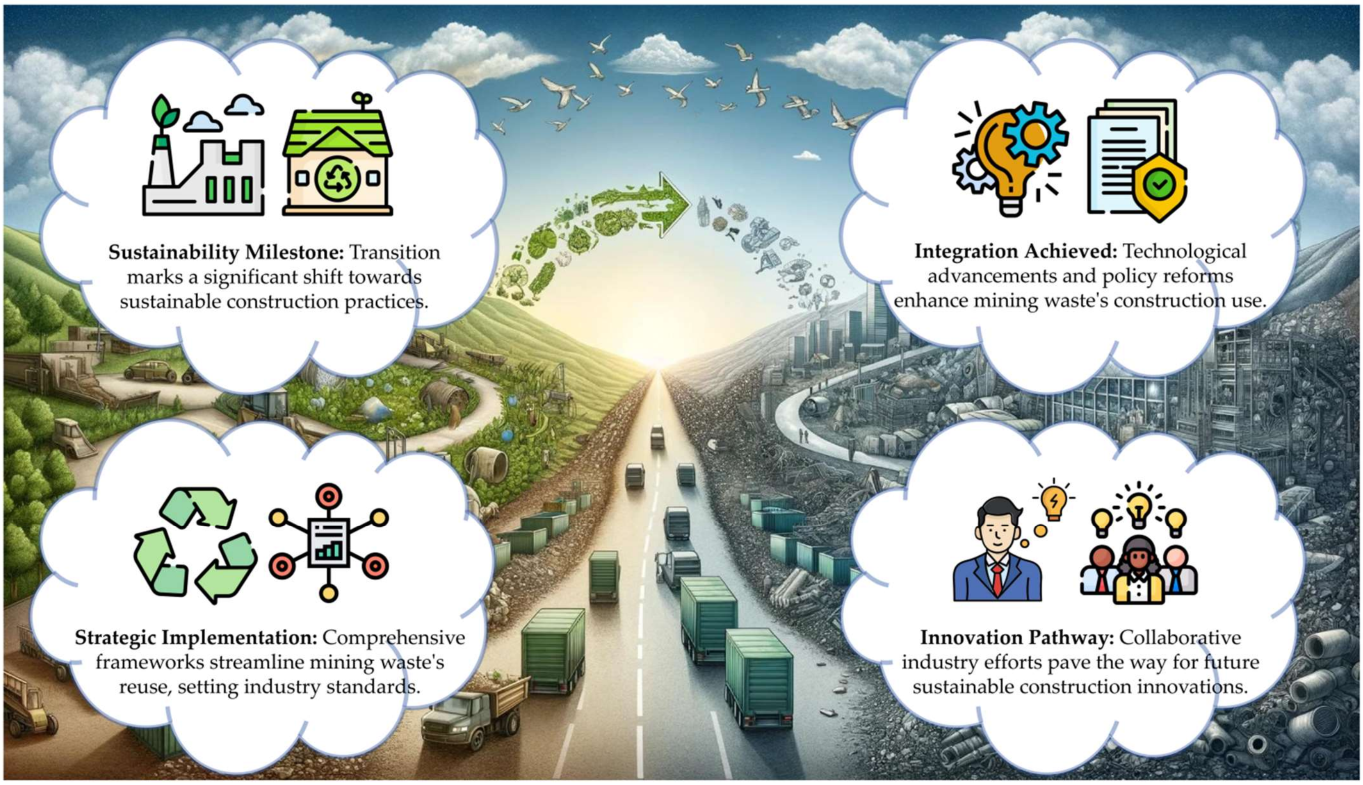

Figure 9. From Reuse to Revolution: Charting the Sustainable Future of Construction and Mining.

In weaving together the past developments with current innovations and future prospects, our study not only highlights the significant strides made in repurposing mining waste for construction but also emphasizes the ongoing need for collaborative, cross-sectoral efforts to realize its full potential (as shown in Figure 9). Embracing this holistic approach, the construction industry can lead the way in sustainable development, transforming challenges into opportunities for environmental stewardship and economic growth.

Acknowledgments: The first author thanks the Graduate Research Excellence Scholarship (GRES) from Monash University Malaysia. **All graphic elements utilised in Figures are sourced from flaticon.com and freepik.com. They are free to use and not subject to copyright restrictions. The author, Haoxuan Yu, is a premium member of both websites (account: @user81357068) and hence, attribution is not required for the materials used.**

Author Contributions: Conceptualisation, H.Y. and I.Z.; methodology, H.Y.; validation, I.Z.; formal analysis, H.Y. and D.Ø.M; resources, H.Y.; data curation, H.Y., D.Ø.M and D.L.; writing—original draft preparation, H.Y. and D.L.;

writing—review and editing, I.Z., C.M.F. and D.Ø.M; visualisation, H.Y. and D.Ø.M; supervision, I.Z., C.M.F. and D.L.; project administration, I.Z. All authors have read and agreed to the published version of the manuscript.

References

1. Hartman, H. L., & Mutmansky, J. M. (2002). Introductory mining engineering. John Wiley & Sons.
2. Tilton, J. E. (2010). On borrowed time: assessing the threat of mineral depletion. Routledge.
3. Haoxuan Yu. Mining waste: curb risks to people and the environment. Nature, 615, 586 (2023). https://doi.org/10.1038/d41586-023-00844-1
4. Hudson-Edwards, K. A., Jamieson, H. E., & Lottermoser, B. G. (2011). Mine wastes: past, present, future. Elements, 7(6), 375-380.
5. Kossoff, D., Dubbin, W. E., Alfredsson, M., Edwards, S. J., Macklin, M. G., & Hudson-Edwards, K. A. (2014). Mine tailings dams: Characteristics, failure, environmental impacts, and remediation. Applied Geochemistry, 51, 229-245.
6. Franks, D. M., Boger, D. V., Côte, C. M., & Mulligan, D. R. (2011). Sustainable development principles for the disposal of mining and mineral processing wastes. Resources policy, 36(2), 114-122.
7. Yu, H., & Zahidi, I. (2023). Tailings Pond Classification Based on Satellite Images and Machine Learning: An Exploration of Microsoft ML. Net. Mathematics, 11(3), 517.
8. Ali, S. H., Giurco, D., Arndt, N., Nickless, E., Brown, G., Demetriades, A., ... & Yakovleva, N. (2017). Mineral supply for sustainable development requires resource governance. Nature, 543(7645), 367-372.
9. Prior, T., Giurco, D., Mudd, G., Mason, L., & Behrisch, J. (2012). Resource depletion, peak minerals and the implications for sustainable resource management. Global environmental change, 22(3), 577-587.
10. Huang, K., Guo, J., & Xu, Z. (2009). Recycling of waste printed circuit boards: A review of current technologies and treatment status in China. Journal of hazardous materials, 164(2-3), 399-408.
11. Yu, H., Zahidi, I., Fai, C. M., Liang, D., & Madsen, D. Ø. (2024). Mineral waste recycling, sustainable chemical engineering, and circular economy. Results in Engineering, 101865.
12. Samir, M., Alama, F., Buysse, P., van Nylen, T., & Ostanin, O. (2018). Disposal of mining waste: Classification and international recycling experience. In E3S Web of Conferences (Vol. 41, p. 02012). EDP Sciences.
13. Duan, H., & Zhu, X. N. (2022). Recent advances in recovering technology for recycling gold from waste printed circuit boards: a review. Energy Sources, Part A: Recovery, Utilisation, and Environmental Effects, 44(1), 1640-1659.
14. Lottermoser, B. G. (2011). Recycling, reuse and rehabilitation of mine wastes. Elements, 7(6), 405-410.
15. Nevskaya, M. A., & Marinina, O. A. (2015). Regulatory aspects of mining waste management in the Russian Federation. Biosciences Biotechnology Research Asia, 12(3), 2619-2628.
16. Lu, Z., & Cai, M. (2012). Disposal methods on solid wastes from mines in transition from open-pit to underground mining. Procedia Environmental Sciences, 16, 715-721.
17. Yang, M., Chen, L., Wang, J. et al. Circular economy strategies for combating climate change and other environmental issues. Environ Chem Lett 21, 55–80 (2023). https://doi.org/10.1007/s10311-022-01499-6
18. Shreekant, R. L., Aruna, M., & Vardhan, H. (2016). Utilisation of mine waste in the construction industry–a critical review. International Journal of Earth Sciences and Engineering, 9(01), 182-195.
19. Vo, T. L., Nash, W., Del Galdo, M., Rezania, M., Crane, R., Nezhad, M. M., & Ferrara, L. (2022). Coal mining wastes valorisation as raw geomaterials in construction: A review with new perspectives. Journal of Cleaner Production, 336, 130213.

20. Benahsina, A., El Haloui, Y., Taha, Y., Elomari, M., & Bennouna, M. A. (2022). Natural sand substitution by copper mine waste rocks for concrete manufacturing. Journal of Building Engineering, 47, 103817.
21. Kurniati, E. O., Pederson, F., & Kim, H. J. (2023). Application of steel slags, ferronickel slags, and copper mining waste as construction materials: A review. Resources, Conservation and Recycling, 198, 107175.
22. Sá, T. S. W., Oda, S., Machado, V. K. C. B. L., & Toledo Filho, R. D. (2022). Use of iron ore tailings and sediments on pavement structure. Construction and Building Materials, 342, 128072.
23. Gayana, B. C., & Ram Chandar, K. (2018). Sustainable use of mine waste and tailings with suitable admixture as aggregates in concrete pavements-A review.
24. Garcia-Troncoso, N., Baykara, H., Cornejo, M. H., Riofrio, A., Tinoco-Hidalgo, M., & Flores-Rada, J. (2022). Comparative mechanical properties of conventional concrete mixture and concrete incorporating mining tailings sands. Case Studies in Construction Materials, 16, e01031.
25. Ahmed, T., Elchalakani, M., Basarir, H., Karrech, A., Sadrossadat, E., & Yang, B. (2021). Development of ECO-UHPC utilising gold mine tailings as quartz sand alternative. Cleaner Engineering and Technology, 4, 100176.
26. Pyo, S., Tafesse, M., Kim, B. J., & Kim, H. K. (2018). Effects of quartz-based mine tailings on characteristics and leaching behavior of ultra-high performance concrete. Construction and Building Materials, 166, 110-117.
27. Edraki, M., Baumgartl, T., Manlapig, E., Bradshaw, D., Franks, D. M., & Moran, C. J. (2014). Designing mine tailings for better environmental, social and economic outcomes: a review of alternative approaches. Journal of Cleaner Production, 84, 411-420.
28. Yilmaz, E. (2011). Advances in reducing large volumes of environmentally harmful mine waste rocks and tailings. Gospodarka Surowcami Mineralnymi-Mineral Resources Management, 89-112.
29. Qaidi, S. M., Tayeh, B. A., Zeyad, A. M., de Azevedo, A. R., Ahmed, H. U., & Emad, W. (2022). Recycling of mine tailings for the geopolymers production: A systematic review. Case Studies in Construction Materials, 16, e00933.
30. Benarchid, Y., Taha, Y., Argane, R., & Benzaazoua, M. (2018). Application of Quebec recycling guidelines to assess the use feasibility of waste rocks as construction aggregates. Resources Policy, 59, 68-76.
31. Zhu, D., Xu, W., Mao, Q., Zhong, G., Chen, R., & Jiao, L. (2023). A Bibliometric Analysis of Acupuncture Treatment of Tension-Type Headache from 2003 to 2022. Journal of Pain Research, 1647-1662.
32. Xu, C., Jiang, R., & Liu, J. Y. (2023). Emerging trends and hot spots in subacute thyroiditis research from 2001 to 2022: A bibliometric analysis. Frontiers in Endocrinology, 14, 1144465.
33. Yao, Y., Li, Y., Liu, X., Jiang, S., Feng, C., & Rafanan, E. (2013). Characterisation on a cementitious material composed of red mud and coal industry by-products. Construction and building materials, 47, 496-501.
34. Ma, S., Zhang, Z., Liu, X., Li, Y., Zeng, Q., & Zhang, W. (2022). Reuse of red mud in magnesium potassium phosphate cement: Reaction mechanism and performance optimisation. Journal of Building Engineering, 61, 105290.
35. Al-Fakih, A., Mohamed Nor, Z., Inayath Basha, S., Nasiruzzaman Shaikh, M., Ahmad, S., Al-Osta, M. A., & Aziz, M. A. (2023). Characterisation and Applications of Red Mud, an Aluminum Industry Waste Material, in the Construction and Building Industries, as well as Catalysis. The Chemical Record, e202300039.
36. Vladić Kancir, I., & Serdar, M. (2022). Contribution to understanding of synergy between red mud and common supplementary cementitious materials. Materials, 15(5), 1968.
37. Dong, S., Zhuo, Q., Chen, L., Wu, F., & Xie, L. (2023). Reuse of pretreated red mud and phosphogypsum as supplementary cementitious material. Sustainability, 15(4), 2856.

38. Nguyen, H. T., & Do, Q. M. (2022). Preparation of a novel cement from red mud and limestone. International Journal of Engineering Research in Africa, 58, 171-182.
39. Li, S., Zhang, Y., Feng, R., Yu, H., Pan, J., & Bian, J. (2021). Environmental safety analysis of red mud-based cemented backfill on groundwater. International journal of environmental research and public health, 18(15), 8094.
40. Wang, Z., Wang, Y., Wu, L., Wu, A., Ruan, Z., Zhang, M., & Zhao, R. (2022). Effective reuse of red mud as supplementary material in cemented paste backfill: Durability and environmental impact. Construction and Building Materials, 328, 127002.
41. Silveira, N. C., Martins, M. L., Bezerra, A. C., & Araújo, F. G. (2021). Red mud from the aluminium industry: production, characteristics, and alternative applications in construction materials—a review. Sustainability, 13(22), 12741.
42. Cai, Y., & Liu, X. (2020). Mechanical properties test of pavement base or subbase made of solid waste stabilised by acetylene sludge and fly ash. AIP Advances, 10(6).
43. Wang, H., Qi, T., Feng, G., Wen, X., Wang, Z., Shi, X., & Du, X. (2021). Effect of partial substitution of corn straw fly ash for fly ash as supplementary cementitious material on the mechanical properties of cemented coal gangue backfill. Construction and Building Materials, 280, 122553.
44. Zhang, X., Lin, J., Liu, J., Li, F., & Pang, Z. (2017). Investigation of hydraulic-mechanical properties of paste backfill containing coal gangue-fly ash and its application in an underground coal mine. Energies, 10(9), 1309.
45. Sarkar, M., Maiti, M., Mandal, S., & Xu, S. (2024). Enhancing concrete resilience and sustainability through fly ash-assisted microbial biomineralization for self-healing: From waste to greening construction materials. Chemical Engineering Journal, 481, 148148.
46. Zhu, Y., Yu, Z., Li, Z., Xu, J., Peng, H., Guan, J., ... & Zhua, Y. (2016). Properties of Coal Gangue Used in Building Materials in Wulanmulun Coalfield, Inner Mongolia, China. In Advanced Material Engineering: Proceedings of the 2015 International Conference on Advanced Material Engineering (pp. 108-114).
47. Zhang, C., Li, B., Yu, Y., Zhang, Y., Xu, H., & Wang, W. X. (2022). An Investigation of the Mechanical Properties of Basalt Fibre-Reinforced Graphite Tailings Cement Mortar. Buildings, 12(12), 2106.
48. Guo, Z., Qiu, J., Kirichek, A., Zhou, H., Liu, C., & Yang, L. (2024). Recycling waste tyre polymer for production of fibre reinforced cemented tailings backfill in green mining. Science of the Total Environment, 908, 168320.
49. Helser, J., Perumal, P., & Cappuyns, V. (2022). Valorising (cleaned) sulfidic mine waste as a resource for construction materials. Journal Of Environmental Management, 319, 115742.
50. Xing, J., Zhao, Y. L., Wang, Q., Qiu, J. P., & Sun, X. G. (2019, February). Preparation and characterisation of metal mine tailings based backfiling material through geopolymerization. In IOP Conference Series: Materials Science and Engineering (Vol. 479, No. 1, p. 012023). IOP Publishing.
51. Lan, G. A. O., Jihong, L. I., Denghong, W., Xiaoyun, X., Chengwei, Y., & Meizhi, H. A. N. (2015). Outline of metallogenic regularity of bauxite deposits in China. Acta Geologica Sinica-English Edition, 89(6), 2072-2084.
52. Yin, J., Xia, W., & Han, M. (2016). Resource utilisation of high-sulfur bauxite of low-median grade in chongqing china. Light Metals 2011, 19-22.
53. Gäbel, K., & Tillman, A. M. (2005). Simulating operational alternatives for future cement production. Journal of Cleaner Production, 13(13-14), 1246-1257.
54. Grice, T. (1998). Underground mining with backfill. 2nd Annual Summit œ Mine Tailings Disposal Systems, Brisbane, Nov, 24-25.

55. Benzaazoua, M., Belem, T., & Bussiere, B. (2002). Chemical factors that influence the performance of mine sulphidic paste backfill. Cement and concrete research, 32(7), 1133-1144.
56. Belem, T., & Benzaazoua, M. (2004). An overview on the use of paste backfill technology as a ground support method in cut-and-fill mines. Proceedings of the Ground Support in Mining Underground Construction, Perth, Australia, 28-30.
57. Li, E., Chen, H., Huang, F., Zhou, L., & Yu, Z. (2022). Waste rocks from the industrial mining process: hazard metals stabilisation behavior evaluating and reusing as construction materials. International Journal of Environmental Science and Technology, 1-16.
58. Martins, L. M., Peixoto, R. A. F., & Mendes, J. C. (2023). Quartzite tailings in civil construction materials: a systematic review. Clean Technologies and Environmental Policy, 1-18.
59. Tang, R. L., Zhao, B. C., Xin, J., Sun, J. P., Xu, B. W., Tian, C., ... & Ren, W. A. (2024). Multisolid waste collaborative production of aeolian sand-red mud-fly ash cemented paste backfill. Case Studies in Construction Materials, 20, e02843.
60. Cong, P., & Cheng, Y. (2021). Advances in geopolymer materials: A comprehensive review. Journal of Traffic and Transportation Engineering (English Edition), 8(3), 283-314.
61. Zhang, Y., & Ling, T. C. (2020). Reactivity activation of waste coal gangue and its impact on the properties of cement-based materials–A review. Construction and Building Materials, 234, 117424.
62. Wu, D., Chen, T., Hou, D., Zhang, X., Wang, M., & Wang, X. (2023). Utilisation of coal gangue powder to improve the sustainability of ultra-high performance concrete. Construction and Building Materials, 385, 131482.
63. Yang, Q., Lü, M., & Luo, Y. (2013). Effects of surface-activated coal gangue aggregates on properties of cement-based materials. Journal of Wuhan University of Technology-Mater. Sci. Ed., 28(6), 1118-1121.
64. Nighot, N. S., & Kumar, R. (2023). A comprehensive study on the synthesis and characterisation of eco-cementitious binders using different kind of industrial wastes for sustainable development. Developments in the Built Environment, 14, 100135.
65. de Azevedo, A. R., Marvila, M. T., de Oliveira, M. A., Umbuzeiro, C. E., Huaman, N. R., & Monteiro, S. N. (2022). Perspectives for the application of bauxite wastes in the development of alternative building materials. Journal of Materials Research and Technology, 20, 3114-3125.
66. Zhang, Y., & Ling, T. C. (2020). Reactivity activation of waste coal gangue and its impact on the properties of cement-based materials–A review. Construction and Building Materials, 234, 117424.
67. Liu, H., Xue, J., Li, B., Wang, J., Lv, X., & Zhang, J. (2022). Effect of graphite tailings as substitute sand on mechanical properties of concrete. European Journal of Environmental and Civil Engineering, 26(7), 2635-2653.
68. Sun, D., Huang, N., Liu, K., Tang, J., Rong, N., Wang, A., ... & Deng, Y. (2023). Effect of recycled fine powder on autoclaved aerated concrete: Gas-foaming, physic-mechanical property and hydration products. Journal of Building Engineering, 67, 106013.
69. Siddique, S., & Jang, J. G. (2020). Assessment of molybdenum mine tailings as filler in cement mortar. Journal of Building Engineering, 31, 101322.
70. Wan, X., Ding, J., Mou, C., Wang, J., & Zhang, S. (2023). Alkali-activated red mud in stabilising marine dredged clay with low amount of cement. European Journal of Environmental and Civil Engineering, 1-15.
71. Giménez-García, R., Vigil de la Villa Mencía, R., Rubio, V., & Frías, M. (2016). The transformation of coal-mining waste minerals in the pozzolanic reactions of cements. Minerals, 6(3), 64.

72. Quan, X., Wang, S., Liu, K., Xu, J., Zhang, K., Zhao, N., & Li, B. (2022). Influence of iron ore tailings by-product on the mechanical and electrical properties of carbon fiber reinforced cement-based composites. Journal of Building Engineering, 45, 103567.
73. Niu, H., Abdulkareem, M., Sreenivasan, H., Kantola, A. M., Havukainen, J., Horttanainen, M., ... & Illikainen, M. (2020). Recycling mica and carbonate-rich mine tailings in alkali-activated composites: A synergy with metakaolin. Minerals Engineering, 157, 106535.
74. Nicoara, A. I., Stoica, A. E., Vrabec, M., Šmuc Rogan, N., Sturm, S., Ow-Yang, C., ... & Vasile, B. S. (2020). End-of-life materials used as supplementary cementitious materials in the concrete industry. Materials, 13(8), 1954.
75. Gong, L., Gong, X., Liang, Y., Jia, Z., & Li, Y. (2022). Experimental study and microscopic analysis on frost resistance of iron ore tailings recycled aggregate concrete. Advances in Materials Science and Engineering, 2022.
76. Zhang, H., Dong, Y., Hou, Y., Qian, Z., Tian, J., & Zhang, Y. (2023). Resurfacing Performance Evaluation of Recycled Mixture with High Content of Iron Tailings Sand. Coatings, 13(3), 487.
77. Halstead, P. E. (1961). The early history of Portland cement. Transactions of the Newcomen Society, 34(1), 37-54.
78. Igliński, B., & Buczkowski, R. (2017). Development of cement industry in Poland–History, current state, ecological aspects. A review. Journal of cleaner production, 141, 702-720.
79. Wu, Y., Lu, B., Bai, T., Wang, H., Du, F., Zhang, Y., ... & Wang, W. (2019). Geopolymer, green alkali activated cementitious material: Synthesis, applications and challenges. Construction and Building Materials, 224, 930-949.
80. Liu, B., Meng, H., Pan, G., Zhou, H., & Li, D. (2022). Relationship between the fineness and specific surface area of iron tailing powder and its effect on compressive strength and drying shrinkage of cement composites. Construction and Building Materials, 357, 129421.
81. Almeida, J., Faria, P., Ribeiro, A. B., & Silva, A. S. (2021). Cement-based mortars production applying mining residues treated with an electro-based technology and a thermal treatment: Technical and economic effects. Construction and Building Materials, 280, 122483.
82. Yu, Z., Wu, L., Zhang, C., & Bangi, T. (2022). Influence of eco-friendly fine aggregate on macroscopic properties, microstructure and durability of ultra-high performance concrete: A review. Journal of Building Engineering, 105783.
83. Yu, H., Zahidi, I., & Liang, D. (2023). Sustainable porous-insulation concrete (SPIC) material: recycling aggregates from mine solid waste, white waste and construction waste. Journal of Materials Research and Technology, 23, 5733-5745.
84. Segui, P., Safhi, A. E. M., Amrani, M., & Benzaazoua, M. (2023). Mining Wastes as Road Construction Material: A Review. Minerals, 13(1), 90.
85. Lim, B., & Alorro, R. D. (2021). Technospheric Mining of Mine Wastes: A Review of Applications and Challenges. Sustainable Chemistry, 2(4), 686-706.
86. Qi, C., Fourie, A., Chen, Q., & Zhang, Q. (2018). A strength prediction model using artificial intelligence for recycling waste tailings as cemented paste backfill. Journal of Cleaner Production, 183, 566-578.
87. Qi, C., Chen, Q., Fourie, A., & Zhang, Q. (2018). An intelligent modelling framework for mechanical properties of cemented paste backfill. Minerals Engineering, 123, 16-27.
88. Qi, C., Tang, X., Dong, X., Chen, Q., Fourie, A., & Liu, E. (2019). Towards Intelligent Mining for Backfill: A genetic programming-based method for strength forecasting of cemented paste backfill. Minerals Engineering, 133, 69-79.

89. Qi, C., Chen, Q., & Kim, S. S. (2020). Integrated and intelligent design framework for cemented paste backfill: A combination of robust machine learning modelling and multi-objective optimisation. Minerals Engineering, 155, 106422.
90. Tayebi-Khorami, M., Edraki, M., Corder, G., & Golev, A. (2019). Re-thinking mining waste through an integrative approach led by circular economy aspirations. Minerals, 9(5), 286.
91. Maruthupandian, S., Chaliasou, N. A., & Kanellopoulos, A. (2021). Recycling Mine Tailings for a Sustainable Future Built Environment. In Energy and Sustainable Futures: Proceedings of 2nd ICESF 2020 (pp. 163-169). Cham: Springer International Publishing.
92. Website Source: https://www.mining.com/circular-economics-reprocessing-waste-and-mining
93. Virgone, K. M., Ramirez-Andreotta, M., Mainhagu, J., & Brusseau, M. L. (2018). Effective integrated frameworks for assessing mining sustainability. Environmental geochemistry and health, 40, 2635-2655.
94. Huang, J., & Koroteev, D. D. (2021). Artificial intelligence for planning of energy and waste management. Sustainable Energy Technologies and Assessments, 47, 101426.
95. Orejarena, L., & Fall, M. (2011). Artificial neural network based modeling of the coupled effect of sulphate and temperature on the strength of cemented paste backfill. Canadian Journal of Civil Engineering, 38(1), 100-109.
96. Ma, H., Liu, J., Zhang, J., & Huang, J. (2021). Estimating the compressive strength of cement-based materials with mining waste using support vector machine, decision tree, and random forest models. Advances in civil engineering, 2021, 1-10.
97. Chou, J. S., Tsai, C. F., Pham, A. D., & Lu, Y. H. (2014). Machine learning in concrete strength simulations: Multi-nation data analytics. Construction and Building materials, 73, 771-780.
98. Qi, C. C. (2020). Big data management in the mining industry. International Journal of Minerals, Metallurgy and Materials, 27, 131-139.
99. Salam, A., & Salam, A. (2020). Internet of things for sustainable mining. Internet of Things for Sustainable Community Development: Wireless Communications, Sensing, and Systems, 243-271.
100. Rodrigo, M. N., Perera, S., Senaratne, S., & Jin, X. (2018, November). Blockchain for construction supply chains: A literature synthesis. In Proceedings of ICEC-PAQS Conference 2018.
101. Xu, J., Lou, J., Lu, W., Wu, L., & Chen, C. (2023). Ensuring construction material provenance using Internet of Things and blockchain: Learning from the food industry. Journal of Industrial Information Integration, 33, 100455.
102. Dutta, Tanushree, Ki-Hyun Kim, Minori Uchimiya, Eilhann E. Kwon, Byong-Hun Jeon, Akash Deep, and Seong-Taek Yun. "Global demand for rare earth resources and strategies for green mining." Environmental Research 150 (2016): 182-190.
103. Qi, Rui, Tongyi Liu, Qingxuan Jia, Li Sun, and Jiangyi Liu. "Simulating the sustainable effect of green mining construction policies on coal mining industry of China." Journal of cleaner production 226 (2019): 392-406.
104. https://web.mit.edu/12.000/www/m2016/finalwebsite/solutions/greenmining.html
105. http://web.mit.edu/12.000/www/m2016/finalwebsite/
106. Li, Shuai, Lifeng Yu, Wanjun Jiang, Haoxuan Yu, and Xinmin Wang. "The recent progress China has made in green mine construction, Part I: Mining groundwater pollution and sustainable mining." International Journal of Environmental Research and Public Health 19, no. 9 (2022): 5673.
107. Yu, Haoxuan, Shuai Li, Lifeng Yu, and Xinmin Wang. "The recent progress China has made in green mine construction, part II: typical examples of green mines." International Journal of Environmental Research and Public Health 19, no. 13 (2022): 8166.

108. Li, Shuai, Peiyuan Zou, Haoxuan Yu, Boyi Hu, and Xinmin Wang. 2023. "Advantages of Backfill Mining Method for Small and Medium-Sized Mines in China: Safe, Eco-Friendly, and Efficient Mining" Applied Sciences 13, no. 12: 7280.
109. Algburi, S. M., Faieza, A. A., & Baharudin, B. T. H. T. (2016). Review of green building index in Malaysia; existing work and challenges. International Journal of Applied Engineering Research, 11(5), 3160-3167.
110. Woźniak, J., & Pactwa, K. (2018). Overview of polish mining wastes with circular economy model and its comparison with other wastes. Sustainability, 10(11), 3994.
111. Balanay, R., & Halog, A. (2016). Charting policy directions for mining's sustainability with circular economy. Recycling, 1(2), 219-230.
112. Bian, Z., Miao, X., Lei, S., Chen, S. E., Wang, W., & Struthers, S. (2012). The challenges of reusing mining and mineral-processing wastes. Science, 337(6095), 702-703.
113. Winterstetter, A.; Heuss-Assbichler, S.; Stegemann, J.; Kral, U.; Wäger, P.; Osmani, M. and Rechberger, H. (2021). The role of anthropogenic resource classification in supporting the transition to a circular economy. Journal of Cleaner Production, 297, 126753. https://doi.org/10.1016/j.jclepro.2021.126753
114. Website information: https://unece.org/unfc-and-anthropogenic-resources-0
115. Lederer, J.; Laner, D. and Fellner, J. (2014). A framework for the evaluation of anthropogenic resources: the case study of phosphorus stocks in Austria. Journal of Cleaner Production, 84, 368-381. https://doi.org/10.1016/j.jclepro.2014.05.078
116. Winterstetter, A., Laner, D., Rechberger, H., & Fellner, J. (2015). Framework for the evaluation of anthropogenic resources: A landfill mining case study–Resource or reserve?. Resources, Conservation and Recycling, 96, 19-30.
117. Winterstetter, A., Wille, E., Nagels, P., & Fellner, J. (2018). Decision making guidelines for mining historic landfill sites in Flanders. Waste management, 77, 225-237.
118. Suppes, R., & Heuss-Aßbichler, S. (2021). How to identify potentials and barriers of raw materials recovery from tailings? Part I: A UNFC-compliant screening approach for site selection. Resources, 10(3), 26.
119. Cui, L., Xu, Y., Wang, L., Ying, P., & Wang, H. (2024). Investigating the hydration characteristics of iron tailings powder cement mortar produced by the mortar substitution method. Journal of Building Engineering, 81, 108100.
120. Yu, H., Gunaratna, G., Zahidi, I., & Fai, C. M. (2024). Sungai Lembing's green tourism: Pioneering the future of resource-based urban renewal. The Innovation, 5(2), 100578.
121. Yu, H., Zahidi, I., Fai, C. M., Liang, D., & Madsen, D. Ø. (2024). Elevating community well-being in mining areas: the proposal of the mining area sustainability index (MASI). Environmental Sciences Europe, 36(1), 1-12.
122. Yu, H., Zahidi, I., & Liang, D. (2023). Mine land reclamation, mine land reuse, and vegetation cover change: An intriguing case study in Dartford, the United Kingdom. Environmental research, 225, 115613.
123. Yu, H., Zahidi, I., & Liang, D. (2023). Spatiotemporal variation of vegetation cover in mining areas of Dexing City, China. Environmental research, 225, 115634.
124. Yu, H., Zahidi, I., & Chow, M. F. (2023). Vegetation as an ecological indicator in assessing environmental restoration in mining areas. Iscience, 26(9).
125. Yu, H., & Zahidi, I. (2023). Spatial and temporal variation of vegetation cover in the main mining area of Qibaoshan Town, China: Potential impacts from mining damage, solid waste discharge and land reclamation. Science of the Total Environment, 859, 160392.

126. Yu, H., Zahidi, I., Fai, C. M., Liang, D., & Madsen, D. Ø. (2024). From waste to wealth: The" Blue Circle" vision for a sustainable ocean future. Science bulletin, S2095-9273.
127. Liu, H., Zhang, J., Li, B., Zhou, N., Li, D., Zhang, L., & Xiao, X. (2021). Long term leaching behavior of arsenic from cemented paste backfill made of construction and demolition waste: Experimental and numerical simulation studies. Journal of Hazardous Materials, 416, 125813.
128. Liu, H., Zhang, J., Li, B., Zhou, N., Xiao, X., Li, M., & Zhu, C. (2020). Environmental behavior of construction and demolition waste as recycled aggregates for backfilling in mines: Leaching toxicity and surface subsidence studies. Journal of Hazardous Materials, 389, 121870.
129. Liu, H., Wang, Y., Pang, S., Wang, X., He, J., Zhang, J., & Rodriguez-Dono, A. (2022). Mining footprint of the underground longwall caving extraction method: A case study of a typical industrial coal area in China. Journal of hazardous materials, 425, 127762.
130. Yu, H., Zahidi, I., & Fai, C. M. (2023). Reclaiming abandoned mine tailings ponds for agricultural use: Opportunities and challenges. Environmental research, 116336.
131. Yu, H., & Zahidi, I. (2023). Environmental hazards posed by mine dust, and monitoring method of mine dust pollution using remote sensing technologies: An overview. Science of The Total Environment, 864, 161135.