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Digitalization of a Customer-Centric Supply Chain

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ABSTRACT

Background: Increasing customer needs and expectations for purchased products and services have for many years emphasized the important role of the customer in supply chains. Another critical aspect of modern supply chains is process automation, data analytics and, consequently, the digital transformation of supply chains. In the context of these challenges, the following questions arise: how does the digital transformation of the supply chain support processes in a customer-centric supply chain, and which groups of technologies are used in a customer-centric supply chain? Therefore, the aim of this article is to identify the role of digital technologies in a supply chain that dynamically adapts to customer expectations.

Methods: The article presents case studies of two supply chains, Electrolux and P&G, which claim that their structures and processes are customer-centric and are currently undergoing changes, including digital transformation. The case studies are additionally supported by research findings from The Global Manufacturing Research Group Survey.

Results: Based on a literature review and the case studies presented, the technologies with the most significant impact on customer-centric supply chain processes are identified. An attempt is also made to create a digital customer-centric supply chain model, which is presented and described in the context of its main processes and the technologies used.

Conclusions: Digital transformation plays an important role and supports processes in the customer-centric supply chain. Advanced analytics and Big Data are particularly important technologies that enable continuous improvement of supply chains, including monitoring and optimisation of processes. As a result, dashboards are becoming the primary tool for supply chain managers to monitor and analyse the effectiveness of supply chain processes.

Keywords:

digital supply chain, customer-oriented planning, customer-driven supply chain, customer-centric supply chain, digital transformation, advanced analytics.

Does CBAM Set a Price for Carbon? An Assessment

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Abstract

Does CBAM Set a Price for Carbon? An Assessment Abstract When the Paris Climate Accords were adopted at the COP 21 meeting late in 2015, there was a sense that the 1997 Kyoto Protocol finally would be accomplished with concrete goals and mechanisms for achieving climate change mitigation. As of early 2024, 195 members of the United Nations Framework Convention on Climate Change had ratified this international treaty, each making a national-level commitment to contribute toward the goal of net zero anthropogenic greenhouse gas emissions by the middle of the 21st Century. The expectation—supported by strong scientific evidence—was that emissions control at the stated amount would limit mean global temperature change to less than a 20 C increase as compared to pre-industrial levels. The Paris Agreement does not prescribe the mechanism for specifying the nationally determined contributions that are required to achieve the aims of the treaty. Neither is there a statement in the accord of the methods that are to be implemented so that the planet-saving goals can be accomplished. The latest European Union (EU) action plan to achieve net zero emissions by 2050 is the Carbon Border Adjustment Mechanism (CBAM). The stated objectives of CBAM—which will not be fully effective until 2026—are twofold: (1) reducing global “carbon leakage,” and (2) inducing EU trading partners to adopt green technologies in their production processes. CBAM is a tariff on carbon intensive products, such as steel, aluminum, and cement, that are imported to the EU from countries with no carbon pricing mechanism. In effect, when a country without a carbon tax trades certain goods with EU component nationstates, the EU will impose one. CBAM engenders a plethora of macroeconomic, international trade, and welfare questions. The significant one addressed in this research is whether CBAM actually sets a price on carbon. In this context, and given the manner in which CBAM is expected to be implemented, the focus is on a nominal pricing mechanism, not the so-called “social price” of carbon. This research provides insight regarding the possibility of linking a national-level carbon market—in this case the EU Emissions Trading System—with a tariff that seeks to curtail cross-border carbon leakage. If CBAM is effective, then not only will a worldwide price for carbon be established but a mechanism will be proven for incentivizing conversion to low-carbon production of those goods that are particularly harmful to the environment.

Transition to Clean Energy: How Can It Be Achieved?

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Abstract

Transition to Clean Energy: How Can It Be Achieved? Recent events, such as COVID-19 and geopolitical conflicts, have affected the future success of global goal of transition to clean energy. This vital transition is currently in danger despite the global vision shared by the European Union, United States, China, and many other countries that have signed the Paris Agreement and have committed to achieving the net-zero carbon emission economy by the year 2050. There has been rapid growth in the renewable energy market demand as more governments enact policies to limit fossil fuel usage and drive this transition into a more sustainable future. This massive increase in demand, however, has outpaced the capacity of supply and created the ripple effects throughout the supply chain creating a serious problem. The flow of the supply chain can be identified as follows: 1. Raw material extractors (supply); 2. Assembly plants (production/generation); 3. Energy distribution networks (distribution); 4. Consumers (demand); 5. Recycling firms (disposal). Each of these steps in the supply chain flow faces unique problems that can result in inefficiencies, delays, and overall failures across the industry. In addition, external factors, such as government regulations, public acceptance, and continued reliance on the fossil fuels play a role in contributing to this supply squeeze. The energy industry is no doubt one of the most complex systems globally given its impact on environmental, political, and socioeconomic factors around the world. The need to shift our reliance away from carbon-based fossil fuel is necessary to ensure the sustainability of our future. Focusing on the supply chain as a whole with specific interest in the development and operation of the renewable energies, this study analyzes the main inefficiencies that is currently plaguing the renewable energy industry, identifies where specific improvements can be made, and offers viable solutions to the problems mentioned above. The results of this study can offer insights as to how the renewable energy industry can fortify the renewable energy market and evolve the industry by implementing sustainable supply chain management.

CSR & Apparel Industry: Zara and Urban Outfitter

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Abstract

The textile and clothing industry has been historically associated with the lack of corporate social responsibility, such as unfair labor policies or negative environmental impact identified in their supply chain. This research investigates the history of two major companies in this industry, Zara and Urban Outfitters. In addition, the study delineates the current strategies of these two companies, their strengths, weaknesses, and their sustainability strategies. The research concludes with highlighting the competitive advantages of these companies and their potential of future success.

Do Greenwashing Practices within the Food Industry Affect the Ability of Making Conscious Purchasing Decisions for Young Consumers in Europe versus the USA?

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Abstract

The textile and clothing industry has been historically associated with the lack of corporate social responsibility, such as unfair labor policies or negative environmental impact identified in their supply chain. This research investigates the history of two major companies in this industry, Zara and Urban Outfitters. In addition, the study delineates the current strategies of these two companies, their strengths, weaknesses, and their sustainability strategies. The research concludes with highlighting the competitive advantages of these companies and their potential of future success

Crafting Green Cities: The Role of Ecco-art in Sustainable Urban Development

A Visual Presentation

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Abstract

Abstract: "Crafting Green Cities: The Role of Art in Sustainable Urban Development" is a visual presentation that explores the transformative power of artistic expression in shaping environmentally conscious urban landscapes. Delving into the profound connections between art and sustainability, the presentation showcases how eco-artists employ innovative strategies such as Material Re-Use, Disruption, Transformation, and Memory to address pressing environmental challenges and inspire positive change. The presentation highlights the work of a multidisciplinary contemporary artist who utilizes art as a tool for social and environmental activism, focusing on their anti-war 3D project, The Peace March. Through sculptures crafted from used prostheses, the artist confronts themes of war, trauma, identity, and gender equality, while fostering hope and advocating for peace and non-violence. Drawing on case studies and examples from New England, the presentation demonstrates how artists have historically played a central role in urban renewal initiatives, revitalizing neglected landscapes and engaging communities in the process. Through public engagement strategies such as community visioning workshops, public art installations, and interactive projects, cities can harness the collective creativity of residents to create more inclusive, sustainable, and resilient urban environments. In conclusion, the presentation calls for a collective effort to harness the transformative power of art in envisioning and realizing a more sustainable future. By embracing the profound connections between art and sustainability, we can craft green cities that nurture both people and the planet, serving as models of resilience, beauty, and positive change.

Best Paper Award in Contribution to Theory

Sustainability and Marketing: How Knowledge-based Companies Shape Their Marketing Mix

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Abstract

Knowledge-based companies often grapple with significant challenges, particularly in the realms of sales and marketing. Many struggle due to a lack of experience and inadequate understanding of market dynamics, leading to some experiencing outright failure during their early operational phases. In response, this article first delves into the literature surrounding knowledge-based companies and marketing practices. Subsequently, through the utilization of the EFQM and Philips marketing model and interviews with managers from knowledge-based companies situated in Qom Science and Technology Park, Iran, a comprehensive mixed marketing model tailored to these companies is developed. The findings underscore the essential elements of this mixed marketing approach, comprising brand positioning, product portfolio management, communication strategies, pricing tactics, distribution/sales channel strategies, market introduction methods, customer account management practices, and sales execution techniques. Furthermore, building on the premise of a direct link between the evolution of knowledge-based firms and environmental sustainability, this study discovered that the marketing and sales ethos of these companies inherently reflects sustainability principles across all aspects of their marketing mix. Such companies unmistakably exhibit traces of sustainability.

1. Introduction

Sustainable Development Goal 8 (SDG) talks about decent work and economic growth. Economic growth is essential for every country's development, and technology plays a vital part in it; SDG9 talks about industry, innovation, and infrastructure. As a result, there is an urgent need to innovate, particularly in mtechnology, in order to achieve long-term goals and progress in various aspects of life. (Kaur, Singh et al. 2022)

Industry 4.0 is revolutionizing manufacturing, increasing flexibility, mass customization, quality and productivity (Silvestri, Forcina et al. 2020). Companies in order to survive in intensive competition and remain competitive with other companies are required to be able to innovate. One internal approach that can be used to create competitive advantage is to use a Resource Based View (RBV). The Resource Based View (RBV) approach highlights a company's capabilities and resources that are unique to that company and adds significant value for the company (Lubis 2022).

Knowledge is recognized as one of those key strategic firm resources that determines firm performance in the long run. Possession or accessibility of knowledge thus ensures sustainable competitive advantage, as it includes all the necessary characteristics (described in RBV view)- namely adds value to firm, rareness, difficult to imitate, and being able to be organized (VRIO) and These aspects offer a rationale for considering knowledge as a strategic resource of the firm and this led to the development of the knowledge-based view (KBV) of the firm.(Pereira and Bamel 2021)

knowledge-based resources (firm specific knowledge) are mainly developed inside, or within the boundaries of the firm and are difficult for competitors to imitate or duplicate and thus offers a foundation for sustainable differentiation. The KBV thus postulates that heterogeneous knowledge base and capabilities (a firm intangible assets), are the main determinants of a firm's performance in a knowledge-based economy (Santos and Eisenhardt 2002). Knowledge-based companies play an important role in the economy by creating employment, contributing to the growth of gross domestic product (GDP), technological innovations, and stimulating other economic activities (Uddin and Bose 2013). These companies are mainly high-tech small- and medium-sized enterprises (SMEs) in the private sector, which are created and managed by professionals to commercialize innovations and inventions and localize technologies (Zameni, Valibeigi et al. 2020). Marketing is crucial for these companies because missing or attracting even 1 customer can determine their survival (Bouazza, Ardjouman and Abada 2015), but many knowledge-based companies face fundamental challenges in entering the market or developing the market for their products (Yaghoubi, Pahlavani and Parsaei 2017) and This is because the development of high-tech products is very difficult due to market insecurity, technological uncertainty, and competitive fluctuations (Grzegorzcyk 2020).

Businesses should monitor marketing differences and update themselves appropriately in order to establish a sustainable competitive edge and adapt to the digital changes occurring in our age. Companies must improve their marketing performance to thrive and overcome competition. In the current era of Industry 4.0 [which provides new types of innovation opportunities for product, process and services(Ricci, Battaglia and Neirotti 2021)] and the circular economy, businesses with morally sound and environmentally friendly practices are in high demand (Kaur, Singh et al. 2022).

While these companies are aware that they can achieve profitability through effective marketing, they are deficient in the requisite marketing expertise (MALEKZADEH, KHANDEROO and SADEGHI 2015). Studies indicate that 70% of small and medium- sized enterprises (SMEs) experience failure during their initial years of operation (Scheers 2018), often attributed to inadequate comprehension of the market, cash flow challenges, or limited marketing efforts. Hence, it is imperative for knowledge- based enterprises to grasp market dynamics, particularly during the inception and growth phases, to ensure their sustainability (Gilmore and Carson 2018).

Knowledge-based companies need to leverage innovative marketing at both strategic and

implementation levels to adapt to current trends. While many studies have addressed the strategic level, and some have even proposed inconsistent recommendations for this purpose,

none have provided a comprehensive framework for marketing plan. Therefore, this research introduces the elements of the marketing mix for knowledge-based and technology-driven companies, taking environmental sustainability into account. This study is majorly guided by two objectives: The primary objective is to define the structure of an integrated marketing mix in knowledge-based companies, ensuring alignment with sustainability goals. The second important objective is to identify the definable marketing components of selected knowledge-based companies, with a focus on their sustainability practices and initiatives. Therefore, Based on the research objectives, the questions are formulated as follows:

1. What is the structure and composition of the definable integrated marketing mix in knowledge-based companies?
2. How do the definable marketing components in selected knowledge-based companies align with sustainability goals and practices?

2. Literature Review

In this section, we analyze research emphasizing the amalgamation of marketing tactics within knowledge-based enterprises, particularly in the context of devising a custom marketing mix aligned with their sustainability endeavors.

Scheers found that factors such as competition establishing product demand, poor local small businesses, ineffective product marketing, and lack of market knowledge caused business failure in SMEs.(Scheers 2018)

According to Huggins, interorganizational and vendor network interactions in new product development are essential for success in technology-based markets.(Huggins 2009)

Lekhanya conducted a study in South Africa and found that access to finance, skills and leadership, management skills, value of training, and personnel skills are among the main factors that affect the marketing of SMEs. (Lekhanya 2015)

Caputo et al., (2018) examine ICT's role in enhancing sustainability through system thinking, particularly in domains like the Smart Grid, and advocate for leveraging ICT to broaden sustainability efforts (Caputo, Buhnova and Wallezky 2018). These technologies (ICT) possess the capacity to fulfill sustainability requirements within an organization's market strategies, including mechanisms related to organizational value creation, strategy, and structure (Kaur, Singh et al. 2022).

In an article the authors state that information technology is capable of the sustainable utilization of energy in the current scenario for sustainability (Gomez- Trujillo and Gonzalez-Perez 2021). The authors of a paper concluded that digital innovation aligns with sustainability goals by facilitating heuristic social relationships within the context of Society 5.0.(Osburg 2017)

By examining the findings of the three articles, the authors discuss the significance of digitalization and sustainability in integrating socio-economic aspects into traditional manufacturing practices (Pasqualino, Demartini and Bagheri 2021) (Camodeca and Almicci 2021, Feroz, Zo and Chiravuri 2021). This study discusses the utilization of industrial IoT, cloud computing, big data analytics, and AI in marketing across various applications, with no emphasis on other enabling technologies.(Jara, Parra and Skarmeta 2012)

The studies mentioned above suggest that Industry 4.0 technologies play a crucial role in attaining sustainability objectives.

Ravneet Kaur et al. (2022) discuss the importance of the Industry 4.0 revolution in addressing challenges and enhancing marketing strategies using digital technologies, focusing on both general and sustainability aspects. The study delves into the incorporation of Industry 4.0 enabling technologies into marketing strategies, examining their specific applications in retail marketing, customer relationship management, and new product development. These technologies offer competitive advantages by addressing issues such as disintermediation, combating click fraud, enhancing trust and accountability, and meeting customer needs and preferences in marketing.(Kaur, Singh et al. 2022).

In this study, to identify the marketing mix factors of knowledge-based companies, the EFQM Excellence Model and Philips' 12-element model are utilized. The reason for using these models is their completeness and excellence compared to all existing marketing and sales models. It is worth noting that, given the scope of this paper, we will be working with the operational level, which consists of 8 elements. Special attention has been paid to the sustainability aspect in the execution of the operational level.

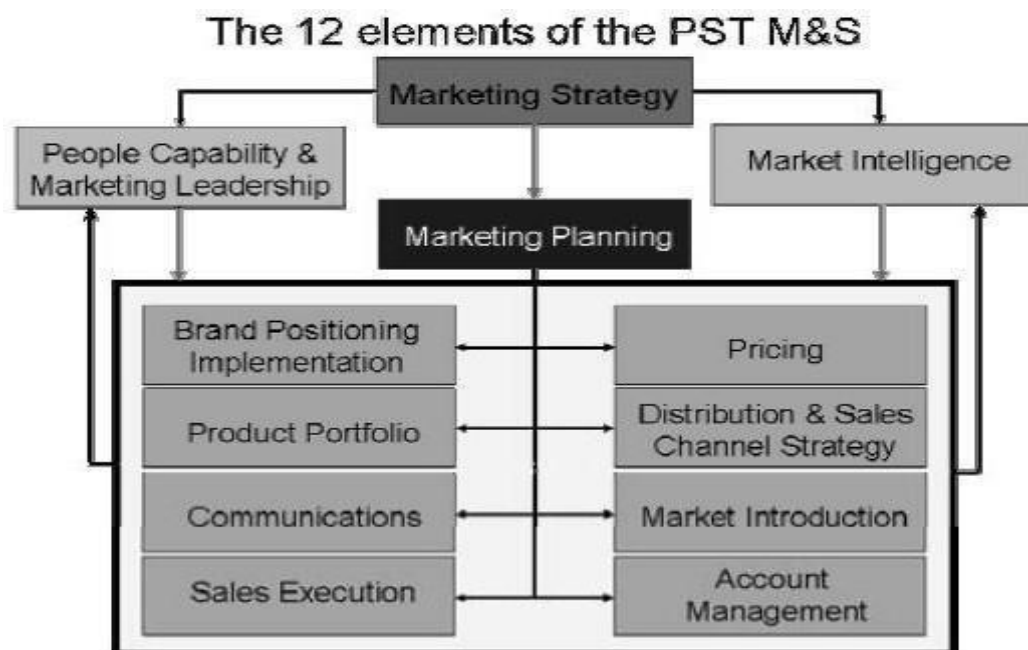


Figure 1EFQM 12-Factor Marketing Model (EFQM & Philips, 2004)

Based on the adaptation from the operational level of the model above, each of the 8 components will be detailed in the following sections.

2.1 Brand Positioning Implementation

Brand positioning is the strategic endeavor of an organization to create a unique image in the minds of stakeholders, distinguishing it from competitors. It involves designing and delivering offers, images, and business approaches to establish distinct value and perception among customers. Employees collectively uphold brand positioning elements, acting as a guiding filter in all organizational activities. Brand positioning articulates the value the company offers to end-users, setting it apart from competitors. It aims to carve out a specific territory in the minds of stakeholders, akin to Volvo's focus on "safety" and Marlboro's on "powerful individualism. (PHILIPS 2004)

2.2 Product Portfolio

Product portfolio management ensures optimal alignment between market inputs and future product/service specifications, reflecting brand position and consumer feedback. Its goal is to create the most competitive product portfolio that best meets customer needs and achieves business success.(PHILIPS 2004)

2.3 Communication

Communication in business is vital for brand positioning and message reinforcement, aiding in customer loyalty and marketing success. Effective strategies include advertising and integrated communication tools. Developing communication competence entails strategic formulation, consumer insights utilization, touchpoint optimization, advertising structure development, analytical tool comprehension, and e-business understanding. It also involves optimizing the balance between advertising and communication capital for cost efficiency.(PHILIPS 2004)

Brand imagery and communications cultivate customer understanding, fostering recognition and trust that enhance market share. Customer identification with a brand drives loyalty, crucial in fast-paced industries. Mission statements communicate a brand's purpose, with Jim Stengel advocating for brands that elevate human values, fostering emotional connections for deeper customer relationships. (DiResta, Forrest and Vinyard 2015)

2.4 Pricing

Pricing is key for profitability and should be managed competitively. It involves understanding market dynamics, setting strategic price points, and maintaining operational control. Understanding market intelligence involves analyzing competition, customer sensitivity, and segmentation. Pricing strategies entail aligning product positioning and competitive goals with price points. Operational control involves defining pricing policies, setting authority levels, and staying market-aware. (PHILIPS 2004)

Pricing determines where and how you sell your product, shaping your market presence. Positioning in pricing refers to how your product's price compares to competitors, reflecting its perceived value. Price is a key element of commercial positioning, influencing buyer behavior based on perceived quality and uniqueness. (DiResta, Forrest and Vinyard 2015)

An effective pricing model considers the market type, production costs, product value, market beliefs, and competitive prices while maximizing profit within market tolerance. Understanding competitive pricing is crucial for optimal results. New businesses have various pricing model options, including value-based pricing, competitive pricing, volume-based pricing, product bundle pricing, razor/razor blade model, leasing, and product-based pricing. (Blank, Blank and Dorf 2012)

2.5 Distribution/ Sales Channel Strategy

Distribution channels are the pathways through which a seller enables customers to purchase products. It's essential for pricing, distribution strategy, packaging, and messaging to be aligned. When discussing location, understanding where the target customers typically make purchases is crucial. You can evaluate your distribution extensively, offering the product both online and offline to reach customers effectively (DiResta, Forrest and Vinyard 2015).

It's essential to effectively and efficiently sell and distribute company products to target customers by integrating them into the value chain and the desired market through appropriate distribution channels and strong marketing support.(PHILIPS 2004)

2.6 Market Introduction

A successful product or service launch involves addressing key issues like clarity in decision-making, defining tasks, and aligning with business goals. The company should present a comprehensive value proposition covering product, brand, services, support, and pricing.(PHILIPS 2004)

2.7 Account Management

Recognizing and managing customer differences is key to customer management. It involves creating customized product/service packages for loyal customers based on their specific needs. In implementing a customer account management system, companies utilize market insights to guide effective customer management and maintain long-term competitive advantage. This includes defining learning objectives for sales/business individuals, transferring insights between customers, selecting key customers transparently, and conducting strategic sessions with customers to align long-term plans.(PHILIPS 2004)

2.8 Sales Execution

Salespeople can convert marketing strategies into customer value propositions to achieve business goals. Effective sales involve branding, offering value-added products/services, and

executing targeted marketing plans. Sales organizations must sell the company's interests, leveraging market insights, understanding customer needs, and employing necessary sales skills. Prioritizing customers, utilizing appropriate sales channels, offering incentives, and providing comprehensive sales skills to customers are crucial.(PHILIPS 2004)

3. Methodology

3.1 introduction

In this study, an attempt has been made to obtain a correct analysis of the marketing mix situation in the knowledge-based companies using a case study approach. This study is classified as applied and employed a qualitative method. The data gathering technique involved description, analysis, and multiple-case study approaches, with interviews serving as the primary method of data collection. Following that, The research employed a comparative qualitative content analysis approach for data analysis.

Broadly, qualitative research is generally employed to support a researcher in generating a deep and nuanced understanding of a given phenomenon(Lester, Cho and Lochmiller 2020). The results of this type of research vary widely, from producing findings that can be applied in practical situations(Lochmiller 2015),to offering in-depth descriptions of specific practical issues(Honig 2006), to providing insights into professional practices within specific contexts(O'Reilly, Karim et al. 2015), and addressing challenges associated with the subjective aspects of qualitative research (Cho, Park et al. 2016), among other outcomes. The effectiveness of qualitative research hinges on researchers' ability to conduct thorough and rigorous analyses while also understanding the essence of qualitative analysis in general.(Lester, Cho and Lochmiller 2020)

In this study, a dual approach of fieldwork and library research was utilized to gather data. Initially, research literature was gathered from library sources and scholarly documents. Subsequently, by using the case study technique and the interview tool, the functions of the mentioned model and the literature were examined.

A “case study,” is best defined as an intensive study of a single unit with an aim to generalize across a larger set of units. Case studies rely on the same sort of covariational evidence utilized in non-case study research. Thus, the case study method is correctly understood as a particular way of defining cases, not a way of analyzing cases or a way of modeling causal relations.(Gerring 2004)

3.2 Data collection

Data was collected through semi-structured in-depth interviews by developing an extensive

interview guide based on a literature review. Hence, a series of guided questions (TQs: Theory-Based Questions), follow-up inquiries (IQs: Interview Questions) were prepared to facilitate a comprehensive understanding of each participant's perspective on the marketing mix structure in knowledge-based companies with a sustainable approach. Adhering to the suggestions of Liu and Rong (2015), each participant was given sufficient time to articulate their responses to the questions based on real work experiences and concrete examples without interruption.

Although it was provided some structure for the interviews, participants could share other issues and ideas that were not included in the interview questions. The interviews were conducted with open-ended questions as shown in the Appendix. The TQs consisted of different themes elements which are Adapted from the concepts of the 8 operational elements of the EFQM model for marketing and sales as its described in previous section. It should be noted that after being on the path of research, based on facts, observations and of course related to literature, Other questions were added to the research and some questions were modified. Sometimes questions were asked experimentally and improvised during the conversation.

Based on the purpose of the study, the participants were selected from the CEO of the technology units located in Qom Science & Technology Park. Judgment sampling, a form of non-probability sampling, was used to select the sample. Sample selection continued until no new data appeared during the process of obtaining information. That is, the data collection continued until the theoretical saturation of the data was reached, and the total number of participants reached 13 people.

3.3 Data Analysis

The method of data analysis of this research is qualitative and comparative analysis. The researcher has tried to place the sub-category under an intermediate category by using the coding process and finally define the categories under a major and main category.

It is worth mentioning that the method of comparative content analysis means that coding is done based on a predefined model or theory, which ultimately results in the development of a similar model.

To analyze the data collected from the interviews, first, the whole texts were examined, and then there were read line by line by the researcher to understand each sentence. Next, the sentences were converted into smaller analysis units or semantic units (which were summarized in the next step), and primary codes were extracted. The codes were compared and classified based on their differences and similarities, and thus the main categories and subcategories were created.

To determine the validity of the data, content validity and face validity were used. To check content validity, the codes extracted from the participants' conversations were provided to participants to express their opinions about the codes. Accordingly, codes that did not convey their views were modified. To check face validity, codes and categories were reviewed by 2 experts familiar with qualitative research who had experience in health-related research.

4. Results

The interview process commenced by sending interview proposals to identified companies. After companies' confirmation and scheduling of interviews, the interviews were conducted. Interviews comprised 8 thematic question areas (theory- based questions) and 24 interview questions were asked to participants. Additionally, supplementary questions were posed during the interviews to clarify topics. All 13 interviews were recorded audio and transcribed into written files. Responses were categorized into 8 tables based on the thematic question areas. Initial codes were extracted from the responses in accordance with the question themes. Personal notes of the researcher were included alongside these codes for clarity. Extracted codes were refined and organized for scientific and systematic editing. Subsequently, tables were created to compile extracted codes from all 13 interviews along with their quantitative status to determine secondary codes. Secondary codes were then placed in final tables for comprehensive thematic analysis.

Below, each of the 8 elements are analyzed in detail. For each of the elements, a table has been prepared that includes the extracted primary code, the frequency, the secondary code, and also the concept obtained from the codes. The primary codes extracted after editing and equating the items of the participants along with the amount of repetition in different interviews are given and then by combining several primary codes, the appropriate secondary code is specified. The secondary codes themselves refer to a more comprehensive concept that brings us closer to identifying the framework. Secondary codes as well as concepts have been specified according to the key words that have been elements in the research literature. At the bottom of the table, an attempt has been made to give statistics, although general, of the status of the primary and secondary codes and concepts so that conclusions can be more easily drawn from the findings. This statistic will be used in chapter 5 and in the interpretation and comparison of the results.

4.1 Brand Positioning Implementation

As stated in the research literature, branding is the first operational factor for marketing in the EFQM organizational excellence model. The answers of the participants in this research to branding questions were in such a way that they emphasized on certain factors for brand positioning.

No	Primary Code	Frequency	Secondary Code	Concept
1	Aesthetic and memorable brand naming	7	Conscious Brand Naming	Establishing Brand Context
2	Abbreviated and suitable brand naming for international activities	4		
3	Descriptive and geographical brand naming	5		
4	Structural differentiation of brand language from competitors	1		
5	Appropriate slogan for the brand and products	5	Conscious Promotion and Distribution	
6	Logo and packaging aligned with the brand for products	5		
7	Consistency of promotion method with distribution method	2		
8	Strong research and high product diversity	4	Diverse, Quality-Conscious Production	Distinctive Feature Development
9	Focus on unique product production	9		
10	Customized and project-based production	6		
11	Quality in key product or service features; rigorous testing; international quality standards	11		
12	Experience, distinguished track record, and resume	1		
13	Accessibility and payment ease for customers	4	Distinctive Services	
14	Guarantees and accompanying after-sales services	13		
15	Attention to social values such as energy efficiency, eco-friendliness, organic quality, societal harm prevention, and data transformation for betterment	6	Attention to Social Values and Preference Needs	Distinctive Value Creation
16	Focus on sincere communications and fostering honesty and trust	3		
17	Addressing preference needs in products such as incentivized standards and exceeding service expectations	4		

4.2 Product Portfolio

The second factor of marketing in the EFQM Excellence Model, as surveyed among participants, was related to product portfolio management. As stated, the goal of product portfolio management is to receive feedback and input from the market and convert it into output, namely products or services for

customers. Product portfolio management, like branding, is listed below with primary and secondary codes, along with synonymous concepts, and a statistical overview of the codes is provided in the table below.

No	Primary Code	Frequensity	Secondary Code	Concept
1	Completing the product portfolio to fulfill all customer needs	3	Comprehensive product and service offerings	Consideration of Product Portfolio Characteristics
2	Customized production	6		
3	Product diversity within the product portfolio	5		
4	Complementary and after-sales services for products	13		
5	Creating competitive advantage for the product compared to competitors' products	3	Distinctive and indigenous product portfolio	
6	Localization of product production	4		
7	Identification of societal needs drivers; changing lifestyle variables and costs such as: Increasing energy costs, Environmental health concerns, Ecological considerations, Attention to life costs and using products with longer lifespans, Lower maintenance and repair costs, Lower infrastructure needs and initial costs, Reduced safety protection needs, Lower risk.	5	Market, assessment, Direct feedback, Research and development	Market feedback and input
8	Global needs assessment and examination of global trends	4		
9	Market monitoring to assess competitor and market trends and customer needs	13		
10	Direct customer engagement for needs assessment and feedback	11		
11	Forecasting needs for development and production (research and development)	11		
12	Product modification and improvement based on: Customer needs, Market analysis, Technological advancements, Company's technical and research team and colleagues' input.	12	Modification and improvement	improvement and output to the market

4.3 Communication

The third marketing factor in the EFQM excellence model that was asked from the participants was communication. Communication seeks a long-term and positive relationship with the organization's customers. Below the table are the primary and secondary codes and their synonyms, and below the table is a statistical look at the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	Establishing Physical Communication Infrastructure with Counterpart Companies: <ul style="list-style-type: none"> • Developing a professional website with a suitable domain • Company email addresses • Contact numbers and fax (headquarters and factory) • Active presence on virtual platforms • Introduction of the organization and product catalog 	13	Establishing communication infrastructure.	Conveying the organization's message.
2	National inauguration and dissemination through news reports (public relations)	3	Promoting the product and organization through informative, persuasive, and reminder advertising (targeted).	
3	Introduction of products and company capabilities to market Stakeholders	6		
4	Direct communication and outreach to potential markets and participation in tenders	12		
5	Participation in national and international specialized exhibitions; attendance at conferences and specialized sessions; organizing specialized meetings and conferences	12		
6	Engagement with product endorsers such as: <ul style="list-style-type: none"> • Specialized industry policymaking organizations 	8		

	<ul style="list-style-type: none"> Physicians for pharmaceutical products Influential market customers 			
7	Advertising products in specialized and non-specialized magazines	3		
8	Content creation and advertising in the digital space	2		
9	Advertisement in national media	2		
10	Introducing products to consumers in public spaces	1		
11	Collaboration with domestic, international companies, and NGOs	4		
12	<p>Establishing positive and long-term relationships with customers, especially project-based clients, involves various activities such as:</p> <ul style="list-style-type: none"> Sending samples and conducting pilots before starting the project. Providing high-quality products and services along with product information. Offering post-sale services and customer support. Having a professional and specialized sales and after-sales service team. Creating online accounts and profiles for customers. Building trust and honesty in relationships. Surprising customers by managing their expectations effectively. 	14	Positive influence and unique expertise.	Fostering customer loyalty.
13	The limited number of specialized companies in the field and the uniqueness of the product have fostered long-term relationships with customers.	3		

4.4 Pricing

The fourth factor of marketing in the EFQM Excellence Model, as inquired by the participants, is pricing. Pricing determines how cash flows into the organization and how demand is generated for its services and products. Below, a table presents primary and secondary codes along with their corresponding concepts, followed by a statistical overview of the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	Identifying and evaluating competitors' prices using colleagues, customers	11	Analyzing the environment (market and competitors) to select pricing strategy.	Pricing Intelligence
2	Identifying market demand from statistical methods and secondary information	9		
3	Identifying the price elasticity of demand based on the examination of the components of the substitute product compared to the company's product and also through pilot and test supply.	5		
4	Preparing a feasibility plan for customers to compare the current costs before and the initial and current costs after the implementation of the project	1		
5	Pricing the product according to the cost price and a reasonable or legal fixed profit percentage	8	Strategically pricing in line with positioning.	Strategic Pricing Approaches.
6	Product pricing according to cost price and market demand + purchase amount + price elasticity	6		
7	Pricing above the market average and competitors	4		
8	lower pricing than competitors' average; penetration pricing; Fair pricing	4		
9	Lower pricing of imported products	4		
10	Price stability throughout the year	2		

11	<p>Calculate the cost price based on:</p> <ul style="list-style-type: none"> • Raw material • Overhead costs • Depreciation costs of non-technology • Personnel costs • after sales service • Legal costs • Research costs 	13	Monitoring and controlling pricing.	Price Management and Oversight
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	<ul style="list-style-type: none"> • Unforeseen expenses • Cost of specialized manpower and manpower training • Installation costs • Sales costs 			
12	Price changes based on the experience Curve	1		
13	Monitoring currency fluctuations to control and change prices	7		
14	The amount of the order and the method of payment have an effect on the price	2		

4.5 Distribution/ Sales Channel Strategy

The fifth marketing factor in the EFQM excellence model that was asked from the participants was the distribution method and distribution channel strategy of the company. It is very important how knowledge-based companies deliver their products to consumers. Below the table are the primary and secondary codes and their synonyms, and below the table is a statistical look at the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	Direct and unmediated communication and distribution channel	9	Appropriate distribution channel	Establishing a Value Chain
2	Product distribution in the market and sales through related and general stores	3		
3	Intermediary for ordering and obtaining the project	1		
4	Regional agents for sales and after sales services	6		
5	Direct and virtual sales (Internet, telephone, social networks)	3		
6	Creating a semi-independent structure for product sales, outsourcing sales with full company supervision	2		
7	Sales through the distribution channel of companies and wholesalers of the mother supplement product	2		
8	Cooperation with national broadcasting	1		

	companies			
9	Creating export infrastructure and communication with foreign agents for export	1		
10	Market monitoring to identify customer needs in product distribution method	2	Identifying the appropriate distribution method	Enhancing Distribution Channel Support
11	Not using existing market agents for representation	1		
12	Working conditions with the distribution channel based on: <ul style="list-style-type: none"> • Experience and history • Power and financial ability • Technical power • Set minimum sales 	4	Reasonable working conditions with the distribution channel	
13	Holding a training class to learn more about products from a technical point of view and training related to sales for market agents	6	Education and motivation of the distribution channel	
14	Identify bonuses and commissions to encourage more sales	4		

4.6 Market Introduction

The sixth marketing factor in the EFQM excellence model that was asked from the participants was introducing the company's products to the market. It is very important how knowledge-based companies introduce their products to the market. Below the table are the primary and secondary codes and their synonyms, and below the table is a statistical look at the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	Holding a new product unveiling ceremony and introducing it to customers	4	Informed and comprehensive introduction of value proposition	Creating a Significant Impact
2	Calling current customers to introduce new products + free samples	4		
3	Communication with related upstream organizations and introduction of new product benefits	3		

4	Introducing the new product to potential customers, as well as industrial customers for whom the company's new product provides an advantage	5		
5	Delivery of new product samples and marketing tools to agents and distribution channels	2		
6	Introducing the new product on the company's website and introducing it virtually	7		
7	Advertising before the release in the distribution channel	3		
8	New product introduction in specialized exhibitions	2		
9	Capillary communication with people to introduce and change mentality	1		
10	Conducting scientific research and publishing the results to the scientific community	2		
11	Perform the authorization process to be in the vendor list for	2		
12	<ul style="list-style-type: none"> The new product will increase the profitability and strategic development of the business 	2	The Necessity of a Fresh Value Proposition	
13	Failure to introduce a new product will cause incompleteness of the product portfolio and loss of customers and will damage the brand (response to the need for a new product)	8		
14	The task of a knowledge-based company is to produce new products	1		
15	The new product includes changes in size and different design or different application and sometimes it is different from zero to hundred. Also, the new product includes new features and creates differentiation.	10	Emerging Characteristics of the New Value Proposition	
16	A new product is a product that includes a different brand name and packaging	2		
17	Needs assessment for new product production should be done	3		

4.7 Account Management

The seventh factor of marketing in the EFQM Excellence Model, asked by the participants, is customer account management. Knowledge-based companies need to categorize their customers and propose appropriate marketing plans for each category. The table below presents the primary and secondary codes along with their synonymous concepts, followed by a statistical overview of the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	Customer categorization based on structure: private sector, government sector, and organizational.	2	Customer identification and categorization	Customer Relationship Management
2	Customer segmentation based on financial records and financial capability.	4		
3	Customer categorization based on mutual respect and win-win projects.	1		
4	Customer segmentation in distribution channels based on performance.	1		
5	Customer account management software system for identifying relationships.	4		
6	Level of commitment to contracts as a criterion for assessing the company and the type of interaction with the customer.	2		
7	Special offers for reliable, busy, and reputable customers.	7	Appropriate action or proposal	
8	Support for reliable and satisfied customers.	2		
9	Termination of cooperation and non-provision of credit offers for unreliable customers.	5		

4.8 Sales Execution

The eighth factor of marketing in the EFQM Excellence Model, as asked to participants, is sales implementation. Sales execution refers to the forefront work in sales, meaning the sales organization. Below is a table including the primary and secondary codes along with their synonymous concepts, followed by a statistical overview of the codes.

No	Primary Code	Frequency	Secondary Code	Concept
1	The commercial and sales unit is responsible for receiving and processing orders and projects (project proposals) and agreeing with the customer	9	Sales organization image	Efficient Sales Execution
2	Agents are in charge of customer relations and product sales	3		
3	The after-sales service team is in charge of handling the after-sales processes such as warranty, repairs, etc.	4		
4	The management of the company is responsible for communicating with customers and making contracts	4		
5	The marketing team is in charge of developing the market with different tools	3		
6	Outsourcing sales organization	2		
7	Sales planning and planning according to: <ul style="list-style-type: none"> • Market feedback • Last year's monitoring • Working season • Company capacity and production licenses • Need and amount of demand • Added number of competitors, prices 	9	Sales planning	

5. Discussion

In this study, we aim to identify a comprehensive framework for marketing mix as one of the fundamental tools in marketing and sales for knowledge-based companies. This framework is intended to provide a cohesive and complete structure in this area to help stabilize and strengthen these companies in the market. Subsequently, it will contribute to taking steps towards environmental sustainability.

5.1 Interpretation of the Results

Section 4 of the research focuses on presenting the findings in the form of secondary codes, which represent different concepts derived from the data analysis. This section provides an overview of the research findings and statistical analysis to define the framework of

knowledge-based companies.

- branding is a critical element in the marketing framework of knowledge-based companies, as identified by participants in the study. The responses highlighted three main concepts:
 - Branding Foundations: This involves strategic naming and distribution of products, with 93% of participants emphasizing its importance. The key aspect here is the strategic naming of brands.
 - Distinguished Features: Knowledge-based companies differentiate themselves by producing unique, high-quality products and services. This concept was universally acknowledged by 100% of participants, indicating the significance of product distinctiveness.
 - Unique Value Creation: In addition to competitive advantages, knowledge-based companies focus on addressing social values and preference needs. While recognized by 60% of participants, this aspect highlights the importance of considering social issues in branding.

Overall, the responses underscored the critical role of branding in knowledge-based companies, emphasizing strategic naming, product distinctiveness, and consideration of social values as key components of effective branding strategies.

- Based on the participants' responses, product portfolio management in knowledge-based companies is considered a prominent component within the framework. Participants highlighted three main concepts:
 - Product Portfolio Characteristics: Emphasizing the importance of having a diverse and comprehensive product portfolio with unique and indigenous services.
 - Market Feedback and Input: Stressing the significance of assessing market needs through trend analysis and direct customer feedback.
 - Adjustment and Output to the Market: Underlining the necessity of continuous adjustment and modification of product portfolios based on market feedback and changing environmental conditions.

In summary, product portfolio management is a crucial element in the framework of knowledge-based companies, encompassing the comprehensive management of diverse products and services, informed by market feedback and adaptable to changing market dynamics.

- The participants highlighted the significance of communication within knowledge-based companies, emphasizing two key aspects:

- **Organizational Messaging:** This involves establishing communication structures and strategically promoting products or services through informative, persuasive, and reminder-based advertising. All participants recognized the importance of this concept, indicating its critical role in knowledge-based companies' promotional strategies.
- **Building Loyalty:** Participants stressed the importance of fostering positive and unique relationships with customers to cultivate loyalty. They acknowledged that loyal customers contribute significantly to a company's sustainability and growth.

Overall, effective communication strategies are essential for knowledge-based companies to succeed in promoting their offerings and building lasting relationships with customers.

- The participants emphasized three key aspects of pricing in knowledge-based companies:
 - **Intelligent Pricing:** This involves analyzing the market and competitors to determine pricing strategies. It was highlighted by 93% of participants, indicating the importance of considering market conditions for effective pricing.
 - **Pricing Strategy:** Knowledge-based companies tailor their pricing strategies to align with their brand positioning. 100% of participants acknowledged the significance of this aspect, with many utilizing cost-plus pricing methods.
 - **Price Control:** Participants emphasized the need for monitoring and controlling pricing decisions internally. All participants recognized the importance of maintaining control over pricing processes to adapt to market changes.

In summary, pricing in knowledge-based companies involves strategic analysis of market conditions, alignment with brand positioning, and internal control over pricing decisions to ensure competitiveness and adaptability.

- In knowledge-based companies, the distribution and sales channel strategy is crucial, as revealed by participant responses. Two main concepts emerged:
 - **Value Chain Creation:** Participants unanimously stressed the importance of establishing appropriate distribution channels, with many companies (60%) opting for direct sales without intermediaries. This underscores the significance of direct communication due to the specialized nature of their products/services.
 - **Channel Support:** While about half of the participants highlighted the importance of supporting distribution channels, the emphasis on this aspect was relatively lower. This may be because knowledge-based companies predominantly rely on direct communication, given the specialized nature of their offerings.

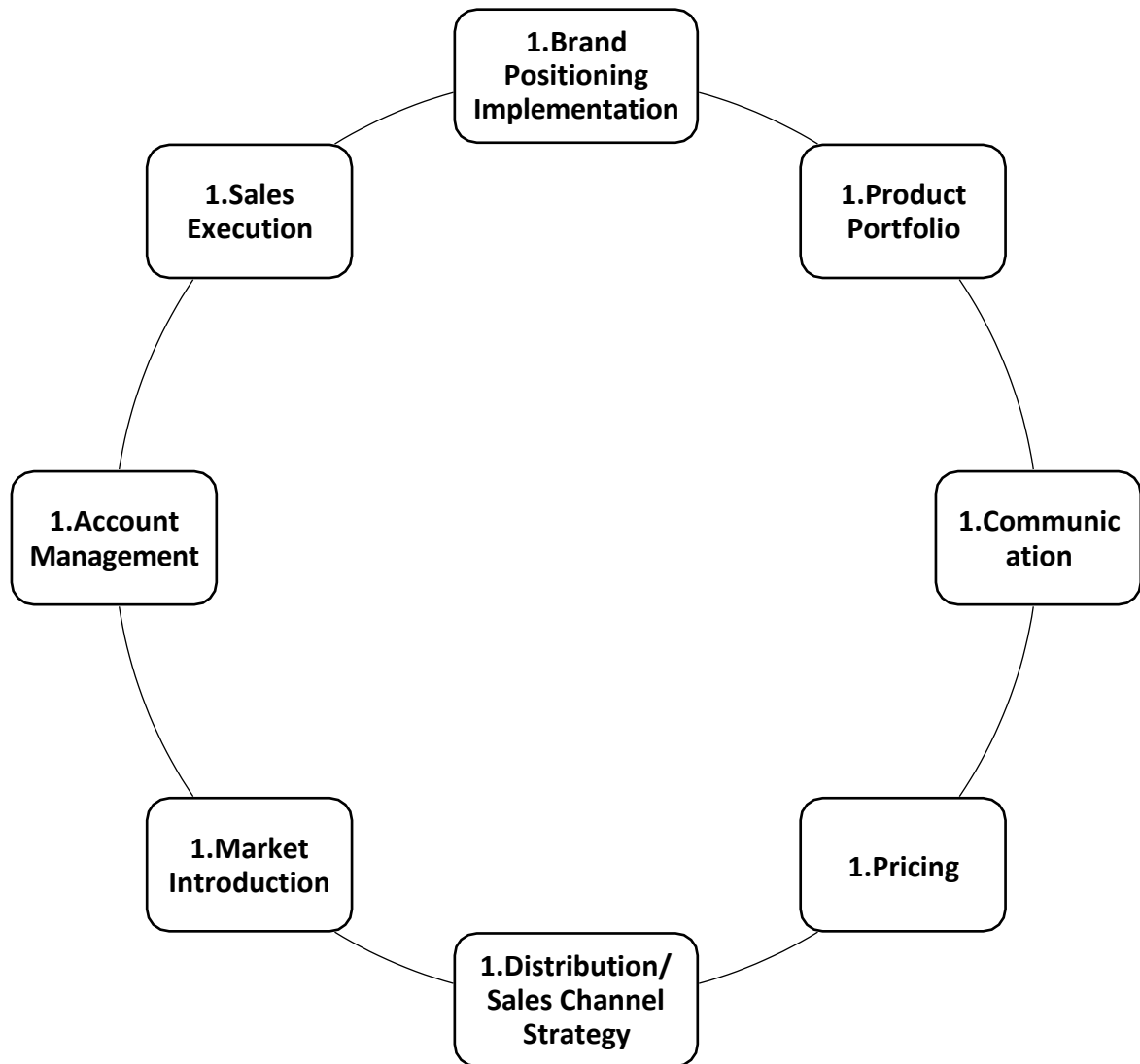
Overall, knowledge-based companies acknowledge the importance of distribution and sales channel strategy but tend to favor direct communication with customers due to the unique nature of their products/services.

- Participants in the study emphasized the importance of introducing new products to the market for knowledge-based companies.
 - They highlighted the concept of creating a significant impact through the deliberate and comprehensive introduction of the new value proposition, emphasizing its necessity and unique features. All participants acknowledged the importance of this concept, with high frequencies across primary codes. Knowledge-based companies employ various methods, including virtual introductions via websites and social media, as well as face-to-face interactions, to introduce their new offerings. Direct communication remains crucial for these companies due to the innovative nature of their products. Overall, the responses confirmed the significance of introducing new products in the context of knowledge-based companies.

- Customer account management is recognized as an essential element in the framework of knowledge-based companies, as indicated by the responses of participants.
 - The concept of customer relationship management, including the identification, categorization, and appropriate action for customers, was highlighted by 80% of participants. However, it's noted that knowledge-based companies tend to focus more on fostering relationships with loyal customers rather than eliminating poor-performing ones due to the specialized nature of their products and limited customer base. While the importance of customer account management is acknowledged, these companies may not systematically pursue it, primarily due to the unique nature of their value proposition.

- In the context of knowledge-based companies, sales execution plays a crucial role and is considered a significant element within their framework.
 - Participants highlighted the importance of organizing sales structures and planning for effective sales execution. This concept received unanimous emphasis from all participants, indicating its critical nature. Regarding sales structure, the findings showed variations, with some companies lacking independent sales units while others outsourcing their sales or establishing dedicated teams for after-sales services. Similarly, in sales planning, while 60% of companies formulate annual plans based on economic variables, there is room for improvement in terms of active engagement in structured sales approaches. Overall, the responses underscore the need for structured sales approaches and planning in knowledge-based companies, despite some variations in implementation across different organizations.

In conclusion, the adapted conceptual framework, as cited in research literature, appears to offer a robust marketing and sales structure suitable for companies of this nature. A notable highlight of this framework is its focus on environmental sustainability and green initiatives, offering these firms a clear pathway to sustainable practices.



Upon reviewing participant responses across the eight elements in technology-based companies, the adapted framework has been fully validated. While some elements may exhibit strengths and weaknesses, it's not due to a lack of belief in these elements by tech companies, but rather their nature guiding their focus. A closer look reveals that these companies particularly emphasize communication, distribution/sales strategy, market introduction, and sales execution. The common thread among all these elements is establishing proper customer relations. Tech companies must maintain, nurture, and foster loyalty with customers, reflecting in their long-term communication strategies. In terms of distribution strategy, tech companies often directly engage with customers, lacking intermediary channels. This emphasis on customer engagement is evident in sales execution, with close managerial involvement often seen. Additionally, the importance of market introduction highlights the need for a proper customer-centric communication model. Lastly, the flexible, market-centric sales structures in tech companies, coupled with close managerial involvement in sales, are distinct features observed.

Regarding other elements, branding, product portfolio management, and pricing have been highlighted with a 100% frequency in responses as areas of focus for tech-based companies. In terms of branding, tech firms prioritize service and product differentiation, aiming to meet societal needs and global preferences, aligning with their mission of creating a better world. Product portfolio management involves continuous market monitoring and agile responses to evolving technological needs, given the dynamic nature of the tech industry. Pricing strategies in tech firms are influenced by unique cost structures, often employing transparent and balanced models to reflect quality and maintain competitiveness. However, customer account management received the least attention, attributed to the typically smaller customer base of tech firms, emphasizing customer-centric approaches and incentivizing purchases to mitigate this challenge.

5.2 Limitation

Research endeavors always entail limitations that may introduce inadequacies in the results, particularly qualitative studies, inherently constrained in nature. However, several constraints were identified in this study. Firstly, the scarcity of marketing-related research in tech-based companies and the absence of a universally recognized concept of "tech-based" globally posed challenges in background preparation. While related concepts exist worldwide, the term "tech-based companies" is less prevalent. In Iran, research on tech-based companies is mostly focused on pre-commercialization stages, hindering comprehensive exploration. Regarding interviews, limitations were evident in their execution. Some companies declined interview participation to safeguard organizational confidentiality or due to time constraints. Additionally, time constraints sometimes led to superficial exploration in interviews, while others resulted in excessive, tangential information.

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Performance Prediction Model for Entrepreneurs with Disabilities

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Abstract

Abstract Increasing the number of entrepreneurs with disabilities is a crucial approach towards achieving the United Nations Sustainable Development Goals (SDGs). Despite the efforts made by governments in developing countries to eliminate the SDG of reducing poverty by supporting entrepreneurs with disabilities (ED), their failure rate remains high. Thus, this study extends prior research by testing the validity of Halabi and Lussier's performance model in predicting factors the drive success or failure of disabled entrepreneurs. The research design is a survey using a logistic regression model to analyze 87 failed and 86 successful businesses owned by people with disabilities (N = 173). We find that the performance factors that distinguish between successful and failed businesses owned by entrepreneurs with disabilities are working capital, financial and accounting information, planning, partners, and marketing skills. The results support the model validity and five variables (working capital, financial and accounting information, planning, parents who owned businesses, marketing skills) are significant in predicting the success or failure of businesses owned by entrepreneurs with disabilities. Entrepreneurs with disabilities who start with adequate working capital with a specific business plan, maintain proper financial controls and accounting information, have a parent that owns a business, and that have marketing skills can increase their probability of success. Implications for theory and practical applications for governments, global advocacy agencies, shareholders, management, regulators, policymakers, and investors, are discussed.

Keywords: Performance, sustainability, sustainable development goals, developing country, entrepreneurs with disabilities

References are available from the senior author

Validation of the Money Ethics Scale (MES) and the Money Attitudes Scale (EAD)

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ABSTRACT

The objective of this study was to validate the factorial structure of the Money Ethics Scale (MES.) and the Money Attitudes Scale (EAD-6), complementing the analysis with a review of their internal consistency. The study of financial education focused on psychological aspects, such as attitudes and beliefs about money, have not received sufficient attention from the scientific community, as evidenced by the lack of a moderately standardized measurement scale models with support and continuous development. To this end, the scales mentioned above were applied to 169 university students (38% men, 62% women). For the factor analysis, the oblimin rotation method was used, ensuring compliance with adequate values in the Kaiser-Meyer-Olkin index (KMO) and Barlett's test of sphericity. Reliability was evaluated using Cronbach's coefficient, obtaining 0.584 for the MES. scale and 0.918 for the EAD-6 scale. Factor analyses confirmed the 5- factor structure for the MES. scale: budget, bad money, equity, success, and motivator with the omission of one item in the equity factor (Eq3) and the two-factor composition for the EAD-6 scale: social power and personal. Results support that the measurement scales analyzed have factorial validity for their application in university communities.

Keywords: attitudes towards money, university students, structural validity, factor analysis.

INTRODUCTION

A literature review on financial education in Latin America evidenced the limitations of programs and efforts to improve personal finance, which, although they have achieved the theoretical teaching of finance, have not achieved the practical use of such skills (LópezLapo et al., 2022).

THEORETICAL FRAMEWORK

This study of financial education focused on psychological aspects, including attitudes and beliefs about money, which we measure using the Money Ethics Scale (M.E.S.) and the Money Attitudes Scale (EAD-6).

METHODS

The Money Ethics Scale (M.E.S.) and the Money Attitudes Scale (EAD-6) were completed by 169 participants (38% male, 62% female) from the digital arts, engineering, and business management programs, who volunteered to participate in the study.

DATA ANALYSIS

For the factorial validity of the two scales, the oblimin rotation method was used to confirm the possible correlations and the correct assignment of items in the components, according to the research development of the instrument. Prior to such tests, adequate values in the Kaiser-Meyer-Olkin index (KMO) greater than 0.6 (even from 0.5 for some authors) and significance levels of less than 5% in Bartlett's test of sphericity were ensured.

To evaluate the reliability of the scales, Cronbach's alpha coefficient was used for each of the factors and the same alpha was calculated by alternating the omission of each of the items. As a result of this procedure, the items that affect the internal consistency of each factor were identified.

RESULTS

In summary, the factor analysis proposes the elimination of item Eq3 of the M.E.S. scale to improve the configuration of the instrument by adapting it to 14 items distributed in 5 factors, while it approves the structure of 12 items divided in two factors for the Attitudes towards Money Scale (EAD-6).

DISCUSSION

The present investigation clarifies the questions that could arise for researchers and other individuals when applying questionnaires such as those in the present work, which have been validated in external populations. The above, by means of factorial validation and suggestions under statistical argument that provide a reliable measurement instrument for the study in university communities.

LIMITATIONS AND FURTHER RESEARCH

The limitations of this study are mainly to be found in the limited academic knowledge of the measurement instruments evaluated and, evidently, in the lack of unification of these instruments. Although it was not necessary in this study, the absence of a reference scale in the interpretation of both scales can cause complications in longitudinal studies.

This research, which validates and refines the M.E.S. and EAD-6 scales in a new population, provides the basis for future exploratory or even longitudinal studies that contribute to the collection and improvement of the topic of financial education and its problems. The validation of the measurement instruments in more populations and the consideration of variables that

deepen the understanding of financial literacy are recommended.

CONCLUSIONS

Given the situation of young people with regard to financial literacy, it is important to provide them with the tools to support them in their daily life in relation to money, decision-making and attitudes to conduct themselves in financial matters.

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Available upon request by the senior author.

Advancing Financial Management Practices of Banks in Sub-Saharan Africa: Do Working Capital, Risk, and Investment Decision Managements Matter?

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Abstract

Abstract The banks in Africa continue to fail, requiring governments to spend considerable funds to give depositors' their money. Extant literatures postulate that the collapse or failure of banks is a result of a lack of financial management practices. However, due to the inconclusive findings on the relationship between financial management and financial performance, there is no theory advancing financial management and performance. This study adds to the international debate by examining how financial management in terms of working capital management, risk management, and investment decision management affects the financial performance of banks in sub-Saharan Africa. The research design is secondary data, using a sample of 211 banks that failed between 2015 and 2021. The regression models show that risk management does not affect financial performance of banks in sub-Saharan Africa; however, working capital management and investment decisions advance financial performance of banks in sub-Saharan Africa. The study recommends that the management of banks should develop sound financial management measures that can be embedded into the financial management systems. Also, banks should implement prudent working capital management practices, such as reducing non-performing loans and current liabilities and investing customers' deposits in risk-free or profitable ventures or investments. Implications for theory and practical applications for global advocacy agencies, shareholders, management, regulators, policymakers, and investors, are discussed.

Keywords: Financial management practices, banks, finance, sustainability, Africa, References are available from the first author.

A Small Business Success versus Failure Prediction Model in North Africa

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Abstract

Around the world, small businesses play a critical role in the economic and social development. However, despite their importance, there is no unified theory or model to predict which small businesses will be successful and those that will fail. Our research question is: Why do some businesses succeed and others fail? Our objective was to develop a success vs failure prediction model in North Africa. This study is based on resource theory and the validated Lussier model to predict small businesses success or failure. Our methodology extends the binomial success or failure logistic regression model by using an ordered probit model analysis with the dependent variable being trinomial, using these three levels of performance. Our data collection includes the Lussier validated questionnaire and we added a variable to include the use of technology. Our sample includes small businesses in the developing economy of Morocco. The preliminary results support the validity of the model in North Africa, improving its global validity and contributes to resource-based theory and the development of success vs failure theory. The model also contributes to practice and entrepreneurship education. Educators can teach the model to aspiring entrepreneurs, and public policy makers can use it when providing small business assistance.

Keywords: Small businesses, Success factors, Failure factors, Lussier model.

Best Paper Award in Knowledge Management

Beyond the Basics: An Expanded Digital Transformation Adoption Model for Biopharmaceutical Manufacturing

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ABSTRACT

Amid the challenges posed by the COVID-19 pandemic, US-based biopharmaceutical companies have been actively pursuing Pharma 4.0 initiatives and digital transformation (Dx) strategies, envisioning the evolution of digital factories. Executives and IT leaders, aware of the inherent complexities in biopharma manufacturing operations, have embraced frameworks aligning with their long-term Dx strategies. Building upon Johnson and Uwaoma's (2023) digital transformation adoption model, the study progresses to address the pressing selection problem within this context. Utilizing SmartPLS4 to evaluate an extended Structural Equation Model, this research not only validates the initial model but establishes a second model with superior performance. The expanded model reveals key external and social factors influencing the selection process, where Perceived Usefulness (PU) has the least impact on Intentions of Use (IU), with Perceived Ease of Use (PEU) showing almost eight times more influence than PU, emphasizing its significant role in framework intention of use. Job Relevance (JBR) also demonstrates a threefold impact on IU compared to PU. Notably, within PU, Hallmark Functional Elements (HFE) have a medium impact, while Image (IM), Perceived Ease of Use (PEU), and Hallmark Structural Elements (HSE) all had a significant but small impact on PU. Only two TAM3 constructs, Perceived Enjoyment (PENJ) and Perception of External Control (PEC), have a significant but small impact on PEU. These insights are particularly pertinent for biopharma IT leaders aiming to sustain their strategic initiatives when adopting any Dx framework. The extended model proves highly beneficial, demonstrating a superior overall fit and heightened predictive power, which highlights the efficacy and relevance of this research in guiding effective decision-making within the biopharma industry.

Keywords: Digital transformation frameworks; digital transformation; technology adoption model; biopharma manufacturing; PLS-SEM; Pharma 4.0; SmartPLS4.

1. INTRODUCTION

1.1. Thriving in a Post-Pandemic World

Amidst the ongoing efforts of businesses worldwide to recover, normalize operations and supply chains in the aftermath of the profound impact of the COVID-19 pandemic (Wallace, 2023), Americans in the United States have demonstrated remarkable resilience. This resilience has manifested in significant lifestyle changes, such as individuals leaving stressful jobs (Fuller & Kerr, 2022), opting for early retirement and embracing RV-based living, or adapting to the new norm of remote work and working from home for those remaining in the labor market (Gast, 2021; Robinson, 2022).

Even as the pandemic fades into the past, its aftermath has left the business environment in a state of uncertainty. In the current economic conditions, biopharmaceutical (biopharma) organizations face the challenge of distinguishing themselves to maintain a competitive advantage. This challenge is heightened as they actively pursue higher digital maturity and business agility through digital transformation (Dx) initiatives. These initiatives serve as a means to transform their organizations, addressing the evolving needs of empowered patients, keeping pace with advancements in technology, and meeting the growing demand for personalized medicine in a post-pandemic world (Levy, 2023). To do that, selecting and using the appropriated Dx tools, and best practices is essential.

2. BACKGROUND

2.1. Going Beyond the Basics

In our previous study (Johnson and Uwaoma, 2022) we evaluated our first Dx adoption model by surveying 210 professionals, comprising executives, managers, IT leaders, consultants, and academics, all actively engaged in the biopharma industry. The survey aimed to assess the perceived usefulness of the proposed Dx framework and the participants' intentions to adopt the proposed framework.

In this study, we extend our initial research by directing our attention on Perceived Ease of Use (PEU), social influencing factors outlined by Venkatesh and Bala (2008), and the hallmark characteristics of a leading Dx framework as outlined by Coundouris (2020), depicted in Table 1. Incorporating these constructs into our analysis, we extend our prior model and conducted a survey, involving 213 professionals. This sample population includes executives, managers, IT leaders, consultants, and academics, who are actively engaged in the biopharma industry and Dx efforts.

[Insert Table 1]

The survey was conducted from April 21 to May 10, 2023, utilizing a web-based survey hosted on the Cintement research platform and delivered through Qualtrics. Data were collected based on constructs derived from Davis (1989), focusing on Perceived Usefulness (PU), Perceived Ease of Use, and User Acceptance of Information Technology. The survey also incorporated Venkatesh and Davis's (2000) technology acceptance model (TAM) and, building on that, Venkatesh and Bala's (2008) foundation of the Technology Acceptance Model 3 (TAM3). Participants were introduced to the same conceptual overview (Figure 1) and a strategic roadmap (Figure 2) from our initial study, both represent two of the nine artifacts within a broader digital transformation framework developed by Johnson (2022).

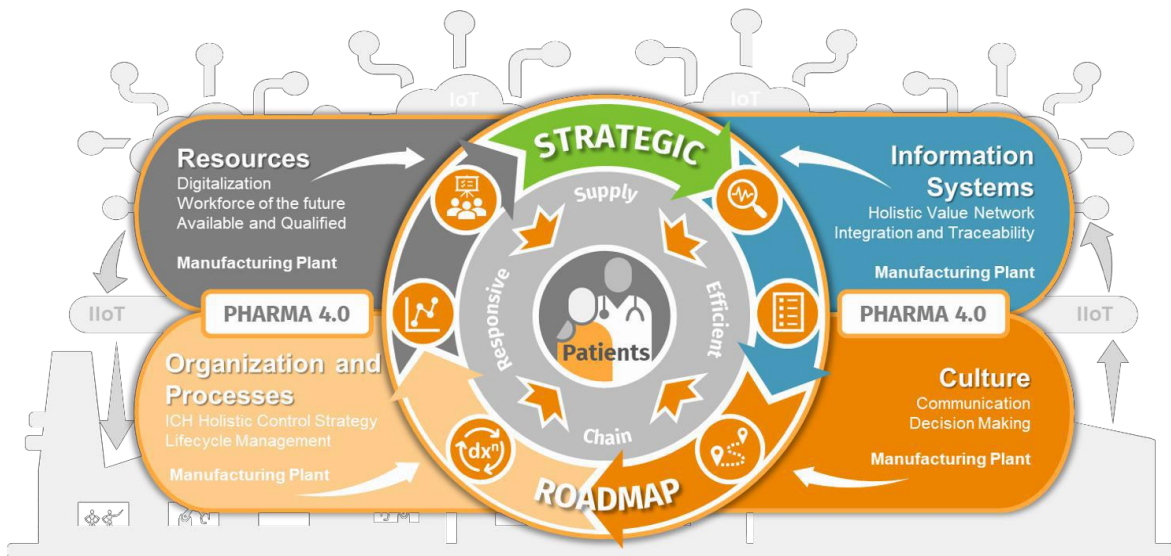


Figure 1: Johnson (2023) - The dxⁿ Conceptual Overview

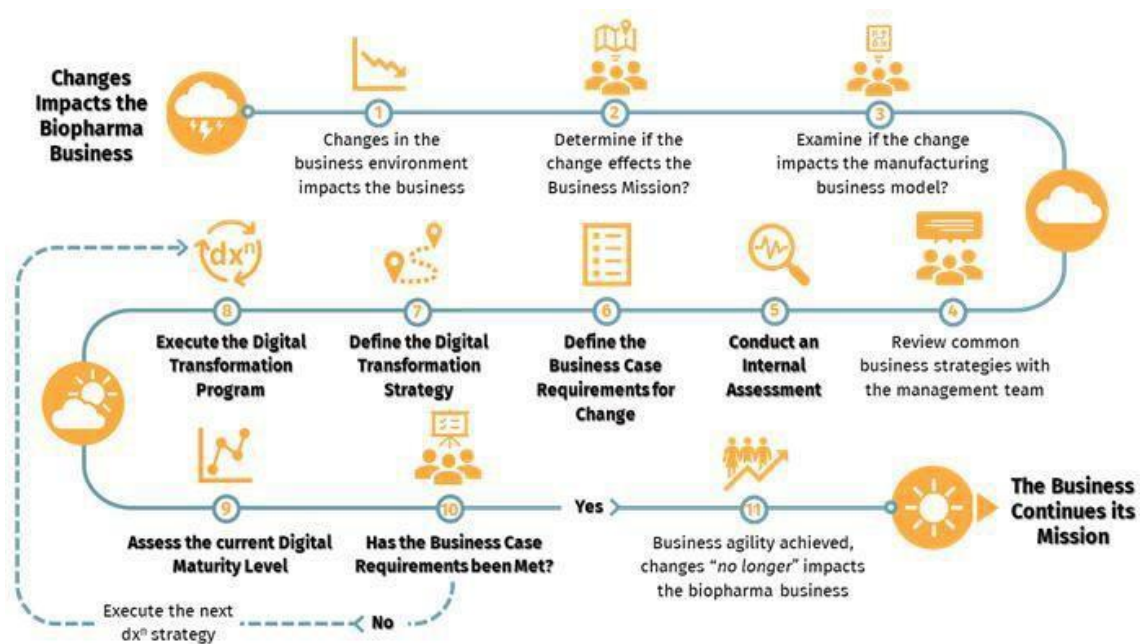


Figure 2: Johnson (2023) - The dxⁿ Strategic Road Map

2.2. Assessing Perceived Ease of Usefulness, Perceived Ease of Use and Intention to Use

Each respondents assessed the artifacts through the lens of their academic or professional expertise and experience. The outcomes validated the practicality of the proposed artifact, employing a seven-point Likert scale that ranged from "Strongly agree" to "Strongly disagree." Our analysis revealed that the prevailing response (i.e., the mode) was "agree," signifying the perceived effectiveness of the proposed artifacts and the respondents' intention to adopt them.

3. The Extended Digital Transformation Adoption Model

3.1. Extending the Technology Adoption Model from Johnson and Uwaoma

With this in mind, this study enhances the previous adoption model through two main approaches: (1) broadening the range of survey questions, and (2) incorporating TAM3 and UTAUT constructs alongside their moderating variables, such as Age (A), Dx Experience (DXEXP), and Gender (G), as well as facilitating conditions. As defined by Venkatesh (2000), Perceived Enjoyment (PENJ), pertains to the extent of an individual's pleasure in using a specific technology, regardless of any performance outcomes resulting from its use. On the other hand, Framework Anxiety (FWANX) characterizes an intense fear of utilizing the proposed framework or other technologies, such as computers, cell phones, or artificial intelligence. Framework Self-efficacy (FWSE) refers to an individual's confidence in effectively using the proposed framework to execute sophisticated tasks.

Perception of External Control (PEC) signifies the individual's evaluation of the availability and adequacy of organizational and technical resources that facilitate the system's usage. Additionally, Framework Playfulness (FWPLAY) captures an individual's readiness to actively engage with the proposed framework in a spontaneous, inventive, and imaginative manner. Our objective is to examine the impact of all moderating variables, identify relevant facilitating condition constructs within the extended model, and evaluate its performance in comparison to our initial model.

4. Research Methodology

Our study utilized a structural equation model (SEM) to analyze the collected data and formulate a digital transformation adoption model for biopharma manufacturing. The primary data constructs extend elements from Johnson (2022) and Johnson and Uwaoma (2023) (see Figure 3), which included (1) Davis et al.'s (1989) TAM, (2) Venkatesh and Davis's (2000) TAM2, and (3) Coundouris's (2020) hallmark elements of top models. Taking the data collected from May 1st through May 10, 2023, we ran partial least squares structural equation modeling (PLS-SEM) analysis against our initial and extended models. Figure 3 defines our initial model.

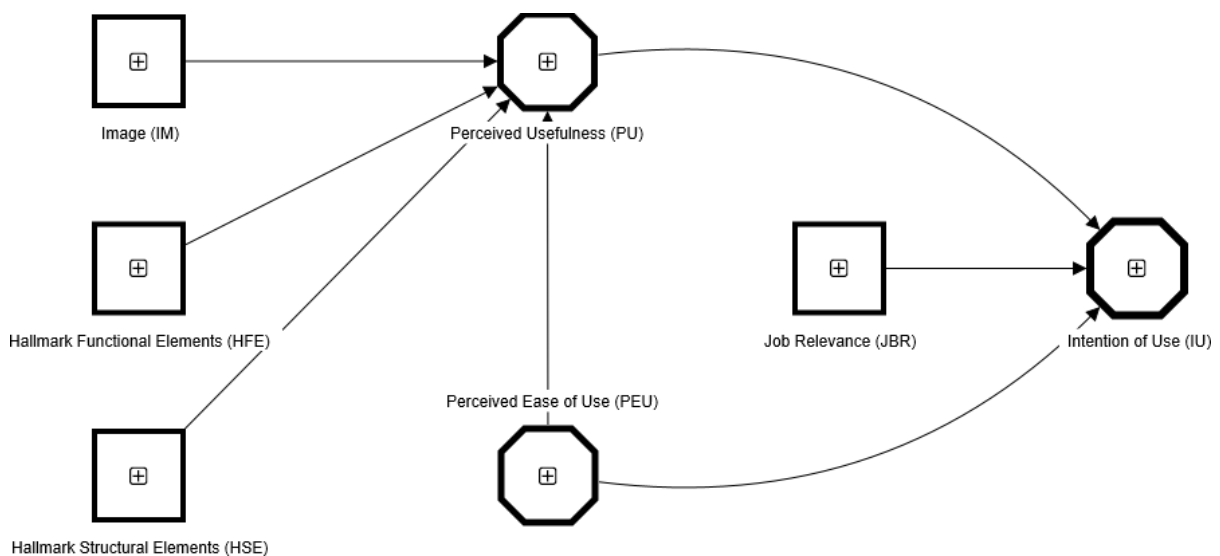


Figure 3: Johnson and Uwaoma (2023) - PLS-SEM Dx Framework Adoption Model

The extended model now incorporates constructs offered by Venkatesh and Bala (2008) TAM3, and UTAUT constructs, with moderating variables presented by Venkatesh et al., (2003) (see Figure 4).

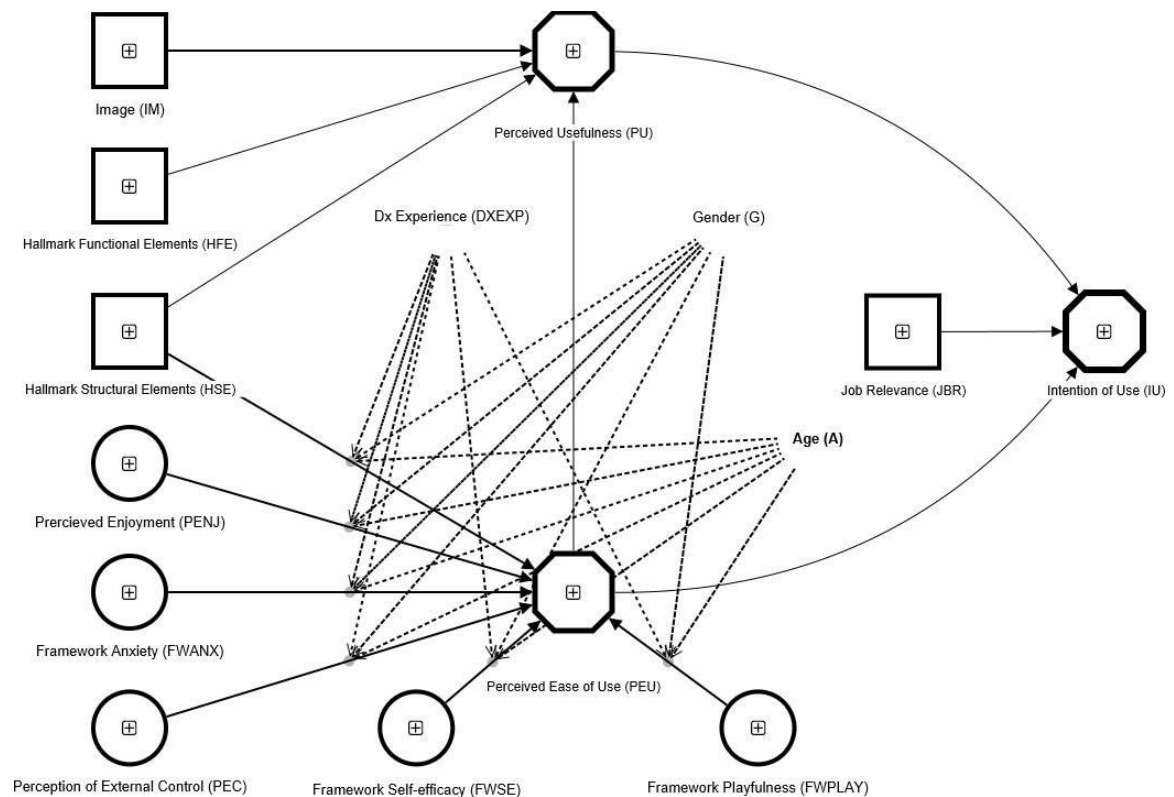


Figure 4: PLS-SEM Extended Dx Framework Adoption Model

4.1. Population and Sampling

Furthermore, data was collected from a panel of 213 individuals, in comparison to 210 from the previous 2021 Study 1, encompassing academics, consultants, executives, IT managers, non-IT managers, and above, employed in the biotech and pharmaceutical industries (Johnson and Uwaoma, 2023). Study 2 results revealed significantly positive feedback, with nearly 54% of respondents actively involved in research or implementation related to digital transformation or Pharma 4.0 programs, as compared to the previous Study 1 at over 57%. Tables 2 and 3 further corroborate the study's precision in targeting the relevant sample population, considering their current job roles, and relevant industries (Johnson and Uwaoma, 2023).

[Insert Table 2]

4.2. Online Survey Instrument:

The data collection instrument comprised fifty-three questions, which included an attention check question for quality verification, resulting in the elimination of 13.77% (34) of responses that failed the attention check. The survey employed a combination of list-based, yes or no, range selection questions, but primarily seven-point Likert scale questions ranging from "Strongly agree" to "Strongly disagree."

Administered through the web-based Qualtrics platform, the survey facilitated distribution and analysis of responses online. The Cintement sample population panel accessed the Qualtrics survey April 21 to May 10, 2023, as seen in Table 3. The survey addressed seventeen variables related to TAM, TAM2, TAM3, UTAUT, and hallmark elements of a top digital transformation framework.

[Insert Table 3]

4.3. Hypothesis

Again, our objective, within this study, is to analyze the impact and identify relevant social influencing constructs, including Perceived Enjoyment (PENJ), Framework Anxiety (FWANX), Framework Self- efficacy (FWSE), Perception of External Control (PEC), and Framework Playfulness (FWPLAY), within the extended model. Additionally, we will explore their interaction with the following moderating variables: Age (A), Dx Experience (DXEXP), and Gender (G). Table 4 and Figure 5 display the relationships (we did not include the effects of the moderating variables as a means to maintain clarity of the image).

[Insert Table 4]

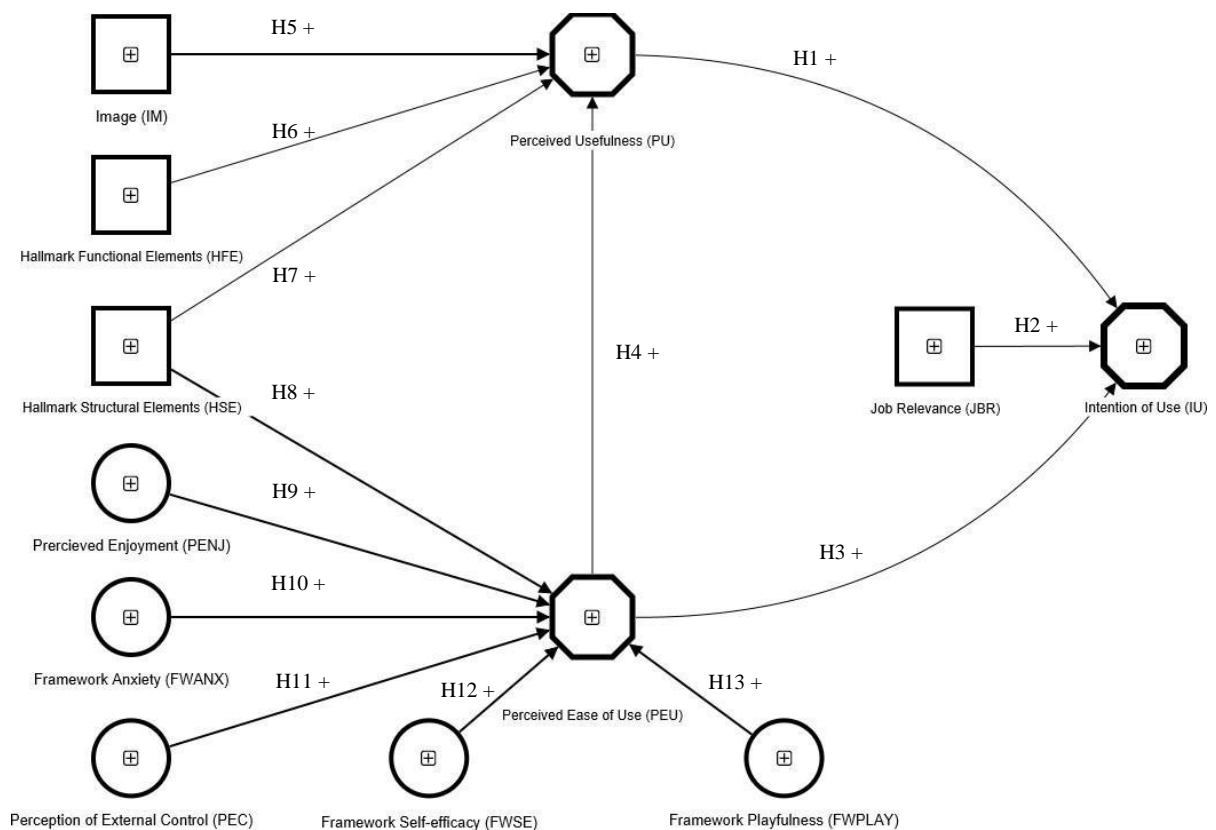


Figure 5: Hypotheses – Extended Model

5. RESULTS AND DISCUSSION

5.1. Data Analysis

Leveraging SmartPLS Version 4.0.9.6, this study underwent a three-step assessment process for the extended PLS-SEM model, as illustrated in Figures 5 (Hair et al., 2019). The first step involved the SmartPLS4 algorithm assessing the measurement model. In the second step, the focus shifted to evaluating the structural model. Finally, in the third step, a stable model was developed, and a model comparison between the optimized extended model and the initial model took place, utilizing the data collected from April 21 to May 10, 2023.

5.2. Step 1 - Measurement Model Assessment

Within this step we, ensuring adequate indicator loadings, composite reliability, convergent validity, and discriminant validity for all constructs. We will examine both the reflexive and formative measurement statistics, and a PLSpredict analysis for robustness (Hair et al., 2016).

5.2.1. Reflective Measurement Model Assessment

Using SmartPLS4, we assessed multiple models, ensuring the statistical independence of unrelated constructs in the reflective measurement model.

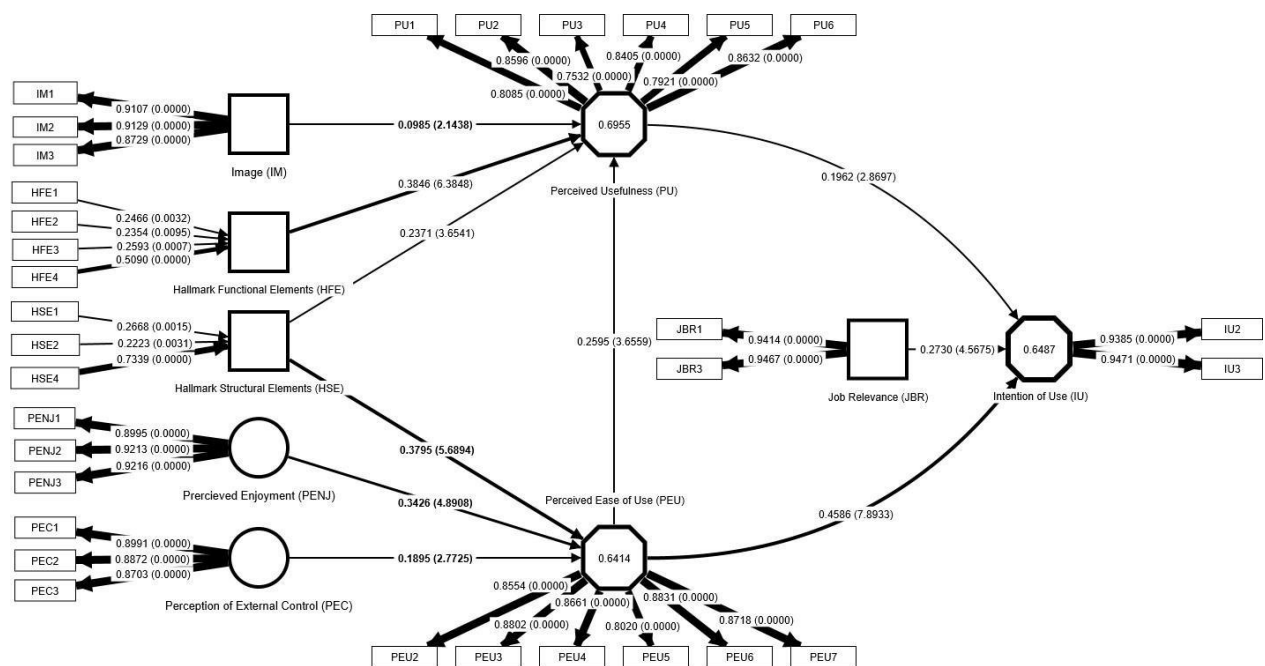


Figure 6: Measurement Model

Perceived Enjoyment (PENJ) and Perception of External Control (PEC) were the only statistically significant facilitating condition constructs, while none of the moderating variables showed significance. As a result, those variables were dropped and the optimal model is seen in Figure 6.

5.2.1.1. Reflective Indicator Factor Loadings

As outlined by Hair et al. (2019), reflective outer factor loadings (FL) exceeding 0.5 are

considered satisfactory and meet the criterion for retaining the respective indicators of the reflective constructs. Additionally, Figure 5 and Table 5 corroborates the reliability of the study measures, as all the reflective indicators display FL values above 0.7 (Hair Jr et al., 2021).

5.2.1.2. Reliability and Validity Assessment

In Step 1, we evaluated the constructs' reliability and validity through the measurement model assessment (Hair, 2006) for the reflexive constructs. Given this, assessed collinearity using the Variance Inflation Factor (VIF) indicators and Common Method Bias (CMB) to establish the measurement the model's reliability and convergent validity as seen in Table 5.

[Insert Table 5]

The VIF values were examined to ensure they remained below the threshold of 3.3, indicating no significant collinearity issues (Kock, 2015). As presented in Table 5, the observed VIF values were within an acceptable range.

To ensure construct reliability, we used Cronbach's alpha ($C\alpha$), composite reliability (CR), rho_A (rho A), and average variance extracted (AVE). All values needed to exceed 0.7 (Ali et al., 2018). Internal consistency was confirmed with Cronbach's alpha ($C\alpha$) values, all above 0.7 (Hair et al., 2019). Additionally, we evaluated composite reliability (CR) to address underestimation concerns, as recommended by Garson (2012). CR values are required to be > 0.7 for confirmation (Hair et al., 2019). Table 6 shows acceptable CR values for all constructs.

[Insert Table 6]

Furthermore, convergent validity is the extent to which a measure is associated with measures of a similar concept (Hair et al., 2019). A construct is deemed to have convergent validity when its AVE > 0.5 (Hair et al., 2019). Table 6 shows that all the reflective measures fulfilled the minimum requirement. Discriminant validity assesses the extent to which a measure is distinct from and uncorrelated to the other measures in a measurement model and measured using Heterotrait-monotrait (HTMT) ratios, which should be < 0.85 or < 0.90 (Hair et al., 2019). In addition, all constructs had an HTMT value of < 0.85 . This confirmed the discriminant validity of our measures.

5.2.2. Formative Measurement Model Assessment

In a formative measurement model, the endogenous variables or indicator items are uncorrelated but can collectively influence the exogenous variable. Unlike a reflective model, a formative model does not necessitate $C\alpha$, AVE, or HTMT, as its indicator variables remain uncorrelated. Instead, it is evaluated using different methods.

5.2.2.1. Formative Convergent Validity

To check for convergent validity, we perform a separate "redundancy analysis" for each formative latent variable, HFE, and HSE. According to Hair Jr et al. (2021), the robustness of the path coefficients that connect the constructs reflects the validity of the chosen set of formative indicators against its reflective construct and indications. Ideally, the path coefficient between the formative and reflective constructs should have a magnitude of 0.80,

with a minimum of 0.70 and above, resulting in an R² value of 0.64 or at least 0.50 (Hair Jr et al., 2021).

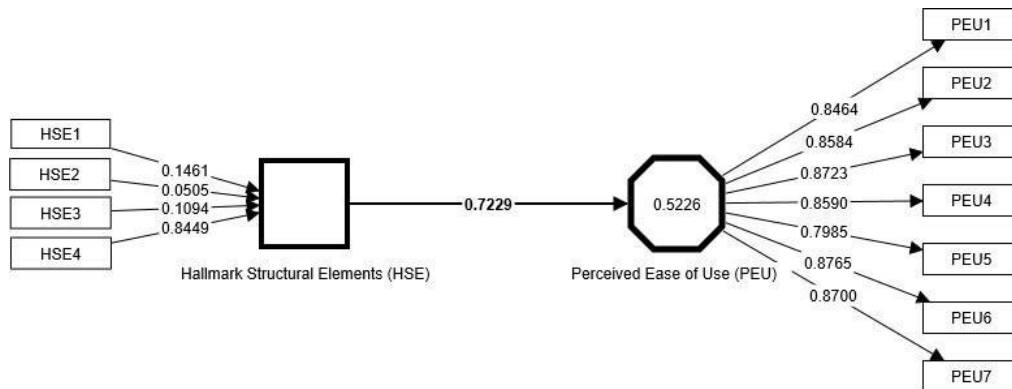


Figure 7: HSE and PEU Redundancy Analysis

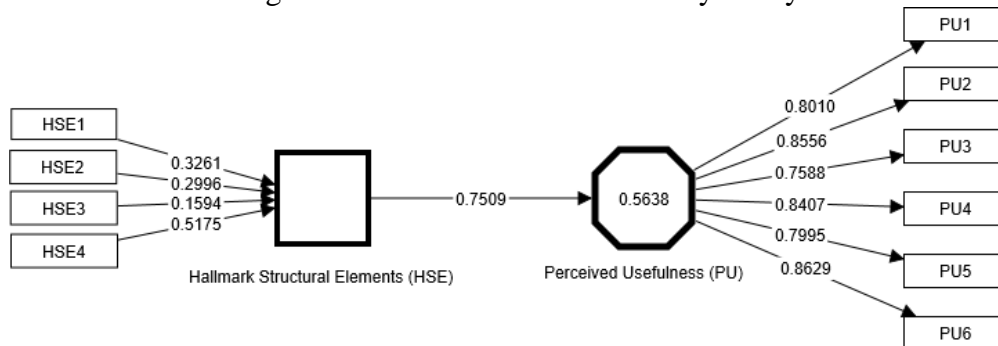


Figure 8: HSE and PU Redundancy Analysis

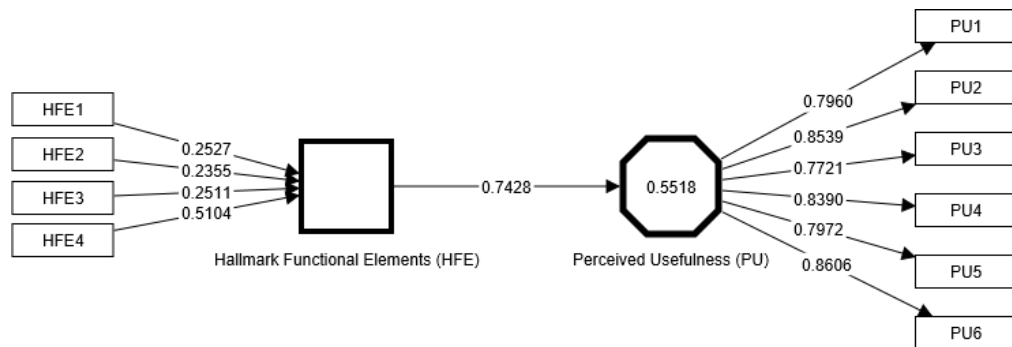


Figure 9: HFE and PU Redundancy Analysis

After analyzing the redundancy analysis depicted in Figures 7, 8 and 9, it is evident that the formative latent variables, HSE and HFE, exhibit path coefficient magnitudes surpassing 0.70 with their corresponding reflective variables, PEU and PU. Moreover, the R² values obtained, as shown in Table 7, are also above 0.50, signifying the presence of convergent validity (Hair Jr et al., 2021).

[Insert Table 7]

5.2.2.2 Formative Collinearity (VIF)

The Variance Inflation Factor (VIF) values are examined to assess the presence of collinearity within the indicators of a formative construct (Hair et al., 2019). Specifically, critical collinearity ($VIF > 5$), possible collinearity ($VIF = 3$ to 5), or ignorable collinearity ($VIF < 3$) are considered. Table 8 indicates that both HFE and HSE have VIF values less than 3, suggesting ignorable

collinearity. We also examined the indicators' outer weights (OW) for significance to assess their relevance. If an OW was insignificant its was considered for potential removal.

However, the final decision to remove an indicator was based on its outer loading (Hair et al., 2019). Table 8 reveals that only HSE3 had an insignificant OW. Consequently, the indicators with significant outer weights were retained, and their relevance was established based on their sizes; the larger the size, the more relevant the indicator. The HSE3 outer weight proved to be statistically insignificant, resulting in the that indicator being dropped from the model. Furthermore, all remaining outer weights and factor loadings demonstrated significance. To maintain relevance, factor loadings greater than 0.5 were considered significant, and based on this criterion, all factor loadings were deemed relevant (see Table 8).

[Insert Table 8]

5.2.3 Measurement Model Robustness

In this investigation, we employ both PLSpredict and CVPAT analyses to evaluate the predictive performance of our measurement model.

5.2.3.2 PLSpredict / CVPAT

It is crucial to have normally distributed prediction errors for the endogenous variables when utilizing these analyses. Figures 10 to 12 validate the normality criteria for the endogenous variables.

Figure 10: Distribution of LV Prediction Errors – IU

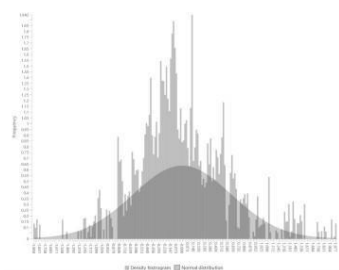


Figure 11: Distribution of LV Prediction Errors – IU

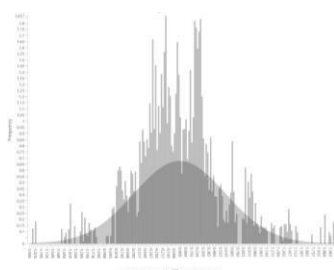
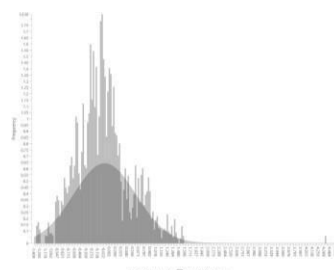


Figure 12: Distribution of LV Prediction Errors – PEU



Normal distribution of prediction errors allows us to opt for RMSE (Root Mean Square Error) over MAE (Mean Absolute Error). This choice is more appropriate for endogenous variables with non-symmetrically distributed prediction errors, as recommended by Shmueli et al. (2019). For the PLSpredict / CVPAT analysis in SmartPLS, we configured parameters with $r =$

10 and $k = 10$, aligning with the recommendations of Shmueli et al. (2019) for assessing the robustness of the measurement model. As seen in Table 9, all indicators and endogenous variables (IU, PEU, and PU) surpass the naïve benchmarks, with Q^2_{predict} values greater than 0, indicating a predictive relevance of the measurement model (Shmueli et al., 2019). Furthermore, positive Q^2_{predict} values across all blocks ensure the predictive relevance of the measurement model. Notably, Q^2_{predict} values exceeding 0.35 for IU, PEU, and PU indicate a substantial predictive relevance effect (Hair et al., 2013).

[Insert Table 9]

CVPAT results in SmartPLS, obtained through PLSpredict, involve a comparison of the PLS-SME to indicator averages (IA) and linear modules (LM) benchmarks against Q^2 and LM values from PLSpredict. CVPAT leverages direct antecedent indicators, offering valuable insights into the model's predictive capabilities (Hair et al., 2022). The presence of a negative difference in average loss values confirms the model's superior predictive capabilities, as demonstrated by CVPAT. Therefore, the inclusion of CVPAT in evaluating PLS-SEM results is pivotal, where we will employ the PLS-SME to IA analysis, as depicted in Table 10 (Hair et al., 2022).

[Insert Table 10]

Given these comparisons, we can conclude that PLSpredict / CVPAT analysis for our extended model fulfilled the required criteria; therefore, we can confidently declare that the predictive relevance and accuracy of the measurement model for this study have been established (Shmueli et al., 2019). All Q^2_{predict} value are great than 0, and perdition error are not highly non-symmetrically distributed, therefore we will use the RMSE values. As we compare the PSL-SEM RMSE value with the LM RMSE values, the PSL-SEM RMSE values are lower than the LM RMSE values for all indicator demonstrating that the extended model has high predictive power.

5.3 Step 2 - Structural Model Assessment

Here we examining collinearity between constructs, significance and relevance of path coefficients, size effect, and predictive relevance using the SmartPLS4 bootstrapping method (Shujahat et al., 2019; Shehzad et al., 2021). A robustness check was also conducted to address *nonlinear effects*, *endogeneity*, and *unobserved heterogeneity*, to ensure reliability of the results, as outlined by Hair et al. (2019) and Sarstedt et al. (2019).

5.3.2 Nonlinearity

Nonlinear (quadratic) effects can create an illusion of linearity, causing a relationship to appear linear when it is, in fact, nonlinear. To eliminate the possibility of such an illusion and adhere to the assumption of linearity, we executed a quadratic effects test by introducing interaction terms for predictor variables, as depicted in Table 10. Employing bias-corrected bootstrapping with 5000 samples (Shmueli et al., 2019), the results revealed insignificance for all quadratic/nonlinear effects. This finding was supported by confidence interval (CI) values. Additionally, we analyzed the F^2 values and observed only one instance, HSFE x HSFE \rightarrow PEU, with an F^2 of .0108, though it remained within the acceptable limit (Cohen,

1988). Based on the lack of significance and negligible F^2 values, we conclude that all relationships in our extended model were linear, and void of any quadratic effects, as detailed in Table 11.

[Insert Table 11]

5.3.3 Unobserved Heterogeneity

Subsequently, we conducted additional testing to evaluate the model's robustness using fixed mixture segmentation (FIMIX) in SmartPLS4, aiming to identify any unobserved heterogeneity—that is, variables that couldn't be further subdivided into additional variables (Shmueli et al., 2019). Initially, we determined the potential segments within the current model, leveraging the number of predictors (nine) and adhering to the approximately 10-times rule, as

suggested by Hair et al. (2019), which estimates a minimum sample size of 90. Consequently, with a total response count of 213 (refer to Table 12), we could theoretically have two to three segments in the dataset.

[Insert Table 12]

5.3.4 Endogeneity

The structural model's robustness was assessed through an endogeneity test to ensure the absence of missing variables, indicating careful model design. The Gaussian Copula (GC) in SmartPLS 4 was employed for testing robustness. Endogeneity is deemed violated if GC values are statistically significant ($p < 0.05$). Examination of Table 13 revealed that all GC values were either greater than 0.05 or non-significant when IU was the dependent variable (DV). This pattern persisted for GC values in the case of PEU as the DV (refer to Table 14) and when PU was the DV (refer to Table 15). As a result, we concluded that there is no indication of endogeneity, confirming the robustness of the extended PLS-SEM as per Shmueli et al. (2019).

[Insert Table 13]

[Insert Table 14]

[Insert Table 15]

Although the above FIMIX was run with 5000 iterations and other default settings, the results, seen in Table 17, were ambiguous and conflicting as AIC, AIC3 and EN suggested a three-segment solution; AIC4 supports two segments, while BIC, CAIC, NFI, and NEC were in favor of a two-segment solution, and MDL5 and LnL indicated a one-segment solution was most suitable (Hair et al., 2019; Matthews et al., 2016; Sarstedt et al., 2011). Since the fit indices did not accurately propose a specific segmentation, we consulted the relative segment sizes for further inferences. The three-segments solution was ruled out as the sample size did not meet the minimum criteria of 90, and a segment-3 could have only 16 samples ($0.0331 \times 213 = 7.0503$). Similarly, in the two-segment solution, segment-2 yielded a sample size of 62 observations ($0.3434 \times 213 = 73.1442$), which was less than the minimum 90 samples required per segment, meaning that 139 samples (i.e., nearly 71%) would be part of segment-1 even in a two-segment solution.

[Insert Table 16]

Upon reviewing the results, we infer that opting for a one-segment solution adequately addresses the analysis requirements based key criteria (i.e., AIC3, CAIC, BIC, and MDL5). As a result, we assert that the robustness assumption stands fulfilled, seem in Table 16.

5.3.5 Structural Model Assessment

The structural model analysis explores connections between constructs and relevant theories based on existing literature (Hair et al., 2019). In this study, only direct effects were examined, and bias-corrected 95% confidence intervals were used to test these direct effects (refer to Table 5 and Figure 5 for details).

5.3.6 Hypotheses Testing

H1 received affirmation, as PU exhibited a positive and significant impact on IU ($\beta = 0.1965$, $t = 2.8697$, $p = 0.0041$), accompanied by a medium effect size according to Cohen's (1988) criteria ($F2 = 0.0457$). Table 9 revealed JB's positive and significant impact on IU ($\beta = 0.2730$, $t = 4.5675$, $p = 0.000$), supporting H2 with a small effect size (Cohen, 1988) on IU ($F2 = 0.1242$).

Similarly, H3 found support, with PEU having a positive and significant impact on IU ($\beta = 0.4586$, $t = 7.8933$, $p = 0.000$) and a medium effect size ($F2 = .209$). H4 gained support due to the positive and significant impact of PEU on PU ($\beta = 0.2595$, $t = 3.6559$, $p = 0.0003$), though PEU had a small effect size on PU at $F2 = 0.3002$. IM demonstrated a small, positive, and significant impact on PU ($\beta = 0.0985$, $t = 2.1438$, $p = 0.0321$), with a small effect on PU ($F2 = 0.0195$), supporting H5. HFE exhibited a positive and significant impact on PU ($\beta = 0.3846$, $t = 6.3848$, $p = 0.0000$) with a medium effect size at $F2 = 0.2505$, confirming H6. HSE had a positive and significant impact on PU ($\beta = 0.2371$, $t = 3.6541$, $p = 0.0003$) with a small effect size ($F2 = 0.0704$), supporting H7. HSE also positively impacted PEU ($\beta = 0.3795$, $t = 5.6894$, $p = 0.0000$) with a small effect size ($F2 = 0.2300$), supporting H8.

Finally, PENJ had a positive and significant impact on PEU ($\beta = 0.3426$, $t = 4.8908$, $p = 0.0003$) but had a small effect size on PEU with an $F2 = 0.1277$. PEC also had a positive impact on PEU ($\beta = 0.1895$, $t = 2.7725$, $p = 0.0056$), but PEC had a small effect size on PEU with an $F2 = 0.0431$ as seen in Table 17 and Figure 17.

[Insert Table 17]

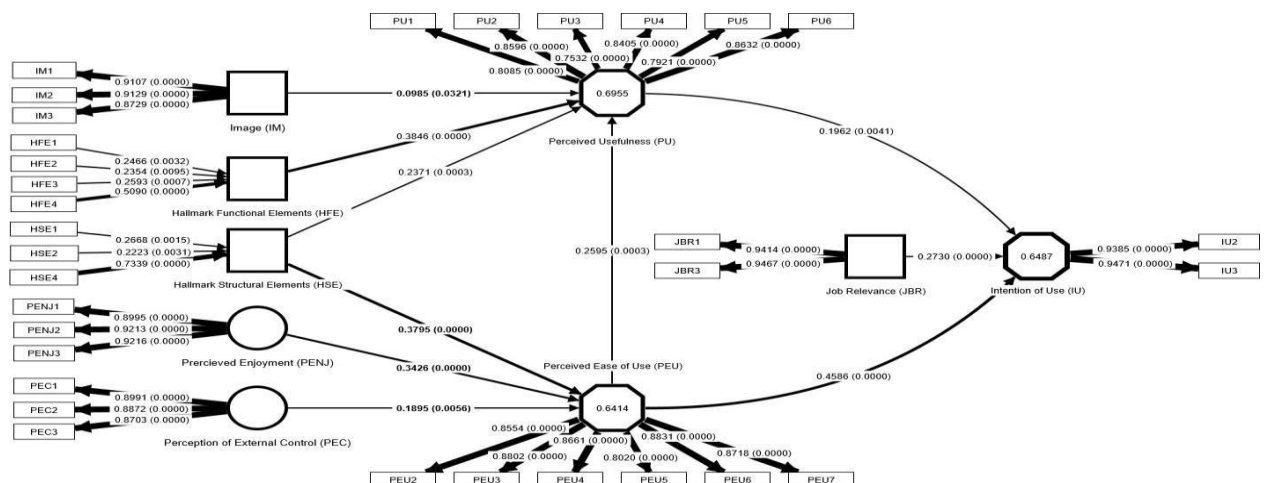


Figure 13: Structural Model (Relative Path Values)

The quality of the structural model's predictions was evaluated through Q^2 and R^2 , with a positive $Q^2 (> 0)$ indicating and establishing good predictive relevance (Hair et al., 2019). The R^2 served as an overall measure of effect size. As outlined in Table 5, the model explained 64.87% of IU, 69.55% of PU, and 64.14% of PEU, with F^2 providing insights into the results of the hypotheses.

6 Model Comparison

In the third phase, our initial model was applied to the study's dataset and compared with the optimized extended model. Table 18 presents the BIC, R^2 and Q^2 values used in our selection process, with a primary focus on the Bayesian information criterion (BIC). According to (Hair et al., 2019), a model exhibiting the lowest BIC is deemed superior. In this case, the extended model outperformed the initial model with a significantly lower BIC across each construct.

[Insert Table 18]

Furthermore, we also evaluated the R^2 to gauge the explanatory power regarding the variance of the endogenous variables. R^2 values of 0.75, 0.50, and 0.25 are considered substantial, moderate, and weak, respectively (Hair et al., 2019). For the extended model, R^2 for IU was 0.6487, PU was 0.6955, and PEU was 0.6414, indicating the explanatory power falls between the substantial and moderate.

Our Q^2 analysis affirmed the relevance of the extended model. Q^2 values greater than 0, 0.25, and 0.5 signify small, medium, and large predictive relevance of the PLS-path model (Hair et al., 2019; Shmueli et al., 2019). In the extended model, Q^2 values for IU, PU, and PEU were 0.6093, 0.6573, and 0.6202, underscoring the predictive relevance of the PLS-path model, as shown in Table 19.

[Insert Table 19]

When using the CVPAT – PLS-SEM vs. Indicator Averages, the average loss should be lower than the average loss of the benchmarks which is expressed by a negative difference in the average loss values. CVPAT tests whether PLS-SEM's average loss is significantly lower than the average loss of the benchmarks (Sharma et al., 2022). The difference of the average loss values should be significantly below zero to substantiate better predictive capabilities of the model compared to the prediction benchmarks (Hair et al., 2022). Therefore, the presence of a negative difference in average loss values confirms the superior predictive power.

[Insert Table 20]

In comparing of the PLS-SEM's average loss is significantly lower than the average loss of the benchmarks for our initial and extended model, the extended model consistently shows lower average loss values for each construct than our initial model, indicating higher predictive power as seen in Table 20.

7 Conclusion

Based on our model this study conducted an analysis by incorporating the TAM3 constructs proposed by Venkatesh and Bala (2008) into our extended framework. However, we found that the relationships, between these added constructs and their moderating variables were

inconsistent and did not accurately reflect behavioral intentions when it comes to selecting a transformation framework.

7.1 Implications of the Theory

Nevertheless, when it comes to choosing transformation frameworks for manufacturing TAM constructs such as Perceived Ease of Use (PEU) Perceived Usefulness (PU) and Intentions of Use (IU) did support the behavioral relationships. According to Cohen (1988), we can interpret effect sizes based on their respective f^2 as follows: $f^2 \geq 0.02$ indicates a small effect size, $f^2 \geq 0.15$ indicates a medium effect size, and $f^2 \geq 0.35$ indicates a large effect size.

In contrast, our findings suggest that Perceived Usefulness (PU) typically has the largest impact on Intentions of Use (IU) according to Venkatesh (2000). Our study revealed that PEU had nearly eight times more impact than PU. This finding demonstrates its effect on respondents' intentions to use the proposed framework. Job Relevance (JBR) also showed an impact on IU three times that of PU despite being small.

Regarding PU, Hallmark Functional Elements (HFE) had a medium impact. On the other hand, Image (IM) Perceived Ease of Use (PEU) and Hallmark Structural Elements (HSE) all had a small impact, on PU in this specific order.

In addition, when we looked at PEU, we observed that Hallmark Structural Elements (HSE) had the largest influence with a medium impact on PEU, which is consistent with Johnson and Uwaoma (2023). Only two constructs introduced from the TAM3 theory, Perceived Enjoyment (PENJ) and Perception of External Control (PEC), were found to have a significant, but small impact on PEU.

7.2 Implications of Practice

Based on the study's findings and the proposed digital transformation framework, respondents prioritize the ease of use and alignment with their job functions over the perceived usefulness of a framework. Recognizing this, any digital transformation framework aiming to support a biopharma environment must prioritize simplicity and direct relevance to the users' job functions.

This sentiment resonated particularly with respondents regarding Hallmark Functional Elements (HFE) and Hallmark Structural Elements (HSE). Respondents acknowledged the proposed framework's adaptability to various biopharma manufacturing scenarios as it is easy to apply. These factors exerted more than twice the influence compared to other indicators related to their respective constructs. This observation aligns with the findings of Johnson and Uwaoma (2023), where IT leaders and practitioners express a preference for customizable, tailored digital transformation frameworks with a flexible approach to both front and back-office transformations. These frameworks should effectively convey the company's vision and, most importantly, be easy to apply (Johnson and Uwaoma, 2023).

7.3 Limitations and Future Research

The limitations encountered in this study were largely attributed to the integration of TAM3 constructs proposed by Venkatesh and Bala (2008) into our extended framework. Notably, the relationships between these newly added constructs and their moderating variables were found to be inconsistent, falling short of accurately depicting behavioral intentions in the realm of selecting a transformation framework. Consequently, our extended model signifies a departure from the TAM theories as we venture into more innovative dimensions.

Future research endeavors will build upon the proposed extended model, focusing on a multidimensional analysis of biopharmaceutical manufacturing operations. The aim is to broaden insights by incorporating additional constructs, that capture other factors that impact the selection process such as business dimension application, digital maturity model relevance, and framework interoperability. Integrating these constructs will enable a comprehensive understanding of the multi-dimensional aspects inherent in biopharmaceutical business operations. This will be achieved through a thorough PLS-SEM analysis, unifying our extended model for application across the biopharmaceutical industry.

Appendix

Table 1: Hallmarks Characteristics of Leading Digital Transformation Frameworks

Hallmark Functional Elements (HFE)	Hallmark Structural Elements (HSE)
1. Vision of the big picture, ideal for executives	1. Patient-centric
2. Drill-down to a set of tasks and sequences	2. Opportunities and constraints
3. Flexibility to transform front and back office	3. Emphasizes culture
4. Customize to suit circumstances	4. Simple to apply

Source: Coundouris (2020)

Table 2: Respondents' Current Digital Transformation Activity

Involved in Dx Efforts	Study 1: November, 2021		Study 2: April, 2023	
	Frequency	Percent	Frequency	Percent
Yes	121	57.60	115	53.99
No	89	42.40	98	46.01
Total	210/277*	100.00	213/247*	100.00

* Indicates the total number of collected responses within the study.

Table 3: Respondent's Demographics

Respondents Categories	Study 1: November, 2021		Study 2: April, 2023	
	Frequency	Percent	Frequency	Percent
Executives	64	30.48	42	19.72
Managers and above in non-IT Roles	74	35.24	69	32.39
Managers or IT Leaders	40	19.05	45	21.13
Consultant	15	7.14	22	10.33
Academic	17	8.10	35	16.43
Total	210/277*	100.00	213/247*	100.00

* Indicates the total number of collected responses within the study.

Table 4: Hypotheses

Hypotheses	IV	→	DV	Effect
H1	Perceived Usefulness	→	Intention of Use	Positive
H2	Job Relevance	→	Intention of Use	Positive
H3	Perceived Ease of Use	→	Intention of Use	Positive
H4	Perceived Ease of Use	→	Perceived Usefulness	Positive
H5	Image	→	Perceived Usefulness	Positive
H6	Hallmark Functional Elements	→	Perceived Usefulness	Positive
H7	Hallmark Structural Elements	→	Perceived Usefulness	Positive
H8	Hallmark Structural Elements	→	Perceived Ease of Use	Positive
H9	Perceived Enjoyment	→	Perceived Ease of Use	Positive
H10	Framework Anxiety	→	Perceived Usefulness	Positive
H11	Perception of External Control	→	Perceived Usefulness	Positive
H12	Framework Self-efficacy	→	Perceived Usefulness	Positive
H13	Framework Playfulness	→	Perceived Usefulness	Positive

Table 5: Reliability and Validity

Constructs	Indicator	Factor Loading	P value	VIF
Intention to use		0.9385	0.000	2.5338
	IU2	0.9471	0.000	2.5338
Perceived usefulness	PU1	0.8085	0.000	2.2512
	PU2	0.8596	0.000	2.7716
		0.7532	0.000	1.8077
	PU4	0.8405	0.000	2.3931
	PU5	0.7921	0.000	2.1705
	PU6	0.8632	0.000	2.7702
Perceived ease of use	PEU2	0.8554	0.000	2.7556
	PEU3	0.8802	0.000	3.0857
		0.8661	0.000	2.7983
	PEU5	0.8020	0.000	2.1628
	PEU6	0.8831	0.000	3.1517
	PEU7	0.8718	0.000	2.9907
		0.9414	0.000	2.5798
Job relevance	JR2	0.9467	0.000	2.5798
	IM1	0.9107	0.000	2.8081
Image	IM2	0.9129	0.000	2.7313
	IM3	0.8729	0.000	2.1187
Perceived enjoyment	PENJ1	0.8995	0.000	2.5774
	PENJ2	0.9213	0.000	3.0759
	PENJ3	0.9216	0.000	2.9893
Perception of external control	PEC1	0.8991	0.000	2.5832
	PEC2	0.8872	0.000	2.4962
	PEC3	0.8703	0.000	1.8848

Table 6: Construct Reliability, Convergent Validity and Discriminant Validity – Reflective Part

Constructs	CA	CR	AVE	HTMT						
				IM	IU	JBR	PEU	PU	PEC	PJEN
IM	0.8812	0.8835	0.8083							
IU	0.8752	0.8785	0.8889	0.7729						
JBR	0.8780	0.8794	0.8912	0.6537	0.7275					
PEU	0.9295	0.9314	0.7400	0.6147	0.8192	0.5815				
PU	0.9025	0.9071	0.6731	0.6393	0.7669	0.7095	0.7530			
PEC	0.8628	0.8660	0.7843	0.6972	0.7833	0.7578	0.7359	0.6871		
PENJ	0.9017	0.9032	0.8357	0.7604	0.7996	0.6740	0.7891	0.7034	0.8383	

Table 7: Convergent Validity - Redundancy Analysis

Formative Construct	Reflective Construct	Path Coefficient	R ²	Convergent Validity
HSE	PEU	0.7229	0.5226	Supported
HSE	PU	0.7509	0.5638	Supported
HFE	PU	0.7428	0.5518	Supported

Table 8: Formative Model Assessment

Indicator	VIF	OW	OW – P value	FL	FL – P value
HFE1	1.7171	0.2466	0.0032	0.7736	0.0000
HFE2	1.5842	0.2354	0.0095	0.7346	0.0000
HFE3	1.5648	0.2593	0.0007	0.7388	0.0000
HFE4	1.5769	0.5090	0.0000	0.8738	0.0000
HSE1	1.4194	0.2668	0.0015	0.6884	0.0000
HSE2	1.3159	0.2223	0.0031	0.6052	0.0000
HSE4	1.2824	0.7339	0.0000	0.9290	0.0000

Table 9: PLS Q²predict Assessment

Indicator	PLS-SEM	LM	Predictive Power	
	RMSE	RMSE	PLS-LM (RMSE)	Q ² predict
IU2	1.0930	1.0959	-0.0029	0.4990
IU3	0.9087	0.9224	-0.0137	0.5791
PEU2	1.0333	1.0534	-0.0201	0.4577
PEU3	0.9980	1.0416	-0.0436	0.4658
PEU4	0.9253	0.9831	-0.0578	0.4639
PEU5	1.2983	1.3527	-0.0544	0.3791
PEU6	0.8880	0.9248	-0.0368	0.4902
PEU7	1.0165	1.0821	-0.0656	0.5027
PU1	0.9839	1.0064	-0.0225	0.4363
PU2	0.9225	0.9633	-0.0408	0.4911
PU3	0.9057	0.9501	-0.0444	0.3774
PU4	0.8959	0.9297	-0.0338	0.4398
PU5	0.9414	1.0063	-0.0649	0.4191
PU6	0.9522	0.9932	-0.0410	0.4746
IU	0.6307	-	-	0.6093
PEU	0.6241	-	-	0.6202
PU	0.5933	-	-	0.6573

Table 10: CVPAT – PLS-SEM vs. Indicator Averages (IA)

Constructs	Average loss difference	t value	p value
Intention of Use (IU)	-1.1631	7.4923	0.0000
Perceived Ease of Use (PEU)	-0.8904	6.0378	0.0000
Perceived Usefulness (PU)	-0.6927	6.0930	0.0000
Overall	-0.8446	7.1592	0.0000

Table 11: Assessment of Non-Linear / Quadratic Effects

Non-Linear Relationship		Coefficient	P	F ²	CI
IM x IM	→ PU	0.0186	0.5926	0.0012	-0.0791, 0.0549
HFE x HFE	→ PU	0.0078	0.8444	0.0002	-0.0864, 0.0677
HSE x HSE	→ PEU	0.0597	0.1681	0.0108	-0.1286, 0.0544
HSE X HSE	→ PU	0.0173	0.7130	0.0008	-0.1086, 0.0751
PENJ x PENJ	→ PEU	0.0064	0.8845	0.0001	-0.0788, 0.0893
PEC x PEC	→ PEU	-0.0225	0.6304	0.0016	-0.0649, 0.1156
PEU x PEU	→ IU	-0.0130	0.6788	0.0007	-0.0453, 0.0918
PEU x PEU	→ PU	0.0411	0.2870	0.0067	-0.1049, 0.0491
PU x PU	→ IU	0.0005	0.9874	0.0000	-0.061, 0.0612
JB x JB	→ IU	-0.0157	0.6911	0.0008	-0.0614, 0.0948

Table 12: Relative Segment Sizes (N = 213)

Segment	1	2	3
1	1.0000		
2	0.6566	0.3434	
3	0.6032	0.3637	0.0331

Table 13: GC Assessment – IU as DV

Test Model	Construct	Coefficient	P values
Gaussian Copula Model 1 (Endogenous variables: PU)	PU ^C	-0.0057	0.9783
Gaussian Copula Model 2 (Endogenous variables: PEU)	PEU ^C	0.2069	0.4040
Gaussian Copula Model 3 (Endogenous variables: JB)	JBR ^C	0.2598	0.4506
Gaussian Copula Model 4 (Endogenous variables: PU, PEU)	PU ^C	-0.1334	0.5849
	PEU ^C	0.2878	0.3012
Gaussian Copula Model 5 (Endogenous variables: PU, JB)	PU ^C	-0.0337	0.8758
	JBR ^C	0.2689	0.4496
Gaussian Copula Model 6 (Endogenous variables: PEU, JB)	PEU ^C	0.1737	0.4967
	JBR ^C	0.2069	0.5573
Gaussian Copula Model 7 (Endogenous variables: PU, PEU, JB)	PU ^C	-0.1433	0.5629
	PEU ^C	0.2585	0.3612
	JBR ^C	0.2197	0.5409

^C = Gaussian Copula

Table 14: GC Assessment – PEU as DV

Test Model	Construct	Coefficient	P values
Gaussian Copula Model 1 (Endogenous variables: HSE)	HSE ^C	-0.1928	0.6779
Gaussian Copula Model 2 (Endogenous variables: PENJ)	PENJ ^C	0.2109	0.5292
Gaussian Copula Model 3 (Endogenous variables: PEC)	PEC ^C	0.2109	0.5292
Gaussian Copula Model 4 (Endogenous variables: HSE, PENJ)	HSE ^C	-0.1697	0.7187
	PENJ ^C	0.2003	0.5524
Gaussian Copula Model 5 (Endogenous variables: HSE, PENJ)	HSE ^C	-0.2111	0.6567
	PEC ^C	0.1281	0.6863
Gaussian Copula Model 6 (Endogenous variables: PENJ, PEC)	PENJ ^C	0.2060	0.5437
	PEC ^C	0.0962	0.7656
Gaussian Copula Model 7 (Endogenous variables: HSE, PEMJ, PEC)	HSE ^C	-0.1868	0.6972
	PENJ ^C	0.1934	0.5696
	PEC ^C	0.1142	0.7288

^C = Gaussian Copula

Table 15: GC Assessment – PU as DV

Test Model	Construct	Coefficient	P values
Gaussian Copula Model 1 (Endogenous variables: IM)	IM ^C	-0.3664	0.2254
Gaussian Copula Model 2 (Endogenous variables: HFE)	HFE ^C	-0.3801	0.3706
Gaussian Copula Model 3 (Endogenous variables: HSE)	HSE ^C	-0.3801	0.3062
Gaussian Copula Model 4 (Endogenous variables: PEU)	PEU ^C	-0.4632	0.0726
Gaussian Copula Model 5 (Endogenous variables: IM, HFE)	IM ^C	-0.3098	0.3184
	HFE ^C	-0.2756	0.5209
Gaussian Copula Model 6 (Endogenous variables: IM, HSE)	IM ^C	-0.3198	0.2973
	HSE ^C	-0.2938	0.4326
Gaussian Copula Model 7 (Endogenous variables: IM, EU)	IM ^C	-0.1661	0.5816
	PEU ^C	-0.4146	0.1165
Gaussian Copula Model 8 (Endogenous variables: IM, HFE, HSE)	IM ^C	-0.2832	0.3641
	HFE ^C	-0.2182	0.6224
	HSE ^C	-0.2416	0.5354
Gaussian Copula Model 9 (Endogenous variables: IM, HFE, EU)	IM ^C	-0.1439	0.6381
	HFE ^C	-0.1524	0.7166
	PEU ^C	-0.3956	0.1421
Gaussian Copula Model 10 (Endogenous variables: IM, HSE, EU)	IM ^C	-0.1577	0.6034
	HSE ^C	-0.1158	0.7618
	PEU ^C	-0.3938	0.1544
Gaussian Copula Model 11 (Endogenous variables: HFE, HSE, EU)	HFE ^C	-0.1646	0.7008
	HSE ^C	-0.0992	0.8003
	PEU ^C	-0.4158	0.1329
Gaussian Copula Model 12 (Endogenous variables: IM, HFE, HSE, EU)	IM ^C	-0.1400	0.6490
	HFE ^C	-0.1356	0.7533
	HSE ^C	-0.0888	0.8217
	PEU ^C	-0.3818	0.1722

^C = Gaussian Copula

Table 16: Fit Indices and Relative Sizes for Segment Solutions

Criteria	Segment		
	1	2	3
AIC (Akaike's Information Criterion)	1144.8775	1100.0208	1078.994
AIC3 (Modified AIC with Factor 3)	1157.8775	1127.0208	1119.994
AIC4 (Modified AIC with Factor 4)	1170.8775	1154.0208	1160.994
BIC (Bayesian Information Criteria)	1188.5743	1190.7757	1216.8069
CAIC (Consistent AIC)	1201.5743	1217.7757	1257.8069
HQ (Hannan Quinn Criterion)	1162.5369	1136.6979	1134.6888
MDL5 (Minimum Description Length with Factor 5)	1467.3615	1769.7952	2096.0588
LnL (Log Likelihood)	-559.4388	-523.0104	-498.497
EN (Entropy Statistic (Normed))		0.4686	0.6267
NFI (Non-Fuzzy Index)		0.5461	0.6069
NEC (Normalized Entropy Criterion)		113.1931	79.5035

Table 17: Hypotheses Testing Results

Path	B	T	P	F ²	R ²	Q ²	Status
PU → IU	0.1962	2.8697	0.0041	0.0457			H1: Supported
JBR → IU	0.2730	4.5675	0.0000	0.1242	0.6436	0.6093	H2: Supported
PEU → IU	0.4586	7.8933	0.0003	0.3002			H3: Supported
PEU → PU	0.2595	3.6559	0.0000	0.1009			H4: Supported
IM → PU	0.0985	2.1438	0.0321	0.0195	0.6955	0.6202	H5: Supported
HFE → PU	0.3864	6.3848	0.0000	0.0704			H6: Supported
HSF → PU	0.2371	3.6541	0.0003	0.2505			H7: Supported
HSF → PEU	0.3795	5.6894	0.0000	0.2300			H8: Supported
PENJ → PEU	0.3426	4.8908	0.0000	0.1277	0.6414	0.6573	H9: Supported
PEC → PEU	0.1895	2.7725	0.0056	0.0431			H11: Supported

Table 18: Model Comparison using BIC, R² and Q²

Constructs	BIC		R ²		Q ²	
	Initial Model	Extended Model*	Initial Model	Extended Model*	Initial Model	Extended Model*
Intention of Use (IU)	-175.1655	-202.3745	0.6008	0.6487	0.6019	0.6093
Perceived Usefulness (PU)	-174.8242	-197.9716	0.6101	0.6955	0.5826	0.6202
Perceived Ease of Use (PEU)		-227.4901		0.6414		0.6573

Table 19: Model Comparison using PLS Q²predict

Indicator	PLS-SEM		LM		Predictive Power			
	Initial Model RMSE1	Extended Model RMSE2*	Initial Model RMSE1	Extended Model RMSE2	Initial Model PLS-LM1	Extended Model PLS-LM2*	Initial Model Q ² predict1	Extended Model Q ² predict2*
IU2	1.0541	1.0930	1.0959	1.0959	0.0201	-0.0029	0.5341	0.4990
IU3	0.8797	0.9087	0.9224	0.9224	-0.0053	-0.0137	0.6055	0.5791
PEU2		1.0333		1.0534		-0.0201		0.4577
PEU3		0.9980		1.0416		-0.0436		0.4658
PEU4		0.9253		0.9831		-0.0578		0.4639
PEU5		1.2983		1.3527		-0.0544		0.3791
PEU6		0.8880		0.9248		-0.0368		0.4902
PEU7		1.0165		1.0821		-0.0656		0.5027
PU1	0.8797	0.9839	0.9857	1.0064	-0.0362	-0.0225	0.4751	0.4363
PU2	0.9495	0.9225	0.9362	0.9633	-0.0409	-0.0408	0.5207	0.4911
PU3	0.8953	0.9057	0.9593	0.9501	-0.0506	-0.0444	0.3733	0.3774
PU4	0.9087	0.8959	0.8852	0.9297	0.0084	-0.0338	0.4425	0.4398
PU5	0.8936	0.9414	1.0134	1.0063	-0.0619	-0.0649	0.4065	0.4191
PU6	0.9515	0.9522	0.9457	0.9932	-0.0234	-0.041	0.5070	0.4746

Table 20: CVPAT – PLS-SEM vs. Indicator Averages (IA) Comparison

Constructs	Average loss difference		t value		p value	
	Initial Model	Extended Model*	Initial Model	Extended Model*	Initial Model	Extended Model*

Intention of Use (IU)	-1.1533	-1.1631	7.6065	7.4923	0.0000	0.0000
Perceived Ease of Use (PEU)	-0.6029	-0.8904	5.8884	6.0378	0.0000	0.0000
Perceived Usefulness (PU)		-0.6927		6.0930		0.0000
Overall	-0.8230	-0.8446	7.8978	7.1592	0.0000	0.0000

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Electronic copy available at: <https://ssrn.com/abstract=4720581>

How Does the Creation of Artifacts Help the Decision Makers to Influence the Residents' Awareness by Using GIS to Site the Optimal Locations of Renewable Energy Technology?

Alaa Alharthi, Claremont Graduate University, UK

Abstract

This research is intended to measure the levels of renewable energy awareness of the residents in

Saudi Arabia through an artifact. Using the artifact is to capture the awareness of the resident before and after they see the map where the renewable energy is going to be outlined in their surrounding area virtually. Awareness was the second barrier to the greening process.

Behavioral

change, and thereby cultural change, cannot be expected to take place unless people are aware to

do so. The initial step towards behavioral changes is to raise awareness as it is the seed for tomorrow's changes. By knowing it one can plan for the improvement of the residence awareness. With the awareness of the significance of the topic, this research applied the design science research method and examine the effect of the artifacts for increasing residents' awareness. By enhancing the awareness level, the potential impact of the study will contribute to

the efficiency of renewable energy implementation.

Key words: suitability model, awareness, renewable energy, solar power, wind turbine

Harnessing the Seas and Winds: A Comparative Analysis of Wave and Off-shore Wind Farms in the Transition toward Sustainable Energy in Europe

Daniel Hayward, Grenoble Ecole de Management, France

Abstract

This research explores the evolution, status, and future potential of wave and offshore wind farms as pivotal elements in the global shift from fossil fuels to renewable energy sources. By examining their historical development, geographic distribution, financial implications, operational challenges, and environmental benefits, this study aims to provide a holistic understanding of their role in sustainable energy generation. Additionally, the research explores the issues related to wave and offshore wind-farms and the impact on marine life and ecosystem.

Best Paper Award in Innovative Education

Classifying Racism as a Behavioral Disorder: A Primer for All

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Abstract:

In this discussion, the authors present a primer or essay highlighting the essential aspects of racism, advocating for a consensus to classify racism as a behavioral disorder. The primary objective is to draw attention from the broader American community and emphasize the recognition of racism's deep-rooted history and its impact on victims and those with such beliefs. By fostering constructive conversations, the authors aim to promote humanistic values of forgiveness and atonement to reduce the harmful effects of racism. The discussion supports an argument for the necessity of social amends to facilitate individual behavioral change. Emphasizing the importance of classifying racism as a treatable condition, the authors wish to enable individuals to seek help and initiate healing. The discussion concludes with suggestions to implement regulations on social media to mitigate its detrimental influence on the American public and provide options and insights to propel the country forward in addressing racism and its consequences.

Keywords: Racism; Behavioral Disorders; Social Amends; Emotional Contagion Pollution; Social Identity Pollution.

1. Introduction

There was a time when waking up to a calm and misty morning meant something special in the United States. Whether you were in the Ozarks of Arkansas, on a dairy farm in middle Wisconsin, or walking your dog on a sandy beach in Southern California, enjoying morning peace over a hot cup of coffee, orange juice, or Chia gave some of us a slight sense of belonging. Besides that, morning peace gave us a feeling of independence and hope for the future. Life in America prior to 2016 was optimistic [1]. The country saw expanding job opportunities over six consecutive years with consistent employment growth, the introduction of affordable care secured healthcare for millions of uninsured Americans and increases in wages and incomes as the economy saw about a two percent growth [2].

Yet, somewhere over the past decade, things dramatically changed for the worse. These days, Americans are waking up to a country in critical condition. The past five years alone have seen a surge in political violence ranging from death threats targeting public-health officials and members of Congress to a conspiracy to kidnap the governor of Michigan [3]. We know America has a long and prolific history of political violence. Still, the 6 January 2021 attack on the U.S. Capitol brought the country dangerously closer to what some called our day of reckoning [4]. Whether or not a reckoning is looming over the country is certainly debatable.

However, Americans have always been divided on many topics, including women's rights, equal pay, and sexual orientation. While gender identity, same-sex marriages, and immigration are all polarizing issues, the division on race is turning deadly [5]. As some parts of the country tore down statues and removed flags commemorating war heroes that affirmed racist messages, others vehemently supported their legitimacy by rallying behind them [6].

For example, the world witnessed hate groups and protestors assembling in Charlottesville, Virginia, and how "false news spreads farther, faster, deeper, and more broadly than the truth" [7]. What started as a tense demonstration, with protestors carrying tiki torches shouting alt-right rants, "United the Right," ended in death and confusion [8], [9]. There is no denying that the country has become increasingly divided on race [10]. Of course, given the history of this country, it is reasonable for anyone to believe the division we see today has always existed in the minds of most Americans, but what has opened these old wounds?

Indeed, Cancel Culture has not made the discussion on race in America easy either [11]. Fear made many Americans afraid to openly share their views on race. Instead, the 2016 Presidential elections revealed everything mainstream America wanted to say [12]. During the 2020 Presidential elections, America doubled down, as the rest of the country felt helpless watching how politicians continued to exploit the divisive nature of racism by

stoking fear in the minds of the American public [13]. Politicians used social media to appeal to distinct voting sectors with “Racist tweets, derogatory terms,” like “white power” and “Kung-flu” [14]. We saw this playing out in our personal lives as Americans captured live-streamed acts of discrimination on their phones, sharing their traumatic experiences via social media [15].

2. Racial Flashpoints in America

Sadly, on May 25, 2020, the world also witnessed how heartless and malignant systemic racism has routinely empowered a few and universally oppressed sectors of society [16]. No one could deny what happened, nor could mainstream America remain complacent or incredulous about racism and police brutality. George Floyd’s death was a flashpoint that reignited the Civil Rights movement. His death also signaled it was time for this country to reconcile its past and relinquish its long-standing relationship and adoration for racism [17].

Nonetheless, the results of racism are unquestionably cruel and lethal for some versus others. What happened to George Floyd is a horrific and tragic event occurring in black communities around the country [18]. With all this happening in the world, how can we foster constructive conversation of change within our communities while moving the country forward when unity is nowhere in sight and confusion is everywhere? This discussion intends to address racism from the perspective of a behavioral disorder rather than how we have traditionally viewed racism. From that viewpoint, we discuss options for a path forward by introducing the concept of social amends as an assumption to facilitate individual behavioral change in addressing racism in the US.

3. Understanding Racism

Of course, understanding the nature of racism and how it functions and is used is challenging since we all experience and see racism from different social perspectives. Our experiences and environment shape not only our understanding, but how we define, perceive and deal with racism through our behavior and relationships [19].

3.1. Exploiting, Monetizing, and Weaponizing Racism

Many of us experience racism based on gender, race, and culture. Sometimes, we also experience racism through other means, like through our favorite TV shows or favorite standup comedians, who joke and make us laugh at “other people’s” racist behavior and not necessarily our own [20]. As harmless as comedians and TV shows may seem, what lies at the center-most parts of their scripts are carefully placed racist elements that writers, producers, and directors intentionally exploit in the name of entertainment [21]. Please note that I am not advocating against freedom of speech nor the censorship of any one person or organization.

After all, what we are watching may sound entertaining, but we must consider how healthy can this be for a society with unresolved race issues? The entertainment community might tell us they are doing society a favor by icebreaking the subject of race in America. In some cases, that could be true; still, we must ask, is an icebreaker a slew of streaming episodes across three seasons? We must consider that monetization, especially when the tragic deaths of Breonna Taylor, Ahmaud Arbery, and George Floyd, were all enough to get America’s attention [22].

Entertainers, comedians, and writers are not the only ones who openly exploit racism [23]. We see this during election time, in the US. Racism is often used as an effective tool by the media, politicians, policing agencies, corporations, and marketing firms to galvanize or influence behavior [24]. Organized groups and influential individuals also adopt forms of racism to exercise power to maintain control and privileges over certain institutions [25]. The point is that we know our country has a big problem, and despite this knowledge, racism is still weaponized by many with no consequences, but “that’s the American way,” which is precisely what needs to change [26].

3.2. Defining Racism

As a definition, most dictionaries would define racism as a complex phenomenon but mainly as a belief in the fundamental role of race in developing human qualities and capabilities, as well as the understanding that racial differences give rise to an inherent superiority of one race over others [27]. From this perspective, we view racism as a belief that is part of a person’s value system. To move the country forward, we must begin to understand how racism may originate as a belief and manifests, primarily as a behavioral disorder.

4. Theories of Racism as a Behavioral Disorder

When examining contemporary theories regarding learned behavior, cognitive processes, and unresolved conflict, social learning, cognitive and psychodynamic theories support the idea of racism as a behavioral disorder. In understanding the "central hypothesis of social learning theory is that people learn through observing others' behavior, attitudes, and outcomes of those behaviors. Such observations provide information about how to behave in similar situations, and they serve as a basis for the formation of rules and strategies for future action" [19]. With this being true, the observational learning process can contribute to the development of racist behavior if racism is an integral part of a person's environment, broader belief, and value system within any social group, like their family or culture.

An example of racism contributing to a person's social learning process is when we see children indoctrinated into militias and hate groups like the Ku Klux Klan and other nationalist or Anti-Semitic groups. Other examples include youths being jumped into gangs, inducted into criminal syndicates, or as a family member coming of age into the ranks of a drug cartel. In all these instances, social learning is inundated with racism, violence, and antisocial behavior, as mental processes interact with social learning.

"According to cognitive theory, human behavior is shaped by the way we think about things. Racism is a belief system, and if people think about race in a certain way, they will behave in a way that reflects that belief system" [28, p. 305]. Although [28] hold the traditional view of racism as a belief, the impact of social learning cognitive processes like perception, memory, and how we approach solving problems are significant. As racism becomes ingrained within our mental processes through social learning, internalized stereotypes, and prejudices. "Cognitive theories explain the maintenance of prejudice by examining the cognitive processes that underlie how we categorize people, how we form stereotypes, and how we process information about individuals who belong to different groups" [29, p. 94]

Furthermore, cognitive theory "suggests that prejudices are often the result of inaccurate or incomplete information processing. As people encounter new information, their attitudes and beliefs are updated to reflect the new information. However, if people are selective in their processing, they may not update their attitudes and beliefs to reflect accurate information" [28]. Through psychodynamics, we understand how our unresolved conflicts, unconscious processes, defense mechanisms, and motivation are significant factors in shaping our behavior and developing relationships. Westen, explains that "Psychodynamic theory emphasizes the importance of early experiences, particularly in the family, in shaping personality and behavior, and suggests that unresolved conflicts from these early experiences can lead to emotional and behavioral problems later in life" [30, p. 13].

According to [31], "The goal of psychodynamic therapy is to help clients gain insight into unconscious conflicts that may be contributing to their symptoms or problems, and to work through these conflicts in a way that leads to greater psychological health and well-being" [31, p. 1]. Examples of psychodynamics are fears, anxiety, and insecurity that trigger our defenses like projection, displacement, and denial. "Projection involves attributing one's own unacceptable impulses or qualities to someone else" [31, p. 9]. "Displacement involves directing an emotion or impulse toward a substitute target that is less threatening or less likely to cause anxiety" [32, p. 34]. "Denial involves the outright refusal to acknowledge the existence of a threatening or anxiety-provoking aspect of reality" [30, p. 24]. Through these theories, we can understand how social learning, cognitive and psychodynamic concepts impact human behavior.

5. The Definition of a Behavioral Disorder

According to [33] a behavioral disorder is described "as patterns of behavior that cause significant distress or impairment in functioning" [33]. The effect of racism can range from death to causing severe physical and emotional trauma. Given this, how we traditionally view racism as a belief needs to change. Namely, because racism has negatively impacted mental health and impaired the overall well-being and ability to function of African-Americans in the United States for decades. With this, we assert that racism meets the APA's definition of a behavioral disorder.

Racism also shares characteristics with other behavioral disorders like sociopathy and narcissism. For example, sociopathy is characterized by consistently demonstrating low moral constraint with little empathy for others [33]. On the other hand, a person with a strong need for admiration and who demonstrates little compassion for others has a narcissistic personality disorder [32]. Each of these disorders is represented by behavioral patterns void of empathy. Behavior such as this can frequently cause distress and impairment since people with this condition resist change. Racism is no different, as it can manifest in various forms and levels, with varying degrees of distress and impairment.

5.1. The Key Elements of Racism

From a structural perspective, racism is made up of several components, each interacting and reinforcing one another in a complicated feedback loop [34, p. 6]. These components include *prejudice, stereotyping, discrimination, power, structural and institutional racism, and internalized racism* [34]

Table 1: Key Elements of Racism

Component	Definition	Impact
Prejudice	<i>Refers to preconceived ideas or attitudes toward people based on race or ethnicity [34, p. 3].</i> (a) <i>Conscious</i> (b) <i>Unconscious</i>	Can lead to discriminatory behavior.
Stereotyping	<i>The act of making assumptions about people based on their race or ethnicity [34, p. 3].</i>	Often oversimplified and inaccurate.
Discrimination	<i>People are treated unfairly based on race or ethnicity [34, p. 4].</i>	Employment, housing, education, and healthcare.
Power	<i>Racism is often intertwined with power dynamics, where certain groups hold more power and privilege than others based on their race [34, p. 7].</i>	This can lead to systemic racism, where institutional policies and practices result in unequal outcomes for different racial groups.
Structural and institutional racism	<i>Refers to the ways in which social structures, policies, and institutions can perpetuate racism even in the absence of explicit discriminatory behavior or attitudes [34, p. 6].</i>	Has long-lasting impacts on wealth and segregation
Internalized racism	<i>Refers to the acceptance of negative messages about one's own racial group, which can lead to feelings of shame, self-hatred, and low self-esteem [34, p. 15].</i>	Can have negative impacts on mental health and well-being.

Source: [34]

5.2. Forms of Extreme Racism

"At its core, racism is about the belief in the inherent superiority of one race over others. This belief can be used to justify unequal treatment, exclusion, and violence towards members of other races" [34, p. 19]. In many cases, the ideology of superiority is not solely limited to racism; it can manifest as sexism, nationalism, religion, and intellectual supremacy, among others [34, pp. 4, 19, 28].

5.3. Forms of Extreme Racism

With this in mind, there are no shortage of examples regarding the ideology of superiority rooted in power and carried out by policies that support ethnic cleansing or genocide worldwide [34, p. 18]. During the Bosnian War, Serbian military forces killed thousands of Bosnian Muslims and Croatian civilians [35]. Similarly, in 1994, Hutu extremists slaughtered almost 800,000 Tutsi and moderate Hutu individuals in Rwanda [36]. Another appalling genocide occurred during the Darfur Conflict when the Sudanese government ordered the murder of approximately 300,000 people in the Darfur region in 2003 [37].

None were more prolific and vile than how Germany's Third Reich slew approximately six million Jewish men, women, and children during World War II [38, 39]. Even the name is entrenched with racist undertones synonymous with the resurrection and continued dominance of the Holy Roman Empire [40]. Nazi Germany's fundamental philosophy was its fervent belief in the superiority of the German race. This belief was based on specific attributes, including color, which attempted to legitimize white supremacy [41].

As Germany's ambitions were cut short by the Allied Forces in 1945, the ideologies, concepts, and principles

developed by Nazi Germany still live on today [42]. At the same time, America was essentially not much better. By that time, white supremacy was fully ingrained into the minds of many Americans through slavery first and then through Jim Crow Laws and discrimination [43]. Black and brown soldiers like the Tuskegee Airmen and the 761st Tank Battalion, whom we call the "Black Panthers," courageously fought against the rise of the Third Reich during the war and its racist overtures, only to return home to a culture that continued the same form of extreme racism as Nazi Germany [43].

5.3.1. White Supremacy as an Extreme Form of Racism

One of the most destructive forms of extreme racism is white supremacy. Extremist hate groups often adopt white supremacy ideology as their core value and frequently relay their message by committing hate crimes against targeted races. Not only that, when the violent nature of the behavior is entirely void of empathy and compassion, this extreme behavior begins to mirror other disorders, like narcissism and psychopathic behavior [44].

We also know that white supremacy is not limited to individual beliefs. Jim Crow Laws are perfect examples of how the superiority ideology can lead to institutional policies and practices [34, p. 11]. In the late 70s, the war on drugs and institutional racism in the judicial system led to the mass incarceration of black and brown men [45] in the United States. The documentary, "13th" took a historical account of how the judicial system criminalized African-American men. These policies and practices can contribute to developing a behavioral disorder at the societal level [45].

The real impact of extreme forms of racism is associated with mental health issues. White supremacy does not only negatively impact victims of hate crimes; the belief holder can also be affected [46]. However, those who have experienced physical violence as a form of racism can arguably meet the criteria for developing post-traumatic stress disorder [47]. Whether or not we spend the time arguing if the impacts of racist incidents are indirect, subtle, or systemic, no one can argue how racism damages the mental health of African-Americans. Nonetheless, this is just another example of how racist behavior patterns can cause significant distress or impairment in function. By understanding the destructive nature of extreme forms of racism, we can better understand the significance of addressing and acknowledging racism as a behavioral disorder [48].

6. Conclusion

Our country and "Society is unwell. The symptoms-- racialised violence, and excess morbidity and mortality in minority ethnic populations--reflect the cause: an unjust and unequal society" [49, p. 112, 50]. Since 2021, 37 states within the US have passed over 200 declarations affirming racism as a public health crisis [50]. Even though these declarations represent a crucial first step, we need to encourage and develop more robust and actionable plans to combat racism [51]. In addition, we must extend our focus beyond training, increased capacity to address racism, transparency, partnership with affected communities, intersectionality, and accountability measures to determine the impact of anti-racism initiatives [51, 52]. We need a call for a consensus, within the American Psychological Association (APA) to classify racism as "patterns of behavior that cause significant distress or impairment in functioning" [53]. We know racism has a long and cruelly profound relationship in American history. We also know from the historical evidence that demonstrates racism as patterns of behavior that are deeply intertwined and centered around power [54]. Therefore, the need to classify racism as a behavioral disorder cannot be overstated.

However, let's consider viewing the elements of racism through a lens of "calculus". If we can imagine racism as complex equation, or as a function of social learning, cognitive and psychodynamic, when we derived the final derivative; we can see the constant ideology of superiority, which manifests itself as white supremacy in the American context. White supremacy, executed as racism, has caused significant distress and functional impairment, ranging from death, torture, mass incarceration, mental illness, loss of wealth, and many other distressful conditions, by those who exploit, monetize, and weaponize racist behavior [45].

To move our culture forward, we must base our progress on ideals or the constant that defines us as people. The one consistent element within all is humanity. Therefore, if we focus on humanism as "a philosophy of responsible freedom, designed to encourage the maximum possible fulfillment of every human being, individually and collectively, and to lead humanity forward to an ever-greater realization of its highest potentialities" [55, p. 17]. we can significantly reduce the impacts of racism. Embracing humanistic values such as empathy and respect for diversity can lead to greater understanding, cooperation, and harmony among individuals and communities, ultimately promoting a more equitable and just society.

6.1. Facilitating Social Amends

Before we can begin to think about placing racism behind us, the United States must first facilitate social amends as it did for the surviving Japanese Americans of its internment camps in 1988 [56]. Several thought leaders, scholars like Beverly Tatum, Ibram X. Kendi, and Bryan Stevenson, all examine the notion of social atonement in the context of racism [57-59]. From this, we expand the idea that “restorative justice is centered on the dynamics of forgiveness and atonement” from a societal perspective [60, p. 203].

Since racism has a long and deep-rooted history in America, many cannot point to one sole living malefactor. Instead, the effects of racism, as an institution in America, inflicted on enslaved black and brown people are essentially acts of complicit behavior by society in general, perpetuated over multiple generations. In this, we not only account for slavery, we include extreme violence that fringes on genocide dating back to 1866 in New Orleans, Tulsa in 1921, and Rosewood in 1923, just to name a few, even though the brutality continues to this day [61]. In this context, we introduce the idea of atonement as a social event since the oppressing sector of society needs to atone for its direct and complicit involvement in institutionalized racism, discrimination, and inhumane behavior.

The idea of amends has its roots in religious and philosophical traditions. For example, forgiveness and atonement practices in Christianity [62, Matthew 6:14-15; Luke 17:3-4] and Judaism [63, Leviticus 16:1-34] allow people to overcome obstacles within their relationship with God on the path to reconciliation. While many faiths teach and practice these same constructs, the social amends theory here consists of two agnostic components when addressing issues like racism. These elements include forgiveness and social atonement, adapted from the theory on the Role of Forgiveness and Atonement in Social Justice [60].

6.1.1. Individual and Community-level Forgiveness

In the theory on social amends, I expand on this relationship by emphasizing and focusing on forgiveness as a function of (1) *individual* and (2) *community-level forgiveness* [60]. In this context, these two components of forgiveness are not mutually exclusive on the journey to social reconciliation. Our theory of social amends requires a concerted effort from both the oppressor and the oppressed to acknowledge and atone for past wrongs openly, address current inequalities through community-level forgiveness, and commit to developing a better future for all through individual forgiveness [60].

6.2. Enabling Individual Behavioral Change

This is why classifying racism as a behavioral disorder is critical in facilitating social amends to move our country forward when people are ready. By recognizing racism as a behavioral disorder, we provide options for healing [48]. One significant benefit is that the reclassification collectively enables society to approach racism as a treatable condition through existing mental health channels [48]. Correctly classifying racism also creates a natural path forward for individuals prepared to seek help, where people can obtain the necessary guidance in the context of individual and or community forgiveness. Taking a personal treatment approach removes the stigma of being humiliated, being called out, or publicly self-identifying as a racist. If people can address their issues privately and at their own pace, many more people will be encouraged to work toward healing and personal growth. Understanding racism as a behavioral disorder provides treatment and long-term support while facilitating the healing process of unresolved transgenerational issues regarding race in America [48].

7. Discussion

Over the years, America has attempted social amends through reparations and a public apology to Japanese Americans from World War II. President Ronald Reagan signed the Civil Liberties Act in 1988 as an atonement for the government placing Japanese Americans into internment camps during the war [56]. The government paid reparations of \$20,000 to over 80,000 Japanese Americans as compensation in the form of reparations [56]. Many of us know too well how in 1865, General William Tecumseh Sherman promised recently freed slaves from the South forty acres and mule as reparations. However, reparations were never paid because President Andrew Johnson later overturned Sherman’s policy [64].

7.1. Reparations

Fast forwarding to 2023, several states are considering or have paid out reparations to descendants of enslaved people. Local government leaders in Evanston, IL, have already made provisions to provide reparations to its residents through a down payment, mortgage, and renovation assistance program [65]. Other states like California,

Vermont, New Jersey, Texas, and New York are all considering laws that support paying reparations to descendants of enslaved people and for long-standing discrimination practices [66]. Even though these bills are not yet laws, certain areas of the country are coming to terms with the idea that the time has come to make social amends. Moreover, with recent social and political unrest, social atonement is likely to become a reality sooner rather than later in some states.

7.2. Social Tipping For the Good of the Nation

As bright and rosy as these ideas are, I am neither naive nor advocating for the entire country to go under therapy. In fact, we do not need complete adoption because that would be an unreasonable sub-optimal solution altogether. Still, if we consider and apply contemporary theories of adoption, our understanding is that “laggards” will always refuse help while “early adopters” are ready and willing to change [67]. The idea is to create a “network effect” where early adopters can encourage others within their communities to seek help [68]. With state and federal-sponsored marketing campaigns, we can demonstrate how diversity can improve our lives by focusing on the unique value proposition of healing our [69]. As this behavior becomes more attractive within border communities, we hope for a snowball effect in changed behavior [70].

Furthermore, given the sensitive nature of racism and the stigma it now possesses, we can see a “spiral of silence” occurring in some communities entrenched with racist behavior [71]. This scenario can lead to a suppression where racist views and behavior are now the minority opinion, thereby accelerating the network effect to the social tipping point with respect to the threshold model [72]. “It is crucial to remember that full atonement and full forgiveness are multigenerational projects, just as transgenerational transmission of trauma takes many generations to heal” [60, p. 204]. Therefore, we can only hope to achieve critical mass in the long run when anti-racist behavior becomes the norm as more people rapidly adopt healthier perspectives on race in America. Again, the proposed path is feasible but requires cooperation on the state and federal levels. Success includes patience, positive reinforcement, and negating the impacts of social media.

7.3. Negating “Acoustic Feedback” and Social Media Pollution

Social media is, by far, the biggest threat to moving America forward on race [72], with its capabilities to influence digital manipulation [73]. If we are to take racism seriously, we need to regulate social media unilaterally. The federal and state governments must seriously consider restricting how social media enables the dissemination of hate, misinformation, and marketing that tampers with our political process through outright propaganda campaigns sponsored by corporate interest, domestic hate groups and nationalist states [72]. The confusion venting through social media platforms is like acoustic feedback; I coin the phenomenon as “emotional contagion pollution” [74]. Pollution of this order refers to the damaging effects social media has on a society’s collective emotional well-being by the spread of fake political support causing negative emotional distress across social networks [75].

Furthermore, the amount of disinformation trafficked by fake or automated social media accounts for another type of pollution I call “identity pollution” [76]. Pollution along this accord refers to social media’s harmful impact on an individual’s identity and self-worth. Social identity pollution happens when users create manual accounts or others create automated accounts to interact with the public using an online digital persona or identities intending to deceive or mislead others. The internet community calls it “catfishing” [77], while the automated accounts are called “bots.” “A bot, short for ‘robot,’ is an automated computer program that can perform a wide range of tasks, from relatively simple repetitive ones to sophisticated data analyses that would be difficult or impossible for humans to do alone” [78, p. 99].

Within social media, there are social bots, which “are often benign, or even useful, but some are created to harm, by tampering with, manipulating, and deceiving social media users” [79]. As you can imagine, bots are serious business. In a time where no one truly knows everything behind any particular social media user account, the general public assumes that what they see, read, and experience on social platforms are fundamental human interactions. Unfortunately, this is not entirely true. “Social bots have been used to infiltrate political discourse, manipulate the stock market, steal personal information, and spread misinformation. The detection of social bots is therefore an important research endeavor” [79]. To regain sanity in this country, we must first silence the acoustic feedback emitted from social media while holding social media organizations accountable for polluting the minds of the American public [72].

Given the history of the United States, there is a good chance our government is waging propaganda campaigns through social media in other countries like the Middle East and Central Asia [80]. “Social media, which was once heralded as a force for freedom and democracy, has come under increasing scrutiny for its role in amplifying

disinformation, inciting violence, and lowering levels of trust in media and democratic institutions” [81]. Perhaps, the racial conflict and confusion occurring in the streets of America could be collateral damage in a new type of war.

Whatever the case, the time has come for the United States to rethink its position on racism altogether. The country is at odds with itself, influenced by social media bots, TV shows, comedians, News Media, and Politicians alike. People are dying over senseless acts of aggression rooted in racism. Classifying racism as a behavior disorder is not a convenient means to that end; rather, it is the right thing to do because racism constitutes a real behavior disorder rooted in social learning, cognitive and psychodynamic theories. Making this kind of change places the country in a position to begin the social atonement process, which includes individual and community-level forgiveness. I know everyone will not change if offered help; that is not the point. What we want to do is enable individual behavioral change by demonstrating the unique value proposition of healing our country, while muting the acoustic feedback of social media as we reboot the democratic process.

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Author Contributions

Dr. Frederick K. Johnson was the exclusive author of this manuscript, overseeing the study's conception, design, material preparation, data collection, analysis, initial draft authorship, and final version review and approval.

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Bio-Asphalt to Enhance Pavement Sustainability and Performance at Sub-Zero Temperature

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Abstract

Bio-asphalt to enhance pavements sustainability and performance at sub-zero temperatures
Abstract This paper investigates the underlying molecular mechanism which leads to enhanced performance of bio-modified asphalts at sub-zero temperatures and stiffening effects of water on asphalt. It further quantifies and compares effect of water diffusion into various bio-modified asphalts. Excessive stiffening of asphalt specially at sub-zero conditions are implicated in low-temperature cracking. Here, we examine whether water-induced stiffening is moderated by the composition of asphalt and water, and if such stiffening effects can be prevented using bio-modification. It has been shown that residual water in asphalt can promote formation of molecular clusters mainly due to increased intermolecular attractions between water-grafted asphaltene dimers (ref). Here we hypothesize that select bio-modifiers with enhanced peptizing effects hinder formation of molecular clusters mitigating asphalt stiffening. To test this hypothesis, we selected four bio-modified asphalt and examined their chemo-mechanics and healing characteristics.

End of Life Plastics to Enhance Sustainability of Pavement Construction

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Abstract

This paper evaluates the efficacy of a hybrid treatment for waste-plastic granules using a bio-oil and carbon coating to make the plastic granules compatible with asphalt binder to both promote environmental sustainability and enhance pavement performance. The bio-oil used in this study was derived from waste vegetable oil, and carbon coating was performed using graphene nanoparticles. To evaluate the extent of surface treatment of plastic granules, the formation of surface functional groups was tracked using Fourier transform infrared spectroscopy and Raman spectroscopy, and their surface energy before and after treatment was measured using inverse gas chromatography. In addition, the thermo-mechanical properties and phase separation of asphalt binders containing treated-plastic granules were studied. The study results showed the total surface energy of plastic was increased by 49% after treatment-promoting interactions between plastics and binder. This in turn led to an 86% reduction in the separation of plastics and binder. The viscosity of binder containing plastics increased significantly; however, the binder with treated plastic had 56% lower viscosity than the binder with non-treated plastic. Binder with treated plastic had increased resistance to fatigue cracking, as evidenced by a significant reduction in $G^*\sin(\delta)$ compared to the binder with non-treated plastic. Low-temperature properties were also improved for binder with treated plastic compared to binder with non-treated plastic. Finally, the moisture-induced shear-thinning index showed that the presence of treated plastic granules in binder made the binder less susceptible to moisture.

Artificial Intelligence in Medical Care

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Abstract:

Medical care is rapidly changing and improving based on technological advances. Artificial intelligence, as one of the most basic and important technologies in this industry, plays a very important role in improving the processes and quality of services to patients. In this article, the applications of artificial intelligence in medical care, including disease diagnosis, prediction of disease process, design of new drugs, improvement of clinical processes and improvement of medical imaging have been discussed. Also, in this article, the challenges and ethical issues related to the use of artificial intelligence in medical care are examined. This article is presented in order to clarify the importance of this technology in improving the level of medical care, as well as to examine possible obstacles and solutions to advance this process.

Key word:

Artificial intelligence, medical care, disease diagnosis, disease process prediction, clinical process improvement, ethical issues.

Introduction

Medical care, as one of the fields that requires high precision, speed of action and up-to-date scientific knowledge, is changing and improving rapidly, relying on technological advances. This field has always received attention and investment in health centers, hospitals, research centers and universities; But with the increasing progress of medical knowledge and the increasing complexity of diseases, the need for new and technology-based approaches to improve the quality of medical care is felt.

One of the new and powerful approaches that have been noticed in this regard is the use of artificial intelligence in medical care. Artificial intelligence, as one of the key technologies of the last decade, provides a lot of ability to improve care processes. From diagnosing disease to predicting the course of the disease, designing new drugs and improving clinical processes, artificial intelligence currently plays a very important role in all aspects of medical care.

In this article, we examine the applications of artificial intelligence in medical care, including diagnosing complex diseases, predicting disease trends, designing new drugs, and improving clinical processes. Also, we will examine the challenges and ethical issues related to the use of artificial intelligence in medical care. Finally, providing solutions to solve these challenges and optimally exploit the capabilities of artificial intelligence in medical care will be examined.

Considering the importance of the discussion, this article is presented in order to improve public understanding and those interested in this field. We hope that this article will play an effective role in promoting the use of artificial intelligence in medical care and help improve the quality of medical services for patients.

Disease Prediction and Diagnosis: Unveiling the Role of Artificial Intelligence

In the realm of healthcare, the integration of artificial intelligence (AI) has seen a remarkable surge, particularly in the areas of disease prediction and diagnosis. While the focus of AI research in healthcare traditionally gravitates towards cancer, neurological disorders, and cardiovascular diseases—owing to their profound impact on morbidity and mortality—recent attention has also shifted towards infectious and chronic ailments such as type 2 diabetes, inflammatory bowel disease, and *C. difficile* infection.

Advancements in AI technologies now enable early detection and diagnosis across a spectrum of medical conditions. By leveraging clinical insights and integrating them into meticulously trained and validated systems, significant strides have been made. For instance, the United States Food and Drug Administration (FDA) recently authorized the use of diagnostic software capable of identifying wrist fractures in adult patients—a testament to AI's potential in enhancing healthcare delivery.

In a notable study examining 1,634 images of lung tissue afflicted with cancer alongside healthy lung tissue, AI algorithms demonstrated a remarkable ability to discern between various types of lung cancer with a precision comparable to that of experienced pathologists. Moreover, in the context of mental health, where depression affects over 6% of the adult population in the United States, AI-driven image heatmap pattern recognition exhibited a promising 74% accuracy in predicting major depressive disorder.

Numerous studies are exploring the transformative potential of AI in facilitating timely and precise disease diagnosis. Supervised learning methods have proven to be particularly effective in capturing intricate nonlinear relationships essential for the classification of complex and multifactorial diseases. For instance, in a cohort study involving 260 patients, it was observed that AI models outperformed trained emergency medical respondents in diagnosing acute cerebral ischemia.

Despite challenges posed by noisy data and experimental constraints, deep learning methodologies offer promising solutions. By employing layered auto-encoding analyses, deep learning models effectively reduce data dimensionality, thereby enhancing diagnostic accuracy. Illustrative examples include the analysis of histopathology images to detect basal cell carcinoma and differentiate between malignant and benign lesions, achieving a diagnostic accuracy of over 90% when compared to expert assessments. Similarly, in the realm of breast cancer screening, AI-enabled analyses of digital mammograms have demonstrated a high acceptance rate among interpreting radiologists, further underscoring the potential of AI in revolutionizing disease diagnosis.

In summary, the burgeoning integration of artificial intelligence in disease prediction and diagnosis heralds a new era in healthcare, offering unprecedented opportunities to enhance diagnostic precision, expedite treatment initiation, and ultimately improve patient outcomes.

Enhancing Treatment Effectiveness and Outcome Prediction: Leveraging Artificial Intelligence

In the realm of healthcare, optimizing treatment effectiveness and accurately predicting patient outcomes stand as pivotal objectives with profound clinical implications for disease management strategies and personalized care plans. Historically, predictions of cancer outcomes were primarily reliant on molecular and clinical information. However, the advent of high-throughput technologies, encompassing genomic, proteomic, and imaging modalities, has ushered in a new era where a diverse array of input parameters are harnessed for outcome prediction.

Integration of multi-modal data types, such as histological or pathological assessments, alongside large sample sizes, has enabled significant advancements in the accuracy of cancer susceptibility assessment, outcome prediction, and prognosis. These methodologies have shown promising results, with potential improvements ranging from 15% to 25% in predictive accuracy.

Electronic health records (EHRs) serve as invaluable repositories of healthcare information, facilitating the documentation and sharing of vital patient data. Machine learning algorithms tailored for administrative datasets have emerged as powerful tools for leveraging EHRs to detect potential complications, optimize healthcare resource allocation, and personalize patient care plans. Studies have demonstrated the efficacy of machine learning-based models in predicting outcomes for conditions such as sepsis, where mortality prediction based on echocardiography combined with EHR data achieved an impressive accuracy of 96%.

In chronic disease management, characterized by multi-organ involvement and long illness progression latencies, artificial intelligence analytics offer a paradigm shift. Machine learning algorithms have demonstrated remarkable success in predicting conditions like retinopathy, with deep learning techniques achieving high specificity and sensitivity in detecting diabetic retinopathy and macular edema.

Precision medicine, particularly in oncology, hinges on accurately predicting optimal drug therapies based on individual patient tumor genomic data. Open-access algorithms have been developed to predict cancer response to common chemotherapeutic medications, exemplifying the potential of artificial intelligence to translate vast -omics data into clinically actionable insights.

In the context of congestive heart failure, supervised machine learning techniques have been utilized to analyze clinical variables and predict patient survival more accurately than conventional risk assessment tools, showcasing the transformative potential of artificial intelligence in enhancing patient care and treatment outcomes.

In conclusion, artificial intelligence stands poised to revolutionize treatment effectiveness and outcome prediction in healthcare, offering unprecedented opportunities to personalize care, optimize resource allocation, and ultimately improve patient outcomes across a spectrum of medical conditions.

Revolutionizing Drug Discovery and Repurposing: Harnessing the Power of Artificial Intelligence

In the ever-evolving landscape of pharmaceuticals, drug discovery and repurposing stand as cornerstones of innovation, with the potential to transform patient care and treatment paradigms. Historically, approximately 25% of all discovered drugs have been serendipitous discoveries, emerging from the convergence of disparate domains by chance. However, the modern pharmaceutical industry increasingly favors targeted drug discovery methodologies, driven by explicit mechanisms, higher success rates, and lower costs compared to traditional blind screening approaches.

In recent years, machine learning has emerged as a powerful ally in the drug discovery process, fueled by several compelling factors. Firstly, the soaring costs associated with drug development necessitate

innovative approaches to streamline the process. Secondly, the proliferation of three-dimensional structural information provides invaluable insights guiding the characterization of drug targets. Lastly, the alarmingly low success rates observed in clinical trials underscore the urgent need for novel methodologies to improve efficacy and efficiency.

Machine learning serves as a conduit, bridging diverse domains and facilitating cross-domain linkage in drug discovery. By leveraging contextual clues and analyzing vast datasets, machine learning algorithms can identify newly approved drugs and elucidate their mechanisms of action. Despite these promising advancements, several challenges persist, including limited access to comprehensive datasets and the fragmentation of data across disparate repositories. Moreover, raw data from clinical trials and preclinical studies are often inaccessible, posing significant barriers to analysis and interpretation.

Nevertheless, artificial intelligence has demonstrated remarkable success when applied to available data sources. Techniques such as similarity metrics enable the extraction of valuable insights into shared pathways across different diseases, facilitating the identification of potential drug candidates. Additionally, natural language processing algorithms play a pivotal role in uncovering hidden or novel associations, shedding light on potential adverse effects of drugs based on scientific publications.

Revolutionizing Clinical Trials: Embracing In Silico Approaches

Clinical trial design, rooted in classical experimental methodologies, has long been the cornerstone of medical research. However, inherent challenges, including uncontrollable sources of variability and ethical considerations, have posed significant hurdles for clinical investigators. Issues such as prolonged and costly subject enrollment underscore the need for innovative approaches to streamline the clinical trial process.

Enter the realm of in silico clinical trials—a paradigm-shifting approach that leverages computational modeling and simulation to emulate real-world clinical scenarios within a virtual environment. This groundbreaking methodology has the potential to revolutionize drug development and patient care by offering predictive, preventive, personalized, and participatory medicine.

In silico clinical trials afford researchers the unprecedented ability to model biological systems, simulate patient responses, and generate virtual cohorts with specific characteristics. By partially replacing animals or humans in traditional clinical trials, these virtual simulations offer a cost-effective and ethically sound alternative, particularly beneficial for pediatric or orphan disease trials.

From pharmacokinetics and pharmacodynamics assessments to post-marketing surveillance, in silico methodologies permeate every phase of drug development, offering insights into efficacy, safety, and dosing optimization. Notably, in a recent study, a large-scale in silico randomized, placebo-controlled Phase III clinical trial was conducted on synthetic Crohn's disease patients. The results revealed intriguing correlations between disease activity scores and treatment efficacy, ultimately validating predictions and informing clinical decision-making.

Moreover, in silico clinical trials hold immense potential in biomarker identification, dose optimization, and intervention duration assessments, offering unparalleled opportunities for accelerating biomedical product development.

Revolutionizing Epidemic Outbreak Prediction: Unveiling the Power of Data-Driven Insights

The dynamics of infectious disease transmission among population groups are intricately intertwined with ecological and biological factors, creating distinctive distribution patterns that shape epidemic

outbreaks. Leveraging prior knowledge of environmental features and population demographics, researchers endeavor to forecast the onset, peak, and duration of epidemics—an endeavor made feasible through the integration of advanced modeling techniques and data analytics.

In recent years, significant strides have been made in epidemic outbreak prediction, driven by the assimilation of diverse datasets and the application of sophisticated predictive models. For instance, in Uganda, the identification of potential outbreak areas for filoviruses—such as Ebola—was achieved through the analysis of bat distribution patterns and historical outbreak data. By elucidating the geographical hotspots susceptible to filovirus transmission, researchers can proactively implement targeted intervention strategies and mitigate the impact of future outbreaks.

Similarly, in central Thailand, predictive modeling techniques were employed to forecast the morbidity rate of dengue hemorrhagic fever—a mosquito-borne viral infection. By estimating the infection rate in female *Aedes aegypti* larvae mosquitoes, researchers achieved remarkable prediction accuracy exceeding 95% in the training phase and 88% in the test phase. These findings underscore the potential of predictive analytics in anticipating disease burden and guiding public health interventions.

The integration of predictive modeling and data analytics holds immense promise in revolutionizing epidemic preparedness and response efforts. By harnessing the power of data-driven insights, policymakers and healthcare professionals can proactively identify at-risk populations, allocate resources efficiently, and implement targeted preventive measures. Moreover, the advent of real-time data surveillance systems enables timely detection of emerging threats, facilitating prompt response and containment strategies.

Empowering Precision Health: Embracing the Promise of Data- Driven Medicine

In the realm of healthcare, precision health emerges as a beacon of hope, promising tailored interventions and personalized care plans driven by insights gleaned from genetic and biomedical studies. At the heart of this transformative journey lies the amalgamation of advanced analytics, machine learning algorithms, and high- resolution data—a convergence poised to revolutionize medical research and patient care.

Recent breakthroughs in precision health underscore the pivotal role of regularized logistic regression—a cornerstone tool for unraveling intricate connections between genes, human traits, and diseases. With an increasing reliance on large-scale genotype and phenotype datasets, collaborative sharing across institutions becomes imperative, laying the foundation for groundbreaking discoveries.

Consider, for instance, a recent case-control study that marries personal whole genome sequencing with electronic health record (EHR) data to investigate abdominal aortic aneurysm. By leveraging sophisticated algorithms, researchers assess the efficacy of modifying personal lifestyles based on individual genomic profiles, illuminating the path towards personalized health management models with far-reaching implications for complex disease biology.

Furthermore, the advent of machine learning heralds unparalleled opportunities in precision medicine, with algorithms poised to self-improve with experience, continuously learning from new data and insights. However, the realization of this potential hinges on addressing critical computational challenges. The "Big Data Research and Development Initiative" underscores the urgency of novel approaches to tackle the voluminous, varied, and velocity-driven nature of healthcare data, propelling the field towards new frontiers of discovery.

Yet, amidst the promise of precision health, ethical considerations loom large. The ethical dimensions of data science span privacy concerns, algorithmic biases, and value-based practices, underscoring the need

for robust frameworks to safeguard individual privacy rights while facilitating data sharing and collaboration.

In this era of data-driven medicine, healthcare institutions grapple with the imperative to balance innovation with ethical responsibility, ensuring trust and transparency in the recommendations provided by machine learning systems. Challenges abound—from noisy, high-dimensional datasets to issues of data interoperability and missingness—necessitating collaborative efforts between researchers and care providers to enhance predictive modeling accuracy and clinical utility.

However, with robust infrastructures and advances in natural language processing, the potential to harness vast troves of clinical data for actionable insights becomes increasingly tangible, paving the way for transformative interventions and improved patient outcomes.

As machine learning algorithms inch closer to replicating real-world conditions, the landscape of clinical medicine stands poised for profound transformation. While algorithms may assume tasks once reserved for human expertise, the essence of clinical practice—navigating complexity, managing data, and delivering compassionate care—remains firmly rooted in the art of healing.

In conclusion, precision health represents a paradigm shift in healthcare, promising individualized interventions and data-driven insights to propel medical research and patient care into a new era of precision and efficacy. Through collaborative efforts and ethical stewardship, the vision of precision health as a cornerstone of modern medicine inches closer to realization, offering hope for a healthier, more equitable future for all.

Conclusion:

Today, the use of artificial intelligence and advanced technologies in medical and health sciences has become one of the most important scientific and medical achievements due to the unique capabilities they offer. Different fields, including the prediction and diagnosis of diseases, reducing the costs and time needed to discover medicines, predicting the spread of diseases and even improving the process of clinical trials using virtual tests in the category of health and pharmaceutical hierarchy, benefit from these developments.

One of the fields in which artificial intelligence plays an important role is the prediction and diagnosis of diseases. By combining large and complex data with machine learning algorithms, we are able to predict the type and severity of diseases in different people and even in society as a whole. These facilities can improve treatment routing and also help in formulating health policies and preventing the spread of diseases.

Drug recovery and revision is another field that artificial intelligence and advanced models make possible to revise and increase their efficiency. The use of genomic and proteomic data alongside medical history data has made it possible to develop drugs that are specifically suited to the genetic characteristics of target individuals.

In addition, artificial intelligence plays a very important role in predicting the spread of diseases and responding to emergency situations. By analyzing the data collected from the prevention and treatment of diseases, preventive and management measures can be effectively adopted to control the outbreak of diseases.

In conclusion, artificial intelligence and related technology has created a revolution in the field of healthcare. Through sophisticated data analysis, advanced modeling, and technological advances, we can expect significant improvements in the diagnosis, prevention, and treatment of diseases in the future,

which will improve people's quality of life and reduce healthcare costs.

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Changing Needs in Supply Chain Management in Fashion Industry with Circular Economy for the SDGs

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1.0 Introduction

Quality is much relied on the fulfillment of requirements, including international and local requirements, industry and organizational requirements, with a system in place supported from top management and all levels of staff.

Business originates from fulfilling customers' requirements and expectations with a quality product and/ or service settled at a price that is agreed by buyers and sellers in the market. The use of inputs in the production process are upstream process flow with supplier sourcing, material forecast, production control and quality control while the distribution of semi-finished products and/ or finished products from wholesalers to retailers, and the delivery of customer-related services to end users are downstream process flow. The chain involves different stakeholders who have their own self-

interest that may or may not affect their upstream or downstream business partners.

No matter what kinds of industries that an organization is involved with, the concept of upstream and downstream process flows in supply chain management can be applied. The current issues in today's business world include technology explosion, environmental awareness, business ethics, social responsibility, and enhancement of soft skills for building the capacity of leaders for the 21 st century. In fact, these contemporary issues can be found in the sub-processes of the chain, for example, suppliers may share the data of products with wholesalers to ease the traceability of shipments, wholesalers may share the data of retailers with producers for realizing the changing tastes and requirements of customers, and retailers may need to collect customer data from business partners to identify the trends of industries for improving operating practices. All in all, supply chain management concept involves with system thinking that is beneficial to learners. And, developing an awareness of data protection, security management, risk management, use of technology for data storage, retrieval and analysis for making a timely and right decision is definitely important for a social responsible educational institute. Hence, it would be desirable if educators can embed these contemporary issues into the curriculum design process with formative and summative assessments to reflect the level of knowledge, skills, attitude and values of learners matched with the dynamics of the business world.

2.0 Linking Current Business Issues with SCM Curriculum Design

Quality assurance is the job of every one working in the supply chain management industry, but also educational institutes that help nurture a new generation of capable labor force for economic development. As a result, educators involved in curriculum design are one of the key stakeholders as they need to make curriculum meaningful to the society, to the employers and to the learners. The following requirements need to be considered during the design, implementation, monitoring and reviewing phases of curriculum design:

- 1) Needs of the society;
- 2) Voices of stakeholders, for example, industry practitioners and learners;
- 3) Requirements of Programme Accreditation Body;
- 4) Objectives of programmes;
- 5) Intended programme and module learning outcomes; and
- 6) Requirements of Education Authority.

For example, the Qualification Framework (QF) requirement of the Education Bureau (EDB), Hong Kong.

This involves with the knowledge, process of learning, accountability and communication dimensions in the QF level to reflect the levels of attainment with measurable intended programme and module learning objectives and learning outcomes. e.g. QF Level 1 is for certificate level;

QF Level 3 is for secondary school diploma; QF Level 5 is for undergraduate level; and QF Level 7 is for doctoral level. In recent years, the supply chain management related industry environment

has been changed significantly, demanding for product and service traceability and transparency to reduce unexpected risks and to increase predictability and control. Cases of food poisoning, infectious diseases, forged products have created a dramatic need of talents with knowledge in information technology and a mindset of ethics and social responsibility.

In response to the above, the Education Bureau (EDB) of Hong Kong has been promoting the use of outcome- based approach for attaining different levels of Qualification Framework (QF) in both academic and vocational sectors in the past five years. Under the Specification of Competency Standards (SCS), there are over 20 industries with specific units of competency, covering industries of banking, hairdressing, logistics printing, jewelry...etc. This chapter focuses on exploring the

needs of the industry and the community with a review of the current design of the unit “Formulating Local Operations Strategies” and the unit ”Manage Network Security” under the Specification of Competency Standards (SCS) for the Logistics Industry – a standard of the vocational sector at QF Level 5 (undergraduate level) to identify the areas that need to be covered in modules related to supply chain management at QF level 5 in Hong Kong.

For the unit on ”Formulate Local Operating Strategies”, it is classified under one of the 10 functional areas of the Logistics Industry – Terminals, Warehouse and Logistics Centre - ”Operations Management”. This unit focuses on understanding, formulating and reviewing of operation related strategies. Its coverage starts from understanding the business environment, restrictions of market participation, to strategies on transportation, wharf warehousing, distribution, IT infrastructure and manpower training.

For the unit of “Manage Network Security”, is classified under one of the 10 functional areas of “E-logistics” of the Logistics Industry – Terminals, Warehouse and Logistics Centre. Its coverage is mostly on building knowledge, identifying, controlling and establishing policies and plans on network security, security devices, controls to be installed in the network to manage elements such as user access or hackers...etc. In fact, linkage between these two units needs to be strengthened for generating a holistic picture for undergraduates to understand the importance of the values:

- Business ethics in operating practices,
- Respect of business partners in use of data, and
- Sustainability with social, economic and environmental impacts.

3.0 Cloud Computing and QDCV (Quality, Delivery, Cost and Values) of SCM Further to the requirements of EDB, the job requirements of the recruitment advertisements of Job Data Base (Job DB) - a key search engine for jobs in Hong Kong and literatures on cloud computing also need to be taken account of. It is understood that the following areas need to be addressed in the curriculum of operations management and data or network security:

- 1) The attributes of supply chain industry;
- 2) The needs of internal and external customers;
- 3) The capabilities of a professional operation manager, including knowledge, skills and experience in

warehouse operation and inventory management, scheduling and forecasting, logistics- related documentation and communication; and

4) The application of cloud computing in addressing the needs of customers.

According to Sharif (2010), cloud computing is an accessible resource of hardware and software which an organization or individual can harness, anywhere in the world via the internet. (p. 131) He mentioned that cloud computing was a trend of integrating internet with information system for almost infinite context to enable configuration and customization. A user-oriented and requirement-driven manner has been adopted in cloud computing as the package of hardware and software for generating a desirable result all relies on the intention of the users.

“...Cloud computing is a kind of computing application service that is like e-mail, office software, a cloud and enterprise resource planning (ERP) and uses ubiquitous resource that can be shared by the business employee or trading partners...Thus, cloud computing provides the opportunity of flexibility and adaptability to attract the market on demand.” (Chan and Wu, 2011, pp. 1007).

However, Sharif brought up the point that vendors, service providers and consumers needed to be educated about their computing needs and expectations, making that cloud computing could create business opportunities with mutual trust, rather than hinder progress in information exchange.

In 2011, Chen and Wu also mentioned that market competition and dramatic change in the business environment drove the emergence of Cloud Computing that improved business operation through operating systems, application software and technological solutions.

“Cloud computing diffusion becomes a significant research topic because it enables firms to execute data transactions long value chain activities (e.g. including manufacturing, finance, distribution, sales, customer service, information sharing and collaboration with trading partners).”

(Chan and Wu, 2011, pp. 1007)

“Cloud computing is a new paradigm shift in which including computing resource services, soft applications of distributed systems and data storage.”

(Chan and Wu, 2011, pp. 1007)

“...the term ‘Cloud’ is derived from the idea of businesses and users being able to access applications from anywhere in the world on demand. In this paper, cloud computing is defined as a collection of disembodied services accessible from anywhere using any mobile device with an internet-based connection.”

(Chan and Wu, 2011, pp. 1008)

From the above quotations, it is understood that cloud computing triggered the enhancement of SCM attributes – reducing COST, increasing DELIVERY and enhancing VALUE. However, the level of quality in operation shall be linked up to the depth of attention given to data usage, storage, retrieval, and disposal in the chain of activities.

4.0 Cloud Computing in the Operations of SCM Industry

Based on the Guidelines on Security and Privacy in Public Cloud Computing of National Institute of Standards and Technology (NIST), cloud computing is defined as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or cloud provider interaction. (Jansen and Grance, 2011, p. vi) The definition of cloud computing provided by NIST shares the concept of “Demand Chain Management” in the discipline of supply chain management as the design of data operation is initiated from the users themselves with the support of professionals in hardware and software development. Hence, **it is predicted that two main challenges confronting logistics business organizations are how to attract new customers to set a boundary to their use of data and how to attract existing customers to enhance or to re-package their current practices.** No matter customers are existing or new ones, data usage, storage, retrieval and disposal in supply chain industry need to be handled with an ethical mindset to respect their business partners for sustainability. Under the age of technology explosion, different products and services can be accessed by organizations through internet anywhere at anytime. Cloud computing has definitely brought the following two main advantages in the supply chain industry for internal and external stakeholders:

- Cost effectiveness in decision making; and
- Productivity in delivery of services.

4.1 Advantages to External Stakeholders:

1) Cost-saving in Promotion and Advertisement

New and potential customers will be attracted staying on the same page of a Certain webpage of an organization that they visit, giving them an opportunity to expose themselves to information that maybe helpful for making their purchase decision. In fact, this is of great help to the organization in

saving cost of promotion.

2) Cost-saving in Sourcing Suppliers

As cloud computing can help an organization access data from organizations that may have common interest with it, the cost in sourcing materials and business partners can be reduced.

For example, cloud-based collaboration can facilitate joint agreements to ease service delivery, to share data for increasing response in supply chain, to trace the whereabouts of products/ services, and to generate reports with analysis for making a better business decision. As a result, allocation of resources, planning of space, determining of pricing and promotion will be carried out in a collaboratively way for efficiency; and business returns will be improved with the use of cloud computing.

4.2 Advantages to Internal Stakeholders:

1) Improving Communication

Customer data, financial data, product and service data are needed within an organization among various departments, such as sales, marketing, advertising, human resource, warehousing...etc. With the help of cloud computing, data can be shared in a timely fashion for quick decision-making. Cloud computing can be regarded as a method of lean management in a sense of saving time and strengthening internal collaboration.

2) Streaming Processes

Cloud computing can help co-ordinate tasks of matching needs of customers, generating sales, processing payments, tracing the level of inventory in warehouse, storing data of products, supplier and customers...etc. Hence, organizations engaging in supply chain industry can save manpower and other kinds of resources in performing a various kinds of tasks at a lower cost but at a faster pace.

3) Consistency and Accuracy of Data

Traditionally, data stored in computers across departments within an organization may require manual data entry of staff working in different departments. Data errors and data misalignment may occur due to the use of different kinds and different versions of software. However, the web-based cloud computing allows data to be easily accessible to employees working in the same organization. Data consistency can then be enhanced and unnecessary errors can then be avoided, especially the error in inventory that may cause financial loss to a logistics organization.

5.0 Concerns of Cloud Computing in Supply Chain Management

Cloud computing can be divided into two main categories – private cloud and public cloud. Private cloud is used within an organization for sharing data across different departments with a bigger size of memory. Based on the guidelines of NIST, a private cloud is implemented exclusively for an organization while a public cloud is involved with infrastructure and computing resources that are available in the public over the internet.

Usually, a private cloud will be used by organizations with countrywide offices with tons of customer or business information. An example for a private cloud is the service tickets of help desk in organizations involved with information technology services. These organizations take a private cloud as a learning opportunity to explore the benefits and drawbacks of using a private cloud, for example, cost-saving, time-saving, chance of losing data, data loss prevention...etc. For a public cloud, cloud service providers provide data storage service, data transfer and re-location service, hardware and software maintenance...etc. The requirements of clients (cloud consumers) stated in the service agreement set a boundary of a public cloud. This type of public cloud is usually found in the supply chain industry, for example, manufacturers can save cost and time when using customer information from a public cloud to predict and calculate materials for mass production and mass customization.

However, protective measures are needed as data access, retrieval and storage will be shared under cloud computing. Organizations need to strike a balance between the above-mentioned advantages versus the security management practices of data control and risk management decision. This leads to the issues of identifying risks of data loss and intrusion of privacy.

“The organization should collect and analyze available data about the state of the system regularly and as often as needed to manage security and privacy risks.Assessing and managing risk in cloud computing systems can be a challenge, since significant portions of the computing environment are under the control of the cloud provider and may likely be beyond the organization’s purview. Both qualitative and quantitative factors apply in a risk analysis. Risks must be carefully weighed against the available technical, management, and operational safeguards and the necessary steps must be taken to reduce risk to an acceptable level.” (Jansen and Grance, 2011, p. ix)

6.0 Conclusion

With the advance of technological development, the setup costs of providing cloud computing for an organization are not much. There is a keen competition in the market of providing cloud-computing

services. As a result, the quality of services offered by these new competitors of cloud computing is a concern for organizations that do not have experts in information technology. Hence, data security is the main issue that may lead to the use of ISO 270001 information management system, CSA and NIST for security control and prevention.

On top of the quality issue, the speed of introducing new products and services in the market may be a pressure for the pace of cloud computing development. Users tracing for new products and services while suppliers need to have cloud computing services engaged in their supply chain for meeting the demands of users. Investment in cloud computing needs to be justified with the sales volume created from demands of end users. As the attributes of supply chain industry are quality, cost, delivery and values, hence, the delivery and values of using cloud computing need to be explored. For the delivery of services, cloud computing may involve the use of data from multiple business partners through collaboration. Since the collaboration among multiple business partners may not be the same, complexities and sensitiveness of data usage, storage, retrieval and disposal need to be clearly identified to protect products and customers. Data loss in the chain may not only lead to loss of confidence in business partners and loss of future business, but also lead to loss of intellectual property which is a concern of business ethics.

From the above, a holistic picture of cloud computing in supply chain industry has been built to cover the issues of business ethics, respect of stakeholders and sustainability for economic, social and environmental impacts through the use of a representative case study. Examples of the suggested curriculum of supply chain management module are:

- Role of cloud service provider and cloud consumer;
- Importance of governance and compliance;
- Importance of data control and overview of involved privacy ordinance;
- Understanding the key elements in a service agreement of cloud computing, for example, application, platform architecture, infrastructure, hardware and software facilities;
- Risk analysis and security management concepts in cloud computing;
 - Monitoring mechanism to control outsourced public cloud;
 - Relevant contingency plan in data backup and recovery; and
 - Cost and benefit analysis of implementing cloud computing. Appendix 1

Table – Comparison among Major requirements of AACSB, ISO, SDG with literatures on strategic partnership from 2000-2010

AACSB 21 Standards				
Standard	AACSB Contents	ISO 9001	SDG Goals in Supply Chain Management related Industries	Strategic Partnership Literature 2001-2010
1	<p>Mission Statement</p> <p>The school publishes a mission statement or its equivalent that provides directions for making decisions. The mission statement derives from a process that includes the <u>viewpoints of various stakeholders</u>. The mission statement is appropriate to higher education for management and consonant with the mission of any institution of which the school is a part. The school <u>periodically reviews and revises the mission statement as appropriate</u>. The review process involves appropriate stakeholders.</p>	<p>4 Quality Management System</p> <p>5.1 Management commitment</p> <p>8.4 Measurement and Analysis</p> <p>8.5.1 Continuous Improvement</p>	<p>SDG#17 – Partnership Stakeholders (e.g. Supply Chain Management project sponsor, contributors, supporters/ ambassador – committed partners / speakers/ participants for SDG12 responsible production and consumption and SDG 4.7 knowledge transfer of SCM under COVID-19 with web 3.0 and NFT as services)</p> <p>SDG#3 Wellness</p> <p>SDG#4.7 Knowledge Transfer –</p> <p>SDG#5 Gender Equality</p>	<p>Wegner R. (2000)</p> <p>“For these four institutions, a central reason for developing more extensive community partnerships is to move beyond theory practice in <u>achieving this dimension of their educational missions.</u>” (pp. 4)</p> <p>Kitagawa (2005)</p> <p>“This section particularly concerns new <u>missions and responsibilities for institutions, and structural issues surrounding knowledge flows and relationship building between universities and their partners in the knowledge society.</u>” (pp.7)</p> <p>“<u>University-industry collaboration</u> has been promoted by recent policy in Japan. (pp.8)</p> <p>“One of the most important functions played by universities in the innovation and learning system in the knowledge society is to provide graduates. Universities have traditionally produced graduates for a national labor market dominated</p>

		<p>SDG#8 Decent Job Creation</p> <p>SDG#9 Innovations</p> <p>SDG#13 Climate Change</p> <p>IT sector (e.g. iSHANG)</p> <p>+</p> <p>Academic sector</p> <p>(e.g. Centre for Business/ Social Sustainability and Innovations BSSI),</p> <p>School of Business, Gratia Christian College, UNPRME Advanced Signatory Institute)</p> <p>Secondary School and university students participation in Digital Asset Seminars and Transformations via SDG/ ESG Seminars (47 times, since 2019)</p> <p>NGO Participation (e.g. JCI chapters and Rotary Club of Peninsular East and Setup Rotaract Club in GCC in past 2 years to understand transformations in SCM related service industries)</p> <p>Partner with UNSDSN-Kenya</p> <p>SDSN-HK</p> <p>ICENECDEV UN</p> <p>Global Compact on SDG/ ESG training with Chinese Calligraphy Drawings and Miss Environmental Contest since 2019 for logistics arrangement with NFT as fundraising service</p>	<p>by large employers with <u>little concern for small and medium enterprises (SMEs) or graduate retention in local labour markets.</u>” (pp. 9 & 10)</p> <p>Bolton (2010)</p> <p>“..we suggest that transnational higher education partnerships provide an opportunity to identify and capture the <u>value of genuine cross-cultural and relevant global business education from the perspectives of both internal and external stakeholders.</u> This objective is consistent with <u>advice from quality accreditation agencies that business educators adjust their educational goals to meet stakeholder needs.</u>” (pp. 702)</p>
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Food Insecurity Challenges for South African Children

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Introduction

Childhood food insecurity poses a significant challenge, particularly among African-American children who encounter distinct hurdles in the face of this pervasive issue (Barnidge et al. 2017). In addressing health disparities, a critical imperative emerges to scrutinize the social determinants that underpin these inequalities, shedding light on the unique circumstances confronted by African-American youth (Mkhize et al. 2022). This research, framed within a Social Determinants of Health (SDH) perspective, embarks on unraveling the intricate factors contributing to food insecurity among African-American children.

The enduring impact of food insecurity on the physical, cognitive, and emotional development of African-American children underscores the significance of this inquiry. Insights derived from these studies collectively illuminate the intricate interplay of economic, geographic, racial, and familial factors that uniquely shape the experience of food insecurity within this demographic (Laraia et al. 2009).

This paper focuses on varied demographic groups, including African children in rural settings, children and adolescents in South Africa, and low-income first-time African-American mothers. The framework involves a thorough exploration of diverse aspects of food insecurity, considering economic, geographic, racial, and familial factors. The integration of Critical Race Theory (CRT) and Social Determinants of Health (SDH) perspectives enhances the understanding of systemic contributors to food insecurity, offering valuable insights for possible interventions.

By framing the inquiry through the lens of social determinants, the research aims to uncover the root causes of this health disparity (Siluleko Mkhize et al. 2022). The goal is to inform targeted interventions that address the specific challenges faced by African-American

youth, with the overarching aim of breaking the cycle of disadvantage and contributing to the broader mission of fostering a more equitable and just society (Laraia et al. 2009). The Social Determinants of Health (SDH) perspective employed in this research allows for a comprehensive understanding that transcends individual-level explanations, acknowledging broader societal structures and conditions perpetuating disparities in access to sufficient, nutritious food for one of our youngest and most vulnerable populations (Altman et al. 2019).

Critical Race Theory (CRT) provides a powerful framework for understanding the systemic and structural factors contributing to childhood food insecurity among African children. CRT asserts that racism extends beyond individual biases and is deeply embedded in societal structures and institutions. Regarding childhood food insecurity, CRT illuminates the racial inequalities that permeate the experiences of African children and their families. The very first one is structural racism, CRT contends that structural racism, embedded in policies and practices, leads to racial disparities. In the studies by Barnidge et al. (2017), Baxter et al. (2018), and Laraia et al. (2009), structural factors such as economic instability, neighborhood resources, and family dynamics contribute significantly to food insecurity among African children. These structures perpetuate racial disparities in food access.

The concept of institutional discrimination within CRT is evident in the disparities revealed by studies like (Baxter et al. 2018). The findings indicate that African children may experience slightly reduced food insecurity compared to other racial groups, highlighting differential impacts of food insecurity influenced by institutional factors such as educational systems. CRT incorporates The idea of intersectionality acknowledges that individuals can face various forms of oppression concurrently. Concerning childhood food insecurity, the intersectionality of race, economic standing, and geographical placement, as explored in the writings of the author, is considered. (Barnidge et al. 2017) and (Leahy 2018) underscores the multifaceted nature of the challenges faced by African children.

The other factor that can be important is cultural Relevance, CRT emphasizes the

importance of cultural relevance in understanding disparities. The involvement of grandparents and fathers in African households, as highlighted in (Laraia et al. 2009), demonstrates the need to consider cultural and familial structures when addressing food insecurity. Cultural competency is crucial in designing interventions that resonate with the experiences of African families. By applying CRT to childhood food insecurity among African children, the research can illuminate the deeply rooted, systemic nature of this health disparity. This framework directs attention to policy changes, institutional reform, and culturally competent interventions as essential components of efforts to promote health equity and dismantle the systemic barriers contributing to food insecurity among African children.

According (Barnidge et al.2017) this scholarly article conducts an extensive analysis of food insecurity among African children, specifically in the summer months, with a focus on contrasting rural and urban environments. It provides valuable insights into the economic and geographic factors contributing to food insecurity, highlighting the specific challenges faced by African families.

Leahy in her book explores food security in rural Africa, indirectly addressing the well-being of children by tackling rural poverty and its impact on food security. While not focused on African children, it provides a broader perspective on economic stability and agricultural practices that can inform interventions.

This article explores the issue of food insecurity among children and adolescents in South Africa, with a particular emphasis on analyzing hunger at the household level. By focusing on South Africa, it sheds light on the specific challenges faced by children and adolescents in this region, contributing critical insights into the severe implications of food insecurity (Mkhize et al.2022). This study examines the impact of assessment mode on responses to the Food Insecurity Questionnaire among children, exploring how food insecurity correlates with academic achievement and race. It underscores the disparities in food security experienced by different racial groups, including African children (Baxter et al. 2018) .

Exploring elements linked to food insecurity in low-income African-American mothers who are first-time parents in North Carolina, this research uncovers a notable correlation between household food insecurity and the participation of both grandmothers and fathers, underscoring the influential role of family dynamics. According to Altman et al. (2019), this investigation examines the relationship between food insecurity and children's dissatisfaction with their bodies in California, revealing the psychological effects of food insecurity on the younger demographic. It emphasizes the need to address not only nutritional needs but also emotional well-being.

While news media may not be explicitly cited in the provided information, it is crucial for supplementing scholarly literature. News articles, op-eds, and reports can provide real-time perspectives, policy implications, and community voices regarding childhood food insecurity among African children. Media coverage may highlight ongoing challenges, successes, or evolving dynamics that shape the discourse around this issue. The relevant literature encompasses scholarly works that delve into economic, geographic, racial, and familial factors contributing to childhood food insecurity among African children. Combining these scholarly insights with news media perspectives offers a comprehensive understanding of the issue, blending academic rigor with real-world implications and lived experiences.

Research Initiatives:

According (Barnidge et al.2017) the extensive analysis on food insecurity among African children contributes valuable information for policymakers and organizations striving to combat hunger. Research findings can inform targeted interventions that address the distinct challenges faced by African families in both rural and urban settings. By highlighting the economic and geographic factors, this research aids in designing strategies to enhance food accessibility and combat disparities. The household-level analysis of hunger in South Africa underscores the urgent need for targeted interventions. Research of this nature informs policymakers and community health organizations about the specific challenges faced by

children and adolescents, guiding the development of programs that address health conditions, both in terms of physical and cognitive growth, and a heightened risk of developing chronic diseases throughout one's lifetime. (Mkhize et al. 2022).

Examining elements linked to food insecurity in low-income African-American mothers who are first-time parents, this study illuminates the difficulties encountered by these families. The findings underline the importance of support systems and targeted interventions. Community health organizations can use this information to develop initiatives that address the involvement of grandparents and fathers, as well as maternal mental health, in the context of food security (Laraia et al.2009).

Community Health Organization Initiatives:

Addressing Economic Stability: Recognizing the economic dimension highlighted in several studies, community health organizations can collaborate with local agencies and advocacy groups to address economic instability. Initiatives focused on improving job opportunities, income support programs, and financial literacy can contribute to alleviating economic barriers to accessing sufficient and nutritious food.

Enhancing Neighborhood Resources: Building on the insights into neighborhood and built environment factors, community health organizations can work towards enhancing neighborhood resources in both rural and urban settings. This may involve advocating for the establishment of grocery stores and fresh produce outlets in underserved areas, ensuring equitable access to nutritious food for African children.

Culturally Competent Interventions: Acknowledging the cultural relevance highlighted in the literature, community health organizations can design interventions that are culturally competent and sensitive to the unique experiences of African families. This may involve collaboration with community leaders, incorporating cultural practices into nutrition education, and engaging with families to understand their specific needs.

Mental Health Support: Considering the correlation between maternal depressive

symptoms and food insecurity, community health organizations can integrate mental health support into their programs. Initiatives may include counseling services, support groups, and awareness campaigns to tackle the mental health issues experienced by African mothers, thereby positively impacting the food security of their children.

Educational Programs: In response to the findings on the impact of assessment mode on responses to food insecurity questionnaires and the correlation between academic achievement and food insecurity, community health organizations can collaborate with schools to implement educational programs. These programs can raise awareness about the importance of nutrition, provide resources for families, and create a supportive environment for academic success.

Policy Advocacy:

Advocating for Policy Changes: Researchers and community health organizations can collaborate to champion alterations in policies on the local, state, and national scales. This may include policies that address economic disparities, improve access to quality healthcare, and promote initiatives aimed at eradicating food deserts and improving food security infrastructure. **Incorporating Racial Equity into Policies:** Building on the insights from Critical Race Theory, policies should be designed with a keen awareness of racial disparities. This involves incorporating a racial equity lens into the development and implementation of policies to ensure that they effectively address the specific challenges faced by African children and families (Barnidge et al.2017). **Long-term Structural Changes:** To achieve sustainable health equity, interventions should aim for long-term structural changes. This may involve advocating for systemic changes in education, healthcare, and economic systems to dismantle institutional discrimination and establish a setting where every child, irrespective of their racial background, enjoys equitable prospects for health and overall well-being.

In conclusion, the multifaceted challenge of childhood food insecurity among African children demands comprehensive and targeted interventions informed by rigorous research and community health initiatives. The scholarly literature, spanning studies by Barnidge, Mkhize,

Laraia, and others, has provided insights into the complex interaction of economic, geographic, racial, and familial elements that influence the occurrence of food insecurity within this particular demographic. Community health organizations and researchers can leverage these insights to implement strategies that address the unique challenges faced by African families, both in rural and urban settings. From initiatives tackling economic instability and improving neighborhood resources to culturally competent interventions and mental health support, collaborative efforts can pave the way for equitable access to sufficient and nutritious food. Furthermore, policy advocacy informed by Critical Race Theory can drive systemic changes, dismantling institutional discrimination and fostering an environment where every African child has an equal opportunity for health and well-being. Through this holistic and intersectional approach, we strive not only to alleviate the immediate impact of food insecurity but also to break the cycle of disadvantage, fostering a future where all children can thrive, irrespective of their racial background.

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Auto Industry: South Korea & Japan

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Abstract

This research focuses on South Korea and Japan and explores a very important industry: Motor Vehicles (EVs). The research discusses the current and the future transition to electric vehicles and the implications regarding EVs. This research examines the top companies in the auto industry in South Korea and Japan and their export destinations. In addition, the research compares these companies and determines their competitive strategies and their outlook. Furthermore, the study discusses the implications of transition to EVs, such as the origin of the needed minerals (lithium, cobalt, nickel) for building the EVs, charging stations, recycling of the batteries, and the implications as far as green and sustainable practices.

Enhancement of Spatial Orientation without Gravitational Cues

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Abstract

Enhancement of Spatial Orientation Without Gravitational Cues Human balancing relies on multiple sensory modalities including vestibular, visual, auditory, proprioceptive, and somatosensory. How the Central Nervous System (CNS) controls balance is a complex question that has yet to be answered and this is mainly due to the difficulty of isolating peripheral and central mechanisms in the process (Hsu et al., 2007; Kiemel et al., 2011; Kuo, 2002). Understanding the mechanisms behind human balancing may require researchers to study balance in terms of direction of gravity (DOG) and direction of balance (DOB). It has been shown in a study by Panic (2016) that subjects are able to successfully align themselves with the DOG or DOB when the two are dissociated; this finding suggests that these tasks rely on independent mechanisms. In the supine and vertical positions in the MARS, the vestibular system is activated in distinct manners (Panic et al., 2017; Vimal et al., 2017). When subjects balance in the supine orientation, although there are motion cues from the transient semicircular canal stimulation as the MARS accelerates away from the DOB, otolith cues that are contingent on direction of gravity for determining body position are absent since the hair cells are at a constant deflection towards the Earth irrespective of the supine position. The otolith and semicircular canals in the supine position can determine their position based on only the dynamic velocity changes without a reference to gravity. Without a reference to gravity, subjects tend to deviate from the DOB in the supine orientation, which is termed as positional drifting. The main objective of this experiment was to investigate whether the control of orientation in humans can improve in tasks involving dynamically balancing without relevant gravitational cues through auditory cueing and incremental training. The findings of this research are applicable to space flight where astronauts are tasked with orienting themselves in low gravity environments and in aviation, where otolith gravitational signaling may be misleading in some instances. The role of the auditory system in human balancing has not been studied in great depth in the past. The first part of this study investigated whether the addition of auditory cues providing location and velocity information in addition to dynamic cues from the semicircular canals can enhance balancing in limited gravity environments. To quantify learning and balance performance we used metrics that were derived from MARS position, joystick

deflections, and the stabilogram diffusion function. We also developed a metric that allowed us to quantify the loss of perception of the location of the DOB, known as positional drifting. The subjects who were exposed to auditory static cueing, in comparison to the control group, spent significantly less time drifting but had limited improvements in other measures. The subjects provided with continuous, auditory dynamic cueing were able to significantly improve on several balancing measures. The results suggest that providing transient auditory cues is not sufficient for balancing in environments lacking gravitational cues, and that successful balancing requires gradient cueing. The second part presents work conducted on incremental exposure and adaptation to environments lacking gravitational cues. To investigate these questions, subjects were seated in a multi-axis rotation system (MARS), which was programmed to behave like an inverted pendulum about the roll axis. The pendulum constant was set to a value that has been experimentally determined to be difficult for the average population. Inverted pendulum dynamics is commonly used in the field to model human stance (Winter, 1995). Subjects were incrementally introduced to reduced gravitational cueing with a gradual increase in the degree of pitch from upright to supine. We found that, among other things, the group that received incremental training produced less destabilizing joystick movements and had significantly smaller drift rates. This suggests that incremental training is a method that has the potential to help improve spatial orientation training in low gravity environments. We also determined that otolith positional cues begin to deteriorate significantly to a performance level like that was observed at 90° pitch somewhere between 52.5° and 55° pitch back.

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Quantifying the Potential Health Impacts of Residential Gas Combustion Cooking and Heating: A Meta-Analysis and Risk Assessment

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Abstract

While a growing body of scientific literature describes the population health impacts of fossil fuel production and burning via climate and air pollution pathways, less is known about the health impacts of indoor combustion. This paper summarizes the results of studies from the last two decades that investigated the association between exposure to sources of unvented combustion pollutants in homes and a range of health outcomes. We found gas combustion to be associated with 6-28% (95% confidence intervals) increased odds of asthma symptoms, 4-51% increased odds of systemic symptoms, 7-81% increased odds of asthma medication use, and 3-12% increased risk of mortality. These findings can be used to improve public health, for example, by informing requirements for improved ventilation and source control, justifying switching to vented appliances, better regulation of device emissions and quantifying the benefits of electrification of end-uses. Dose-response relationships between human health, NO₂ exposure, and other by-products of combustion are not characterized with a high degree of precision. However, there is clear evidence of a wide range of health effects, even at low levels of exposure. Despite the various designs, geographic sites, length of follow-up, and study dates, we noted a level of consistency between the studies within the current met analysis, and with previous ones, which strengthens the level of confidence in our findings.

Keywords: Health; gas combustion; gas cooking; gas heating; nitrogen dioxide; indoor environmental health; meta-analysis

Tax on Mutual Funds and ETFs

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Individuals invest in mutual funds and ETFs due to their ability to provide diversified exposure to a broad range of U.S. and international stocks and bonds. Whether seeking broad market coverage or specific sector-focused investments, these funds offer flexibility to tailor investment strategies according to an individual preference. Both options include instant diversification and the expertise of professional fund managers, mitigating risks associated with investing in individual securities while enhancing convenience. Exchange traded funds gained initial recognition for their lower fees compared to similar mutual funds. Because of this, ETFs have an appeal among investors looking for cost-effective investment solutions. However, like any other income from the sale of any other investment, the client of a mutual fund or ETF must pay taxes. Therefore, understanding the nuances of mutual fund taxation is crucial for maximizing investment efficiency and achieving long-term financial goals.

This paper begins by exploring the fundamentals of mutual fund taxation, exploring the various tax implications that investors encounter when owning mutual funds and ETFs. It then delves into specific strategies for reducing tax liabilities, offering insights into how investors can mitigate the impact of taxes on their investment returns. Subsequently, the focus shifts to Vanguard, tracing its history, and detailing the evolution of its tax-efficient strategies over time. By analyzing Vanguard's approach to tax efficiency, this paper aims to provide a comprehensive understanding of mutual fund taxation and Vanguard's role in promoting tax-efficient investing.

Among the various mutual fund providers, Vanguard has garnered attention for its commitment to tax efficiency and low-cost investing. With a history rooted in investor empowerment and innovation, Vanguard has pioneered strategies to minimize tax liabilities for its clients, setting a standard for the industry. This paper examines Vanguard's approach to tax efficiency, explaining the measures it employs to optimize after-tax returns and enhance investor outcomes.

According to the IRS, there are many regulations when it comes to taxes and individual investments. If the investor owns shares in a taxable account, they must pay taxes on any money received from the mutual funds. Whether the money is given as cash or reinvested in more shares, the money will be taxed. The funds will let the investor know how much they have earned through the IRS Form 1099-DIV after each year. If the individual bought or sold mutual shares during the year, they must report those transactions on their tax return and pay

taxes on any profit or dividends. Along with this, the investor is responsible for reporting and potentially paying taxes on any transactions made by the fund itself. From the perspective of the IRS, tax on mutual funds and ETFs are treated the same.

While there are taxes on mutual funds, there are numerous ways to reduce these taxes. To minimize taxes on mutual fund investments, consider these six strategies. Firstly, hold onto your mutual fund shares for an extended period to avoid higher capital gains taxes that may arise from selling within a year. Secondly, take advantage of tax-advantaged accounts like traditional or Roth IRAs, where investments can grow tax-deferred or even tax-free upon withdrawal after age 59 ½. Thirdly, channel funds into traditional 401k accounts to defer taxes until withdrawal. Additionally, choosing mutual funds to invest in based on their holdings to minimize taxable dividends or capital gains distributions.

There are also many common mistakes that may occur while taxing a mutual fund or ETF. Numerous individuals often misunderstand the basis for tax reporting. Many investors mistakenly believe that only the amount they initially invested out of their own pocket constitutes their original investment. However, according to IRS regulations, all reinvested dividend and capital gain distributions also count as investments. To avoid this error, it's essential for clients to keep track of all mutual fund statements and pay attention not only to the initial investment but also to the amounts reinvested over time. By staying vigilant about all contributions and reinvestments, investors can ensure accurate tax reporting and avoid potential penalties or complications with the IRS.

Mutual funds come with several tax disadvantages, as there are various tax traps that investors should be aware of throughout the year. Equity mutual funds frequently adjust their stock holdings, buying and selling shares to generate profits. When these sales result in capital gains, they become taxable events. At the end of the year, mutual funds that have net capital gains distribute these gains to investors, who then bear the associated tax burden. However, not all funds make capital gains distributions, such as those held in tax-deferred portfolios like 401(k)s. It's crucial to pay attention to capital gains, especially towards the end of December, as mistakes can lead to unexpected tax liabilities. For example, if an investor buys into a fund and receives a capital gains distribution in December, it can essentially result in a taxable return of the initial investment. While taxes on capital gains may seem small compared to potential market returns, they can still impact overall investment performance. Investors paying substantial taxes on capital gains may need to reassess their investment strategy to minimize tax liabilities.

Due to numerous headaches taxes can cause to individuals while investing in mutual funds and ETFs, investors have found that some mutual funds try to prevent high taxation as

much as they can. For example, The Vanguard Group has a reputation for being extremely tax efficient to investors. The mutual fund is headquartered in Malvern, Pennsylvania, and stands as a prominent American registered investment advisor. As of April 2023, it commands an impressive \$7.7 trillion in global assets under its management umbrella. Renowned as the largest issuer of mutual funds globally, Vanguard's influence resonates throughout the investment landscape, exemplifying a commitment to stewarding wealth and fostering financial growth for countless individuals and institutions alike.

In order to fully understand how Vanguard is as successful as they are today, it is important to know their history and how they started. In 1929, the first mutual fund emerged, focusing on stocks and high-quality bonds, catering to conservative investors. Among them, the Wellington fund was known for their principles of balance, diversification, discipline, and long-term vision. Vanguard adopted the investment philosophy of this fund due to their success, which led them to industry leadership. They initiated the first index mutual fund, implementing a commission-free distribution system in 1975-1976. Operating under a unique investor-owned structure, Vanguard aimed to revolutionize mutual fund management based on investor ownership. In 1975, Vanguard introduced their first money market fund, enabling higher yields than traditional savings options. Pioneering mutual fund indexing in 1976 with the First Index Trust, Vanguard brought low costs and broad diversification to individual investors. Over time, from 1985 to 1997, they expanded offerings, slashed investing costs by going no-load, and introduced portfolios with different target maturities. In 1981, they developed an active investment management function and strengthened their investment capabilities with the creation of the fixed income group. They prioritized investor interests by closing top-performing funds.

In the mid-1980s, Vanguard introduced its first bond index fund. This offered investors an easy and affordable way to invest in a variety of U.S. bonds. Over the next few years, they added more index funds, which led them to become known as leaders in this type of investing. By the early 1990s, Vanguard's index funds were so popular that they managed trillions of dollars in assets, with one fund alone reaching over a trillion dollars. During this time, Vanguard also built new offices to accommodate its growing business which expanded across the United States. In 1995, they launched Vanguard Online, a website where investors could manage their accounts and learn about investing. This year also marked their first change in leadership, with the company's founder stepping down and a new leader taking over.

Between 1996 and 2000, Vanguard expanded its global reach by establishing its first international office in Australia, followed by further expansion into multiple European countries, Canada, Mexico, and China over the next two decades. Throughout this time,

Vanguard introduced advisory and financial planning services with affordable fees to their clients, which aimed to improve outcomes for individual investors. Additionally, in response to the growing demand from investors who wanted their portfolios to align with their values, Vanguard launched its first socially responsible investment option, known as the Vanguard Calvert Social Index Fund (now Vanguard FTSE Social Index Fund), which screens large- and mid-cap U.S. stocks based on certain environmental, social, and governance (ESG) criteria. Vanguard also introduced Admiral Shares in 2000, offering cost savings to its largest and most loyal retail shareholders.

Between 2001 and 2014, Vanguard made significant strides in widening the accessibility of indexing. They revolutionized the ETF market by introducing a patented approach offering exchange-traded shares of Vanguard index funds, starting with the Vanguard Total Stock Market ETF. Vanguard also partnered with Nevada to offer a low-cost 529 College Savings Plan, expanding their offerings to help investors save for college. In 2003, Vanguard introduced Target Retirement Funds, diversified portfolios designed to shift allocations over time, becoming a leader in the target-date fund industry. By 2006, Vanguard surpassed \$1 trillion in assets under management, marking a significant milestone for the company. Additionally, F. William McNabb III took over as Vanguard CEO in 2008, steering the company through turbulent times during the

financial crisis. Vanguard continued its commitment to innovation and client-centricity, launching a dedicated division to serve financial intermediaries in 2011 and implementing benchmark changes in 2012 to deliver cost savings and certainty for investors. Between 2015 and 2022, Vanguard focused on making financial advice more accessible and affordable while expanding its investment offerings. In 2015, Vanguard introduced Personal Advisor Services, combining licensed advisor support with online tools and investment modeling technology, catering to individual investors with at least \$50,000 in Vanguard investments at a competitive fee. The company also ventured into actively managed ETFs, offering factor-based ETFs in the U.K. and subsequently expanding to Canada and the U.S.

Vanguard continued its commitment to low-cost investing by providing commission-free trading for ETFs, stocks, and options through Vanguard Brokerage Services, resulting in significant savings for clients. In 2018, Mortimer J. Buckley took over as CEO, succeeding Bill McNabb, and Vanguard surpassed \$5 trillion in assets under management. Vanguard further enhanced its advice offerings by launching Digital Advisor in 2020, providing digital financial planning and money management services. Additionally, Vanguard expanded its presence in the retirement planning space by reimagining its 401k business and made its first-ever acquisition of Just Invest to bolster its investment product lineup. As Vanguard continues to

grow, it remains committed to extending its investment philosophy globally and prioritizing diversity, equity, and inclusion through initiatives like joining the World Economic Forum's Global Parity Alliance.

From the start, Vanguard has had the goal of tax efficiency and low costs for their clients. Vanguard's competitive advantage lies in its strategic approach to fee reduction within the asset management sphere. This advantage stems from a phenomenon where, upon Vanguard's entry into a market or introduction of products in a specific category, asset managers tend to follow suit by lowering their fees. This trend leads to a ripple effect across the industry, ultimately resulting in reduced costs for all investors. By championing this ethos of fee reduction and fostering a culture of affordability, Vanguard not only sets a standard for industry practices but also creates a more accessible and equitable investment landscape for individuals and institutions alike.

Vanguard's tax efficiency is fortified through several strategic measures. Firstly, its utilization of the index fund approach minimizes unnecessary trading activity, thereby reducing taxable events within its portfolios. Additionally, its ETF structure offers multiple tax advantages, promoting tax-efficient investing for its clients. Vanguard further enhances tax efficiency through its offering of tax-managed funds, which employ specialized strategies to optimize after-tax returns. Moreover, the firm exercises meticulous distribution control, strategically managing dividend and capital gains distributions to mitigate tax implications for investors. Lastly, Vanguard's lean cost structure contributes to overall tax efficiency, as lower expenses translate into higher after-tax returns for investors. This multifaceted approach underscores Vanguard's commitment to maximizing tax efficiency and delivering optimal outcomes for its clients.

Vanguard's utilization of the index approach is crucial to its tax efficiency strategy. Index funds, which mirror the holdings of an index, typically engage in less frequent trading compared to actively managed funds. This reduced trading activity minimizes taxable gains, particularly short-term gains taxed at higher rates. Furthermore, index funds benefit from a large pool of lots to choose from when selling securities, enabling fund managers to select lots with the lowest tax implications. Unlike active funds, index funds typically only sell their complete holdings of a specific security if the index itself removes the security, which helps mitigate the impact of large capital gains for investors. Along with this, the structure of ETFs offers an additional tax benefit. When investors sell shares of an ETF, they transact with other buyers, circumventing the need for the fund itself to sell securities, thus avoiding potential capital gains triggers. Overall, Vanguard's adherence to the index approach, coupled with the tax advantages inherent

in ETF structures, reinforces its commitment to delivering tax-efficient investment solutions for its clients.

Vanguard's ETF structure stands out for its distinctive investor-owned model. In this unique arrangement, Vanguard fund shareholders collectively own the funds themselves, and these funds, in turn, own Vanguard. Due to this, when an investor decides to sell shares of an ETF, they are actually selling them directly to another investor, not back to the company that manages the fund. Because of this, the fund itself doesn't typically get involved in the sale. This setup means the fund does not have to sell any of its investments, which leads to avoiding taxes on any profits. This investor-owned structure underpins Vanguard's core mission: to champion the interests of all investors, treating them equitably and providing them with optimal opportunities for investment success. By aligning its purpose with the collective goals of its shareholders, Vanguard embodies a commitment to transparency, fairness, and investor empowerment. This underscores Vanguard's reputation as a trusted steward of wealth and a beacon of integrity within the investment industry.

Another way Vanguard achieves tax efficiency is through its tax-managed funds by employing strategies designed to minimize taxable distributions to investors. These strategies include low turnover rates, harvesting their losses, selecting tax friendly investments, and minimizing dividend distributions. These funds generally have low turnover rates, meaning they buy and sell securities less frequently. Lower turnover reduces the likelihood of generating capital gains, which are taxable to investors. They strategically sell investments that have experienced losses to offset gains elsewhere in the portfolio, reducing the overall tax liability. The funds may focus on investments that tend to generate fewer taxable distributions, such as stocks with low dividend yields or municipal bonds whose interest is often tax-exempt at the federal level. Vanguard also invests in securities that pay qualified dividends, which are taxed at lower rates than ordinary income, or reinvest dividends in a tax-efficient manner to avoid unnecessary distributions.

Vanguard keeps taxes low for investors by also carefully controlling how and when distributions are made and cost structure. First, they might time distributions to happen when investors are in lower tax brackets, cutting down on taxes for shareholders. Second, investors can choose to reinvest distributions into the fund instead of getting cash, delaying taxes until they sell their shares. Lastly, Vanguard manages dividends by investing in assets with lower yields or using strategies like dividend reinvestment plans to lessen taxable distributions. These methods help investors keep more of their returns by reducing their tax bills. Through cost structure, Vanguard's funds have low expense ratios, meaning less money goes toward operating costs, resulting in lower taxable income for investors. Vanguard may also implement fee

waivers or expense caps on some funds, reducing expenses further and allowing investors to keep more of their returns after taxes. Additionally, they employ cost-effective trading methods to minimize transaction costs and lower the tax impact of buying and selling securities within the fund's portfolio.

Due to Vanguard having so many benefits on the tax regulations themselves, it causes clients to want to invest. Taxation is a main factor as to why an individual would prefer a mutual fund, which is why Vanguard has a great reputation of success. As a day to day investor in Vanguard, the clients also benefit. All of Vanguard clients enjoy the perk of trading ETFs and stocks online without paying any commissions. Additionally, the client can gain access to over 160 mutual funds from Vanguard without transaction fees, as well as a vast selection of over 3,000 funds from other providers. When seeking investment guidance from Vanguard, rest assured that our professionals are salaried employees who do not earn commissions. This means the client can trust that every decision made on the clients behalf is solely focused on addressing your needs and financial goals. Vanguard has recently released its annual economic and market outlook for 2024.

According to their analysis, the current environment of higher interest rates surpassing inflation could be the most positive development for savers and investors in twenty years. This shift towards higher rates is expected to affect various aspects of the economy. For households and businesses, it may limit borrowing, increase capital costs, and promote saving habits. Governments will face pressure to reevaluate their fiscal strategies sooner rather than later due to the impact of higher rates on deficits and sustainability concerns. Vanguard emphasizes the urgency for governments to address these issues promptly. Despite the potential for near-term financial market volatility as the transition to higher rates continues, well-diversified investors stand to benefit from the stability provided by higher real interest rates, leading to stronger long-term risk-adjusted returns.

The bond market has undergone significant repricing in response to these changes, with bond valuations now considered fair and long-term rates more closely aligned with higher neutral rates. However, Vanguard warns of the likelihood of increasingly restrictive monetary policies, particularly in the U.S., as inflation decreases and other economic factors stabilize. This tightening of monetary policy may lead to a mild economic downturn, although the possibility of a delayed recession remains. In Europe, sluggish growth is anticipated due to persistent restrictive policies, while China is expected to implement further stimulus measures to counter external and structural challenges. Vanguard's outlook suggests that higher interest rates could ultimately benefit savers and investors, although risks remain inherent in all investment activities, including those involving bonds.

Although through research and data Vanguard has been a successful mutual fund, not all mutual funds are perfect. For example, on June 1, 2023, Vanguard was in the news due to a scandal. Vanguard Group faced penalties from the Financial Industry Regulatory Authority for inaccuracies in about 8.5 million customer account statements. The errors involved overstating projected yield and projected annual income for nine money market funds between November 2019 and September 2020. As a result, Vanguard was fined \$800,000 and censured by FINRA. The organization stated that certain account statements inaccurately represented market appreciation/depreciation and investment returns from October 2019 to June 2021. Although Vanguard corrected the errors in May and June 2021 and clarified that the technical issue didn't affect customers' actual returns, they acknowledged the findings without admitting wrongdoing. Vanguard self-reported additional errors to FINRA during their investigation. When investing in a mutual fund, it is important to take a look at any scandals or wrongs they have committed in order to prevent any harm to an individual's funds.

The Vanguard Group is now facing criticism from climate activists over its decision to withdraw from the Net-Zero Asset Managers (NZAM) initiative. Individuals argue that this signals a departure from environmental, social, and governance (ESG) principles. The Sunrise Project, which is a climate activist group, accuses Vanguard of prioritizing the interests of climate skeptics over its investors and refusing to engage with them directly. As part of a public relations campaign, the Sunrise Project has launched localized advertising targeting Vanguard, its employees, and investors, aiming to pressure Vanguard into reconsidering its stance on ESG.

Despite Vanguard's significant advertising budget, the Sunrise Project's campaign seeks to influence Vanguard employees in Chester County, Pennsylvania. The campaign includes attack ads portraying Vanguard as neglecting its fiduciary duty and prioritizing political interests over financial security. The article also discusses Vanguard's governance structure, which entails a recent ban on crypto-related investments, and the complexity of its position regarding ESG issues. Some experts suggest that proving Vanguard's fiduciary negligence in the face of climate risk is challenging, but concerns remain about the company's opaque governance structure and potential violation of its duty of care. While opinions on Vanguard's approach to ESG differ, the article highlights criticisms of its lack of clear principles and suggests that the company may face further scrutiny in the future. Finally, it mentions the backers of the Sunrise Project, including various foundations and individuals with ties to Democratic politics.

Along with this, Investors considering Vanguard as a whole should be aware of a few drawbacks. Firstly, Vanguard has a high mutual fund minimum, meaning the client needs a significant amount of money to invest in their funds upfront, which might not be easy or

feasible for everyone. Secondly, they have higher options trading fees compared to some other platforms, potentially making options trading more expensive. Additionally, Vanguard doesn't provide a separate trading platform tailored for advanced trading strategies, which could be limiting for experienced traders seeking sophisticated tools. Lastly, Vanguard doesn't support cryptocurrencies, so if you're interested in investing in digital currencies like Bitcoin or Ethereum, an individual needs to explore other platforms. These factors should be taken into consideration when evaluating Vanguard as an investment option. There are also other established mutual funds that implement tax efficiency as well.

Fidelity Investments is a leading financial services company offering a wide range of investment products and services to individual investors, institutions, and financial advisors. Founded in 1946, Fidelity is known for its mutual funds, ETFs, brokerage services, retirement solutions, wealth management, and more. They provide access to a diverse selection of investment options, including actively managed funds, index funds, and target-date funds, catering to investors with varying risk tolerances and investment goals. Fidelity is also recognized for its robust research and educational resources, helping investors make informed decisions. With a focus on innovation and customer service, Fidelity aims to empower investors to achieve their financial goals efficiently and effectively.

Fidelity Investments offers a comprehensive guide to understanding the tax implications of investing in mutual funds. Mutual fund distributions, which occur for various reasons, are subject to different tax rates. The major distribution usually happens at the end of each year, comprising capital gains and other earnings minus expenses. It's the responsibility of investors to report mutual fund transactions on their tax returns and pay taxes on each type of fund income. While certain accounts like retirement and college savings accounts offer tax advantages, taxable accounts require investors to pay taxes on distributions, whether received as cash or reinvested. Different types of distributions, such as long-term capital gains, short-term capital gains, qualified dividends, and ordinary dividends, are taxed differently at the federal level. Fidelity emphasizes the importance of considering the timing of fund purchases and sales relative to distributions, as well as the fund's turnover rate, to minimize taxable gains. Consultation with a tax advisor is recommended for personalized tax strategies based on individual circumstances.

Tax Loss Harvesting with Fidelity is a savvy strategy enabling investors to mitigate taxable gains by balancing them with tax-deductible losses, leading to improved portfolio performance and lower tax obligations. By strategically selling underperforming investments, investors can leverage these losses to reduce their overall tax liability, potentially resulting in significant tax savings. Fidelity offers resources and support to guide investors through the

intricacies of tax loss harvesting effectively. Reinvesting the tax savings back into the portfolio can potentially expedite long-term growth. Mastery of rules regarding wash sales and timing is essential to optimize the advantages of tax loss harvesting while adhering to tax laws.

While Fidelity is a tax efficient fund, there are pros and cons to their fund as a whole when being compared to Vanguard. For example, the first difference is costs. Vanguard and Fidelity both offer \$0 commissions for online equity, options, and ETF trades for customers based in the U.S. However, there are differences in additional fees. Fidelity charges \$0.65 per contract for options, while Vanguard charges \$1. When it comes to broker-assisted stock trades,

Fidelity is pricier at \$32.95 compared to Vanguard \$25. For mutual fund trades outside the no-transaction-fee family, Fidelity charges \$49.95, while Vanguard's fees range from \$0 to \$20 depending on account balance. Margin rates are similar, with Vanguard charging 10.75% for \$10,000 and Fidelity charging 10.575%. Fidelity may be more cost-effective for options trading, whereas Vanguard is likely cheaper for those primarily focused on mutual funds.

There are also numerous other ways why some people might not choose Vanguard. For example, when reading an article on a client choosing Fidelity or Vanguard, there are many pros and cons to each situation. Fidelity and Vanguard are among the world's largest investment companies, with Fidelity boasting over 43 million individual investors and \$11.5 trillion in assets under administration, while Vanguard has more than 30 million investors and \$8.5 trillion in assets under management. Both offer low-cost mutual funds, ETFs, and related services.

Fidelity provides a robust trading platform, excellent research, and asset screeners, catering to various types of investors. On the other hand, Vanguard, focuses on buy-and-hold investors with its impressive lineup of low-cost mutual funds and ETFs. While Vanguard's website has been updated for user-friendliness, Fidelity's platform offers more tools and resources. Fidelity also excels in trade experience, offering advanced features for both passive and active traders. In terms of mobile experience, Fidelity's app surpasses Vanguard's with its functionality and user interface. Both brokers offer a similar range of offerings and account types, but Fidelity stands out for its trading technology, research amenities, and overall usability, making it the preferred choice for investors seeking a high-tech experience. However, Vanguard remains attractive for its low-cost funds and suitability for long-term and retirement investors.

In terms of mobile experience, Fidelity's app surpasses Vanguard's with its functionality and user interface. Both brokers offer a similar range of offerings and account types, but Fidelity stands out for its trading technology, research amenities, and overall usability, making it the preferred choice for investors seeking a high-tech experience. However, Vanguard

remains attractive for its low-cost funds and suitability for long-term and retirement investors.

Overall, both firms have strengths and weaknesses in terms of fees, online experience, and features. Vanguard typically offers lower expense ratios on its funds, but Fidelity has a wider range of investment options and advanced trading tools. In terms of fees, both firms have adopted a commission-free model for stock, ETF, and most mutual fund trades, with slight variations in options and bond trading fees. Additionally, both offer advisory services, with Vanguard's Personal Advisor Services requiring a \$50,000 minimum investment and Fidelity offering various advisory options based on account balance. Mobile app satisfaction levels differ between the two, with Fidelity generally receiving higher ratings. Ultimately, the choice between Vanguard and Fidelity depends on individual preferences, investment goals, and level of experience.

Another investment firm that has a great reputation for tax efficient mutual funds is the Charles Schwab Corporation. The corporation offers a modern way to manage their wealth. They focus on helping their clients to take ownership of their financial futures. Their main goal is to put their clients first in order to achieve their goals, long term and short term. Their corporation includes about 32,000 employees, including individual investors, advisors, and employers. They have \$9.12 trillion total client assets, 35.3 million brokerage accounts, 5.9 million daily trades, and 1.9 million banking accounts. They were founded in 1975 by creating a discount brokerage account, and as of 2020 they are an award winning company. They treat their clients like colleagues and offer an intelligent way to invest by combining people and technology. However, in comparison to Vanguard, there are key difference to take note of.

Investors of Charles Schwab strategically allocate their assets based on the tax implications associated with different types of accounts. For assets such as individual stocks intended for holding over a year, as well as tax-efficient mutual funds, index funds, ETFs, and stocks or funds yielding qualified dividends, taxable brokerage accounts are typically recommended. These accounts are also appropriate for municipal and I bonds. In contrast, tax-advantaged accounts are more suitable for short-term holdings under a year, like individual stocks or actively managed funds that are likely to accrue substantial short-term capital gains. They are also fitting for taxable bonds, high-yield bond funds, and real estate investment trusts.

Furthermore, like Vanguard tax-loss harvesting is a critical tactic employed to mitigate taxes on investment returns. This strategy involves offsetting taxes on capital gains and up to \$3,000 of ordinary income annually using investment losses, with the ability to carry forward excess losses to future years. Investors must remain cautious of the wash-sale rule, which prohibits claiming a loss on a security if a substantially identical security is purchased within 30 days before or after the sale. This rule is applicable only in taxable accounts, not tax-deferred

accounts such as 401(k)s or IRAs, underscoring the need for strategic planning in tax management.

Charles Schwab and Vanguard offer distinct approaches to online investing. Updated by Jean Folger on August 27, 2023, this comparison highlights their differences. Charles Schwab boasts a robust array of services catering to active traders and self-directed investors, including multiple trading platforms and a wide range of investment options. This makes it an excellent choice for those who prefer a hands-on trading experience. On the other hand, Vanguard appeals to buy-and-hold investors who favor a more straightforward, less technologically intensive approach, along with access to professional investment advice.

Schwab's platforms, such as Schwab.com and StreetSmart Edge, offer sophisticated tools and features designed to enhance the trading experience. These platforms support various order types and come equipped with advanced research tools and resources. Conversely, Vanguard's platform is more basic, focusing on essentials suitable for long-term investors, and does not offer the same level of technological sophistication or range of features as Schwab's platforms. Both firms offer extensive portfolios, but Schwab provides a broader range of assets, including access to cryptocurrencies via Bitcoin futures, which Vanguard does not. Additionally, Schwab's educational resources and customer service, including 24/7 support and multiple branches, are more extensive compared to Vanguard's more limited offerings in these areas.

Overall, while both firms are leaders in the investment industry, the choice between Charles Schwab and Vanguard depends largely on the individual investor's style and needs. Schwab is suited to those looking for depth in trading technology and customer support, whereas Vanguard is better for those who prefer a simple, advisory-focused investment approach with access to some of the lowest-cost funds available.

A real-life example of a tax-inefficient mutual fund having to close involves the Magellan Fund managed by Fidelity in the late 1990s and early 2000s. This fund was once the largest mutual fund in the world and renowned for its exceptional returns under the management of Peter Lynch. However, after Lynch stepped down, the fund began to struggle with both performance and tax efficiency. During the tech bubble in the late 1990s, the Magellan Fund had a high turnover rate as it tried to capitalize on the tech stock rally. However, when the bubble burst, the fund suffered significant losses, and the high turnover continued, compounding the fund's problems with large capital gains distributions. These distributions were taxable events for investors, which significantly diminished their after-tax returns. The situation was exacerbated by the fund's large size, which made it difficult to maneuver in and out of positions without impacting the market. This size and the associated high turnover led to

substantial tax inefficiencies, contributing further to its underperformance relative to its peers and benchmarks. This example underscores the importance for investors to consider both performance and tax efficiency when selecting mutual funds, particularly in volatile markets where high turnover can lead to significant tax liabilities.

In the future, there are numerous ways tax efficient investing can evolve and change, especially within Vanguard. There are numerous trends that are likely to change the strategies of Vanguard to maintain or enhance their tax efficiency. Taking a look at these trends can help investors and fund managers prepare for the future and navigate the changing economic environment. The most significant shift that will influence the investment world is navigating the retirement wave. The baby boomer population are all in the process of moving into retirement.

As the baby boomers shift into retirement, they enter distribution phases in their investment cycles, which increases the demand for tax efficient retirement solutions. Vanguard is known for its investor- focused offerings, which may lead them to enhance their range of tax managed retirement funds and income focused investments that can enhance after-tax returns for their retirees.

The advancement of technology can also reshape the efficiency of tax investing. For example, automated tax-loss harvesting, algorithm-driven portfolio balancing, and tax planning tools are more feasible by leading financial institutions. Due to Vanguard receiving criticism to their online tools, they could eventually offer more personalized tax management strategies using technology. This would allow investors and clients to decrease their tax liabilities in real-time based on their unique financial situations including any changes within tax laws.

Laws on taxation are never the same, and there are constant changes at the federal and state level, ultimately leading to investment strategies. For example, if capital gains taxes increase along with changes in the treatment of dividends, this could prompt Vanguard to adjust its offerings or investment strategies to protect investors from higher taxes. Vanguard should stay ahead of these changes and prepare to have adaptive strategies. This will help Vanguard maintain their reputation of tax efficiency.

Globalization of markets is also a factor when it comes to the future of tax investing. Globalization means that tax efficient investing can no longer be structured as just domestic strategies. Due to this, Vanguard may think about increasing their focus on international tax regulations and treaties in order to manage the foreign components of their funds. This would include having an understanding of the foreign tax credentials and the taxation of foreign dividends for U.S. investors.

Lastly, the importance of environmental, social, and governance criteria among investors influences the tax on mutual funds. Vanguard might integrate ESG factors with tax efficiency investing in order to attract a broader base of investors that try to lower taxes and also be environmentally and socially aware. For example, ESG-focused funds often include longer holding periods, which aligns perfectly with Vanguard and how they minimize their tax distributions.

In summary, this paper has illustrated the vital role of tax efficiency in mutual fund and ETF investments, particularly highlighting Vanguard's strategies in optimizing tax implications for investors. Through a detailed examination of the tax challenges and strategies within mutual fund investments, it is clear that understanding and leveraging tax-efficient practices are crucial for enhancing long-term financial returns. Vanguard's commitment to low-cost, tax-efficient solutions not only positions it as a leader in the field but also provides a valuable model for investors aiming to maximize their after-tax returns. As the investment landscape continues to evolve, the principles of tax efficiency will remain central to achieving successful investment outcomes. By prioritizing these strategies, investors can significantly improve their investment efficiency and meet their long-term financial goals more effectively. This conclusion reiterates the importance of tax considerations and positions Vanguard's approach as a benchmark for the industry, while also pointing towards the ongoing relevance of these strategies.

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Prescriptive Change Activator (PCA) Model: A framework to Drive and Accelerate Elimination of Technical Debt in an Organization

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Abstract

The accumulation of technical debt is a complex problem faced by organizations, resulting in a financial burden due to increased security, compliance, supportability, and availability risks. The Prescriptive Change Activator (PCA) model is a visual tool for business leaders who want a structured framework to coach them through planning and prioritizing the elimination of outdated information technology infrastructure and applications in an enterprise. Organizations implement standards-based models to provide technical service delivery and guide processes which become embedded within the company's operational culture. However, the reference models do not sufficiently serve as a tool that can spotlight the problem of technical debt and facilitate a plan to eliminate it. The PCA Model is immediately and directly applicable to organizations that need a model to follow for modernizing legacy technology from an infrastructure, systems, or process perspective. The PCA Model engages a cross-functional team, creating an equitable template for innovation. The Activator component emphasizes the catalytic element of the purpose for using the model, supplying the expectation that change will occur rapidly and with reduced friction, capturing prescribed inputs for a transformation of knowledge acquisition into actionable outputs. Development of the PCA model is supported by current research in intelligence, creativity, and wisdom. The toolset produced by this research also demonstrates the process of solving a problem through model building and explores opportunities to further develop a sustainable model through observation, revision, and scale.

The Dominican Republic-Central America Free Trade Agreement

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Abstract

This research examines the free trade agreement (CAFTA-DR) composed of Dominican Republic, several Central American countries, and the U.S. CAFTA-DR was established in 2005 and the current members are Dominican Republic, El Salvador, Cost Rica, Guatemala, Honduras, Nicaragua, and the U.S. This research examines this trade pact along several dimension, goals and objectives, functions, rules and regulations, and the trade impacts. Our research indicates that U.S. exports of poultry meat and products to the CAFTA-DR member countries have increased by more than \$200 million since 2011. In addition, the rules regarding intellectual property rights have strengthened. The research shows that the exports of the member countries of CAFTA-DR to the U.S. have also doubled since 2005. In addition, the study explores the impact of CAFTA-DR on sustainability practices in Dominican Republic and other Central American countries member of CAFTA. Furthermore, “Due Diligence”, the observance of human rights, in the above countries is studied. Based on the findings, CAFTADR does not require the member countries’ labor laws to conform or observe the basic international labor laws that have been established by the International Labor Organization (ILO) of the United Nations. Our research indicates that there are anti-union practices, not allowing labor strikes, sexual harassment, and pregnancy-based discrimination. The research concludes with the accomplishments of this trade pact and the areas that need more attention to enhance sustainability and human rights.

The Next Paradigm in Leadership Theory: Leadership of Emergence

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Introduction

Leaders are facing a challenge. The old styles of leadership and training do not prepare leaders for the challenges of the present and the future. Leaders attempting to lead in older models of leadership are discovering the weaknesses of those theories. Harrison (2018) describes these models as The Great Man Theory, Skills and Traits Theory, Transformational Theory, and Entrepreneurial Theory. They are still effective, but increasingly less so, especially when the return on investments for leaders continues to decrease, while the cost to leaders increases. In the field of religious leadership, congregations are resisting top-down leadership styles and pushing back on religious leaders or simply ignoring them. At the same time, the rise in pastors considering resigning since COVID has increased dramatically (Smith, 2024). This same challenge exists in the corporate world, for example, when companies attempted to reduce or remove remote work, employees pushed back with “walkouts and resignations” (Abril, 2023). New leadership concepts are needed to address these challenges.

Methodology

In an effort to learn new leadership concepts, successful leaders were studied by selecting leaders facing similar situations in their context to those being faced today. Since the focus of the research was for Christian Church leadership, specifically building a lay leadership development program, leaders contained within the Bible were selected. Leaders were chosen facing crisis, significant cultural transformation, an emergence into a new era of operations within their fields and who were not the primary authoritative leader based on their situation or cultural context. The selected leaders were Deborah, from the book of Judges and the work of Paul as recorded in the book of Acts. From each leader, specific archetypes of leadership operation were discovered that allowed them to succeed in their context. Archetypes were selected by identifying the effective use of leadership skills and tactics by the leaders in view, distilling those skills into specific attributes that were set apart from normative or expected leadership skills. Two archetypes were discovered. The effect of those archetypes could be seen in the effective use of those leaders in advancing the specific cause for which they were leading

– Deborah in defeating an opponent to the nation of Israel, Paul in furthering the advancement of Christianity. Those archetypes were collaboration and emergence. These two archetypes of leadership were distinctive standouts for these leaders. Deborah, as a woman, was an emergent phenomenon of her day who utilized collaborative skills in achieving her mission. Paul, as a

previous opponent to Christianity, was an emergent phenomenon who used collaborative skills in achieving his mission. Those specific attributes became what we call archetypes of leadership leading to a new discovery in the advancement of leadership theory. These archetypes were researched further in the respective fields of collaborative leadership, emergence theory, and systems leadership and a new paradigm of leadership was developed. The new paradigm does not replace older models, but rather builds on them for improved leadership effectiveness.

Leadership Paradigm Development

Leadership Theory goes back to the 1840s with the Great Man Leadership Theory. But the research has been more scientific over the past 75 years (Hemphill, 1949; Bennis & Warr, 1959; Richards & Engle, 1986; Clark & Clark, 1996; Barker, 2001; Lussier & Achua, 2023). These researchers show the development of leadership from a study of the individual known as the leader (Great Man Theory), to the study of leadership skills and traits (Skill and Trait Theory), then to the study of the role and impact of the follower on the leader and leadership (Leader-Member Exchange Theory) and finally to the study of the intersection of leader, follower and their relationship (Distributed Theory). Leadership Theory has advanced again, and a further dynamic is in play – the leader, the follower, their relationship and the wider context in which they work – the world around them.

Leadership Emergence Theory

This new evolution, aptly called “The Leadership of Emergence” by Lichtenstein and Plowman (2009) can be studied and implemented for greater impact and effectiveness for leaders and organizations. The Leadership of Emergence phase advocates for new skills and traits, a honing of existing skills and identifies that leadership as influence exists outside of the leader, the follower or their relationship. Leadership is in the system too. The system itself exerts influence on the leader, the followers and their relationship. This influence can be assessed and harnessed for positive returns on investment. A leader of the future will know how to harness these skills and leverage this influence for success.

Emergency Leadership Defined

Each of the existing theories of leadership came with their own definitions, as discussed. With a new development of leadership, our definitions will need to adapt too. Which is why we propose a new definition for leadership that fits the leadership of emergence theory. Western (2019) simply defined leadership as the “psychosocial influencing dynamic.”(36). We developed a more accessible lay-person definition that is less abstract. In consultation with the Faith Community Church of Hopkinton, who funded the research, and who desired a definition in simpler terms for a nonacademic reader to grasp, we define leadership “as the dynamic art of influence between an

individual, others and the world around them.” It comprises two components. The first component is the dynamic art of influence, which is the specific act of leadership, and the second component is individual, others, and the world around you, which are the arenas of leadership. This definition is expanded and discussed for each arena and means of leading using the leadership toolboxes.

Leadership Toolboxes

Beyond a new definition of leadership, new and further developed skills are discussed too. These are presented as seven toolboxes, collectives of skills that when used by the formal leader can be harnessed for leadership of emergence to be successful. These seven toolboxes are listed below.

1. The Investment Toolbox: skills related to improvement and development of the person, the team or environment.
2. The Observation Toolbox: skills related to listening, pattern recognition, feedback and evaluation of the leader, the team or the environment.
3. The Agility Toolbox: skills related to emotional management and culture development of the person, the team or the environment.
4. The Collaboration Toolbox: skills related to conflict management, relationship building and control sharing of the person, the team or the environment.
5. The Empowerment Toolbox: skills related to training, development, coaching and decisiveness of the person, the team or the environment.
6. The Discipline Toolbox: skills related to rhythms for wholeness, accountability and boundary setting of the person, the team or the environment.
7. The Grit toolbox: skills related to courage, tenacity, perseverance and vulnerability of the person, the team or the environment.

Conclusions, Theoretical Contributions, and Practical Applications

Leadership continues to advance, and leadership theory needs to advance with it. Thus, our paper advances leadership theory to a new paradigm. The impact of global affairs, like the COVID Pandemic, reveal the next paradigm of leadership development: leadership of emergence. A successful leader today and in the future will know how to harness the skills of leadership of emergence for greater success. This paper provides a foundation for leadership theory evolution, provides a usable definition for the next paradigm of leadership and provides relevant skills that can be used for impact. Capable leaders will learn how to make better decisions, how to evaluate the impact and influence of the environment on themselves and their teams, guide them in personal and team development and begin to influence the systems around them for increased performance. Organizations led by these types of leaders will be fluid and flexible, able to adapt to the changing environment with increased agility leading to improved efficiency and effectiveness,

and growth, with a greater return on investment of leaders.

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Best Paper Award in Contribution to Theory

Crafting Jobs Using Role and Resource Approach: The Influence of Core Self Evaluations and Perceived Supports on Work Engagement

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Abstract

Purpose – This paper presents a conceptual model on how job crafting approaches make employees more engaged in their job tasks. Specifically, it provides new insights into the dynamics of job crafting behavior by examining the effects of core self-evaluations (CSE), perceived supervisor support (PSS), perceived organizational support (POS), and perceived social support (PSoS) on employees' role approach/resource approach forms of crafting and work engagement.

Design/methodology/approach – Building on the role-resource approach model of Bruning and Campion (2018), we theorize that role-approach crafting relates more strongly to work engagement than resource-approach crafting.

Findings – Propositions were developed to suggest that approach job crafting mediates the relationship between CSE and work engagement. Finally, we propose that while PSS, POS, and PSoS moderate the positive relationship between CSE and role-resource approach crafting, PSoS mediates the effect of CSE on role-approach crafting.

Research limitations/implications – While the avoidance job crafting model is not considered in this paper, the proposed model can be further tested and validated with empirical studies.

Originality/value – The paper demonstrates the role of CSE, PSS, POS and PSoS in influencing approach job crafting – engagement relationship.

Keywords – job crafting, role-approach crafting, resource-approach crafting, core-self evaluations, perceived supports, work engagement.

Paper type – Conceptual paper

Introduction

In the last decade, research works from organizational behavior (OB) scholars have occasioned a paradigm shift from top-down (job enrichment) to bottom-up (job crafting) role redesign approach (Rai, 2018; Tims *et al.*, 2015). This shift elicited increased studies on job crafting due to substantiated implications for employees and firms. The studies found employee engagement, improved performance, work attachment as outcomes of granting workers the autonomy to craft their jobs (Bakker *et al.*, 2012; Bipp *et al.*, 2019; Cullinane *et al.*, 2017; Petrou *et al.*, 2012; Petrou *et al.*, 2015; Tims *et al.*, 2013; Wang *et al.*, 2018). Similarly, Callea and Urbini (2020) found that job crafting as human resource management (HRM) interventions mitigate job insecurity. Conversely, studies reported exhaustion (Petrou *et al.*, 2015) and burnout (Bipp *et al.*, 2019; Tims *et al.*, 2013) as negative outcomes of job crafting.

Extant literature indicates two broad perspectives to job crafting: the role-based job crafting model of Wrzesniewski and Dutton (2001) and the job demands-resources (JD-R) model derived from work design theory. The first perspective sees job crafting as a form of altering work meanings (what individuals understand as the purpose of their work) and work identity (how individuals define themselves at work) through “changing [of] cognitive, task, and/or relational boundaries to shape interactions and relationships with others at work” (Wrzesniewski & Dutton, 2001, p. 179). Alternatively, the JD-R model of Bakker and Demerouti (2007) conceptualizes job crafting as “the changes that employees may make to balance their job demands and job resources with personal abilities and needs” (Tims *et al.*, 2012, p.174). These two perspectives, although incongruent, differ in content and underpinning purpose, which consequently leads to difficulties in mapping out the core facets of job crafting and their measurements (Zhang and Parker, 2019).

Although this dichotomous theorization of the job crafting concept is not new, scholars have advocated for a more robust view by combining both streams of thought. In response, Bruning and Campion (2018) developed a role-resource approach-avoidance model by successfully integrating the two perspectives into a detailed framework. The model divided job crafting into approach and avoidance crafting, which requires employees to take up some changes in roles or resources to craft their jobs. However, the model has not been employed to draw up a more robust conceptual and empirical understanding of the antecedents and outcomes of job crafting beyond engagement and work strain. Furthering the integration of these streams of thought, the purpose of this paper is to advance job crafting literature by using the role-resource approach-avoidance model, particularly the role-resource approach domain, to explore the effects of individual factor (core-self evaluations (CSE)) and situational factors (perceived supervisor support (PSS), perceived organizational support (POS), perceived social support (PSoS)) on work

engagement transmitted through job crafting.

Theoretical perspectives of job crafting

Role-based perspective

In the role-based perspective, Wrzesniewski and Dutton (2001) conceived crafting of jobs as a way in which employees shape (either cognitively or physically) the task that composes the job they do and form interactions and relationships with other people at their workplace in a bid to make work more meaningful and improve work identity. Under this perspective, the authors conceive job crafting as “the physical and cognitive changes individuals make in the task or relational boundaries of their work” (p. 179). To craft jobs, individuals may exhibit any three of the following crafting practices or their combinations. First, changing the physical task boundary of a job by modifying the type, scope, or the number of activities they perform at work often outside the formally defined job task. Second, adjusting the cognitive task boundary by reframing opinions about the job or how the job is viewed either as discrete parts or whole. Third, changing the relational boundary of a job by altering who they interact with and the nature of such interactions.

According to Wrzesniewski and Dutton (2001), the act of job crafting influences the meaning “job crafters” give their work and how they identify with it. The authors thus recognize “meaning of work” and “work identity” as the primary reasons people craft their jobs. Individuals gain more meaning from work as they understand the purpose of the work or their belief in the achievement therein. Consequently, Wrzesniewski and Dutton believe the motivation to craft jobs usually stems from the need to exercise more control over the job, build a positive self-image, and humanly connect with others at work. The perspective is advocated in the works of Berg, Grant, and Johnson (2010); Berg, Dutton, and Wrzesniewski (2013); Clegg and Spencer (2007); Leana, Appelbaum, and Shevchuk (2009); and Lyons (2008).

Resource-based perspective

Using the JD-R model, scholars (e.g., Tims *et al.*, 2015) conceptualize job crafting by considering job features rather than content. The overarching premise is that job characteristics can be framed into two categories – job demands and job resources. Job demands refer to the “physical, social, or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs” (Demerouti *et al.*, 2001, p. 501), while job resources are perceived as the aspects of the job that are functional to accomplishing work goals, reducing job demands and related costs, and stimulating personal growth and development. When employees are exposed to a deluge of duties such that job demands become overwhelming and turn to job stressors, job resources are essential to keep workers engaged.

Individuals are often motivated to balance job demands with job resources through the development of job crafting behaviors that reduce job strain and increase work engagement, and at the same time, align with their preferences, skills, and desires.

Using the JD-R model, Tims *et al.* (2012) identified four independent dimensions of job crafting: increasing social job resources (seeking social support, supervisory coaching, and feedback); increasing structural job resources (seeking resources variety, the opportunity for development, and autonomy); increasing challenging job demands (involving in new projects, and taking up extra tasks); and decreasing hindering job demands (involving in less emotionally draining work, and low participation in tasks that are mentally demanding). In line with these dimensions, the job-resources-seeking propensity of individuals will impact more on job design and social interaction with others at work. In contrast, the job-demands-seeking tendency affects employees' ability to take up cognitively and emotionally demanding roles.

Role-resource approach-avoidance model

The two broad perspectives summarized above, though unique and complementary, fail to articulate structures of job crafting that are required to explicate some specific outcomes such as process improvement, work-home conflict, teamwork, and work withdrawal (Bruning & Campion, 2018). Based on the recent empirical findings of Bipp and Demerouti (2015) that job crafting can take both approach and avoidance patterns, Bruning and Campion integrated the role-based and resource-based perspectives to develop a more robust role-resource approach-avoidance model. The authors view job crafting as an individual-centric way used by employees to make consciously meaningful proactive changes or modifications to the work environment, intending to reap the benefits that come thereof. According to the model, employees can craft their jobs either in role or resource using approach or avoidance strategies. Under the approach strategy, employees deliberately and actively direct their efforts toward set goals, whereas individuals evade, decrease, or eliminate some parts of their tasks under the avoidance strategy.

Bruning and Campion's Job Crafting Categorization

In the 2×2 job crafting classification of role-resource approach-avoidance model, Bruning and Campion (2018) identified seven domains of job crafting under four groups (see Fig. 1).

Role approach crafting. Through *work role expansion* and *social expansion*. Under the work role expansion domain, proactive manifestations of individuals propel them to self-initiate and expand work roles over and beyond what is stipulated in the original formal job description, which may involve increasing challenges or altering task boundaries. On the other hand, individuals in the social expansion domain change the number, scope, and nature of social interactions and

relationships with others at work.

Avoidance role crafting. Through *work role reduction*. In this domain, individuals actively and systematically attempt to reduce formal work roles by evading tasks, responsibilities, or interactions. Duty delegation and surrogacy by supervisors to subordinates fall under this dimension if the purpose of such delegation or surrogacy is intended to eschew duties originally meant for the supervisors.

Resource approach crafting. Through *work organization, adoption, and metacognition*. In the work organization domain, individuals systematically and strategically design and organize tangible work elements to better manage their physical work environments. By adoption, individuals actively use technology and other knowledge bases to change the way job is done, improve the work process and achieve some set goals. Finally, metacognition involves autonomous task-associated priming of individuals' psychological states to create meaning, identity, sense of responsibility, and organizations' priorities in their minds. Although related to the active cognitive changes of role in Wrzesniewski and Dutton's perspective, metacognition is "characterized by increasing cognitive activity instead of psychological withdrawal or reduction" (Bruning and Campion, 2018, p. 510), and thus closely reflects resource crafting.

Avoidance resource crafting. This dimension of job crafting involves relatively permanent, systematic, and voluntary removal of oneself from some situations or events in a bid to change one's job tasks.

Using the role-resource approach-avoidance model, a conceptual framework (Fig. 2) is developed to theoretically explain how CSE impacts job crafting in the presence of situational factors as moderating and mediating variables.

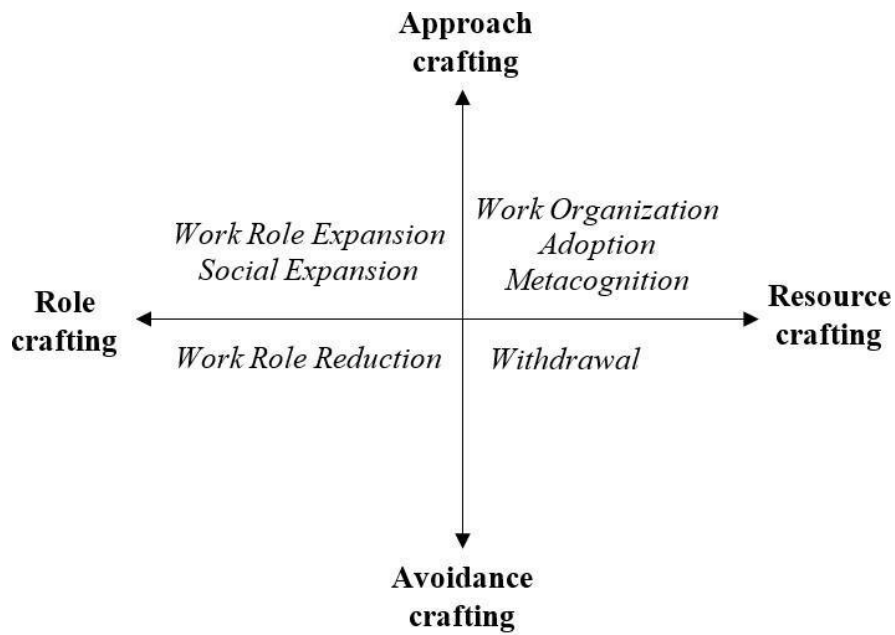
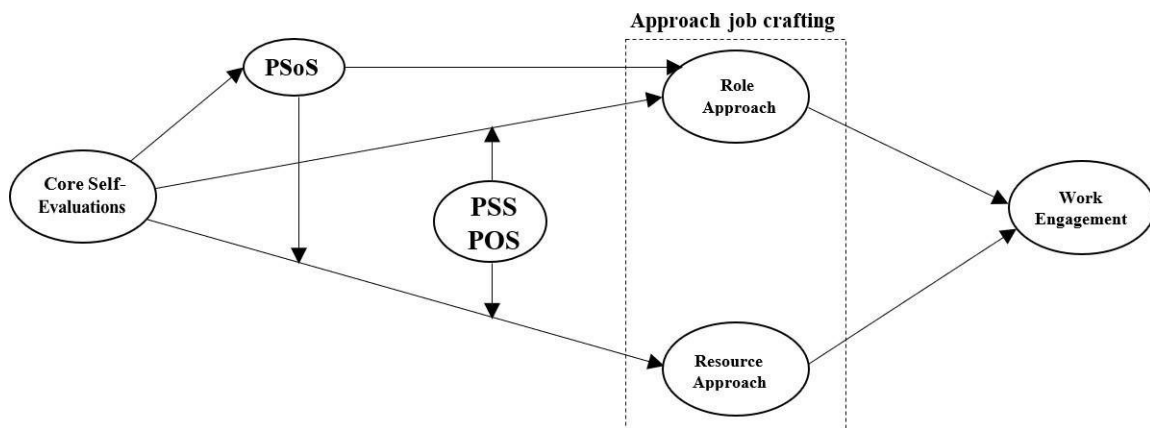


Fig. 1: Role-Resource Approach-Avoidance Matrix
 Source: Bruning & Campion (2018)



NOTE: PSS = Perceived supervisor support; POS = Perceived organizational support; PSoS = Perceived social support.

Fig. 2: Conceptual framework

Work Engagement

Work engagement refers to the “...positive, fulfilling and work-related state of mind characterized by vigor, dedication, and absorption” (Petrou *et al.*, 2012, p. 1124). By engaging in specific work activities, employees develop positive motivation that results in positive emotional outcomes such as work enjoyment (Tims *et al.*, 2014), work attachment (Wang *et al.*, 2018), and other positive work-related well-being (Tims *et al.*, 2013).

In the model, we focus primarily on a single outcome variable of work engagement because of its strong relationship to job crafting and its relevance in predicting other positive organizational work outcomes (see Tims *et al.*, 2015). For instance, Albrecht, Bakker, Gruman, Macey, and Saks (2015) argued that engagement impact a range of attitudinal, behavioral, performance, and financial outcomes. The exhibition of job crafting behavior by employees increases their intrinsic motivation to be more energetic and influential in the work environment. Individual job crafting of seeking resources and challenges acts as a strategic resource for employees to respond to organizational change and become more engaged in their work (Petrou *et al.*, 2015).

Similarly, we propose that approach job crafting, either in role or resource, is positively related to work engagement. According to the role-resource approach-avoidance model, expanding the role and social environment and gaining more control over work organization, adoption and metacognition will substantially positively stimulate workers’ work experience at the individual and organizational levels. Employees in role-approach and resource-approach dimensions will especially become more energetic to allocate more effort and time to job activities they prefer and perform such activities effectively. Under such vigor of engagement, employees fully concentrate on tasks at hand, are more absorbed in their roles, and form, in their psychological mind, a positively significant dedication to their work role (Bakker *et al.*, 2012).

Seeking feedback, social support from coworkers, and skill variety, which are forms of role-resource-approach tactic, is positively associated with work engagement (Halbesleben, 2010).

Hence:

Proposition 1a: *Role-approach job crafting positively relates to work engagement.*

Proposition 1b: *Resource-approach job crafting positively relates to work engagement.*

Because work role expansion (increasing task boundaries) and social expansion (increasing relational boundaries) make employees’ work meaningful (Wrzesniewski and Dutton, 2001), we argue that role-approach crafting will make individuals more engaged in work than resource-approach crafting. Zhang and Parker (2019) posited that two essential characteristics distinguish

role-based crafting from resource-based crafting. First, role crafting is more employee-centric than resource crafting. In other words, it centers on idiosyncratic change of work boundaries in alignment with employees' motives and preferences. In contrast, resource crafting primarily involves resource management of either increasing resources or reducing demands. Second, the positive outcomes of role crafting primarily focus on enrichment (fulfilling of mind) rather than performance efficiency, which is usually the motivation in resource crafting.

Some elements of this claim have been subtly echoed in the findings of some JD-R scholars. For example, Petrou *et al.* (2012) reported that seeking challenges (a form of work role expansion), but not resources (a form of resource adoption), is positively related to work engagement. Similarly, Tims *et al.* (2013) revealed that crafting job demands initially does not result in a change in job demands, whereas crafting challenging demands directly affects increasing work engagement and employee well-being. It, therefore, appears that role-approach crafting has more effects on stimulating the intrinsic motivation of employees to improve dedication to work than resource-approach crafting. The commitment to work, in turn, leads to more fulfillment of work meaning and identity than extrinsic motivation, which primarily drives individuals to self-initiate personal learning development and to gain more resources to work better.

It is to be noted that job resources of work organization and adoption are necessary ingredients to get individuals engaged in challenging tasks at work. However, an individual cannot possibly derive enjoyment from work when there are no resources to execute challenging roles that are taking up effectively. Therefore, it is not surprising that Bakker *et al.* (2012) found that increasing structural demands is the strongest predictor for engagement and performance. Thus, we propose that, although approach crafting of resources of work organization, adoption and metacognition make individuals engage in tasks, enlarging roles and social environment make job crafters much more engaged, as they eccentrically align job roles with their desires, preferences, and passion, from which meaning of work and work identity are formed. Thus:

Proposition 2: Role-approach crafting more strongly relates to work engagement than resource-approach crafting.

Core self-evaluations

Prior studies (e.g., Bakker *et al.*, 2012) have shown that individual differences in personality traits shape the attitude and behavior that employees put up while performing job tasks. One of such personality traits is core self-evaluations (CSE), a higher-order personality construct encompassing four dimensions: self-esteem, generalized self-efficacy, locus of control, and emotional stability (Bono and Judge, 2003). CSE is viewed as the “fundamental premises that individuals hold about themselves and their functioning in the world” (Johnson *et al.*, 2008,

(p. 391) and has been shown to influence several work outcomes, including creativity and job crafting (Bipp *et al.*, 2019; Tims and Akkermans, 2017). The disposition-based effects of CSE on work attitudes and behavior have been shown to positively affect job motivation, in-role performance, job satisfaction, and coping with work difficulties and challenging job tasks (Erez & Judge, 2001; Kammeyer-Mueller, Judge, & Scott, 2009).

We posit that approach job crafting acts as a transmitting mechanism between CSE and work engagement. In a study to understand the influence of individual differences on work motivation and performance, Bipp (2010) revealed that CSE is strongly correlated with intrinsic work motivation aspects such as experienced meaningfulness and autonomy, which are ingredients of job crafting. Job characteristics, task complexity, and work environment have been reported as mediators between CSE relationships and work outcomes (Joo *et al.*, 2012). Because approach job crafting involves role expansion and seeking of resources, which are related to job design characteristics and task complexity, some previous empirical findings have reported job crafting as an intervening mechanism between the association of CSE and work outcomes. For example, Tims and Akkermans (2017) found that job crafting and career competencies fully mediate the relationship between CSE and job satisfaction. Hence, we argue that both role and resource approaches to job crafting mediate the CSE-work engagement relationship. This argument is consistent with recent empirical findings by Kim and Beehr (2020), who demonstrated that CSE positively relates to expansive/approach forms of job crafting, which in turn relates to three different well-being outcomes (work-family enrichment, flourishing, and life satisfaction). Thus, we propose that:

Proposition 3: *Both role- and resource-approach forms of job crafting partially mediate the relationship between CSE and work engagement.*

CSE is a positive individual resource required to sustain the building of psychological and job resources (Bipp *et al.*, 2019). Since approach job crafting in the new role-resource approach-avoidance model distinguishes between the features of role-approach and resource-approach forms of crafting, we argue that CSE will differentially affect each approach. Some JD-R scholars have provided empirical evidence that independent variables affect some dimensions of resource crafting more than others. For example, Bakker *et al.* (2012) showed that proactive personality significantly predicts all three aspects of job crafting (increasing structural resources, increasing social resources, and increasing job demands); however, increasing structural demands is the strongest predictor for work engagement. In a somewhat similar study, Petrou *et al.* (2012) found that high day-level work pressure and autonomy are associated with higher day-level seeking resources and seeking challenges. Moreover, the authors revealed that increasing challenges

rather than seeking resources is more effective in further engaging employees and preventing burnout.

As such, we argue that individuals with high levels of CSE, due to the combined effects of its inner dimensions of self-esteem, generalized self-efficacy, locus of control, and emotional stability, will display more role-approach crafting than resource-approach crafting. Joo *et al.* (2012) asserted that people with high levels of CSE are more likely to exhibit three characteristics in the workplace. First, their possession of high positive self-regard makes them highly confident in their skills and competencies, facing challenging tasks with a positive attitude, and concentrating more on positive aspects of jobs. Second, individuals who self-evaluate themselves higher than others generally perceive their situations (especially when challenging) as intrinsically fulfilling and have positive expectations about their capacities to take up challenging job responsibilities. Third, people with higher CSE exhibit positive social interactions and constructive collaborations to strengthen emotional attachment with other people. All these three attributes are closely aligned with individuals' inclinations to seek challenging tasks and improve social connections, the qualities that are hallmarks of role expansion and social expansion. Indeed, a few studies have subtly given testimonies to these assertions. For instance, Bipp (2010) found out that people with high CSE are attracted to enriched jobs and are not suited for jobs lacking motivating potentials. The enriching job aspects are particularly beneficial in role-approach crafting to derive meaningfulness and work identity (Wrzesniewski and Dutton, 2001). Besides, to the extent that resource-approach crafting is more directed toward performance (an organizational outcome) than work enrichment (Zhang and Parker, 2019), it suggests that employees will perform tasks more individual-centrally to derive enjoyment from their jobs, crafting more in roles ahead of resources. In line with the above arguments, we propose that, in similar working environments, individuals with high levels of CSE will role-approach craft their jobs more than they will resource-approach craft.

Proposition 4: *CSE positively relates to approach job crafting such that high levels of CSE more strongly relates to role-approach crafting than resource-approach crafting.*

Perceived Supervisor Support

Previous studies (e.g., Kacmar *et al.*, 2009; Ahmed and Nawaz, 2015) have found a strong relationship between employee perception of their work environment and positive job outcomes. One of the ways to foster a positive work environment is through employees' perception of their supervisors' support captured by perceived supervisor support (PSS). PSS is viewed as the extent to which a supervisor values the contributions of their subordinates, supports them, and values their general well-being (Eisenberger *et al.*, 2002). According to Baek-Kyoo, Bozer, and Ready (2019, p. 195), when employees perceive that an organization offers a conducive environment through supportive leadership, they are "more likely to find greater meaning in their jobs, competence in their knowledge and skills, and self-determination

to make strong impacts on their work unit and organization.” Further, a recent review by Wang, Li, and Chen (2020) demonstrates that social factors (e.g., positive leadership styles and coworker support) positively relate to employee job crafting. It is thus evident that PSS creates a stimulating environment for employees to work and develop their intrinsic capabilities toward job crafting.

Consequently, we theorize that PSS moderates the relationship between CSE and job crafting such that employees who perceive higher support from their superiors will craft their job more in resources than in roles. Although PSS affects both role and resource forms of job crafting, arguments from Trait Activation Theory (TAT) (Deci & Ryan, 2000) and the norm of reciprocity (Gouldner, 1960) support this distinction. Following the TAT, individuals with higher levels of CSEs are attached to and motivated by positive situational factors (e.g., higher levels of PSS), which are likely to positively influence their cognitions, affects, and self-relevance (Kacmar *et al.*, 2009). Similarly, drawing from the norm of reciprocity, employees’ perceptions of their supervisor’s support will act as a driving force towards self-belief and motivation to utilize their capabilities beyond job requirements (Eisenberger *et al.*, 2002). According to the JD-R model (Bakker & Demerouti, 2007), PSS is perceived as a viable interpersonal resource for formulating and implementing innovative and creative work ideas (Skerlavaj, Cerne & Dysvik, 2014).

The direct link between supervisors and subordinates requires the former to provide resources and give freedom of work organization to the latter, indicating that supervisors play a vital role in encouraging subordinates to build more resource-approach crafting behaviors than role-approach behaviors. As an illustration, to the extent that a subordinate believes his supervisor values his contributions to job activities, he may be more inclined to learn new skills and adopt new technologies to perform more in his roles. Favorable evaluations of a supervisor by their subordinates are borne out of the supervisor’s ability to meet their needs by fostering their creative skills and providing necessary resources to convey care and support. Eisenberger *et al.* (2002), in their study of the effect of PSS on perceived organizational support and employee retention, asserted that to foster personal loyalty between supervisors and subordinates, many supervisors even go as far as exaggerating their positive valuations of subordinates and their role in obtaining benefits for the subordinates (p. 572). Hence, in line with social exchange theory and the norm of reciprocity, subordinates who perceive such overwhelming positive support from their supervisors feel obligated to repay such supervisors by crafting job activities targeted at improving job resources.

Hence, we argue that the approach job crafting behavior of core self-evaluators will be low in a work environment where supervisors offer little or no support to employees. Deprived of the valuable resources provided through supervisor support, employees may respond by engaging less in role and resource crafting. However, in a relatively high PSS work environment, supervisors' support is likely to offer employees the self-worth required to utilize their individual and supervisor inputs to craft their jobs more in resources than in roles. Based on these arguments, we propose that:

Proposition 5: *PSS positively moderates the relationship between CSE and approach job crafting such that at high levels of PSS, the CSE-resource-approach crafting relationship is stronger than the CSE-role-approach crafting relationship.*

Perceived Organizational Support

The role-resource approach job crafting is a social process, which is affected by motivational, social, and situational factors (Bruning and Campion, 2018). As argued earlier, while PSS represents a vital aspect of employee support perception (Skerlavaj *et al.*, 2014), a more germane source of situational influence on the linkage between CSE and role-resource approach job crafting may be perceived organizational support (POS). POS is conceptualized as the extent to which employees' perception demonstrates the organization's appreciation and approval of their effort and happiness (Eisenberger, Huntington, Hutchison, and Sowa, 1986). Using organizational support and social exchange theories, we argue that when employees attribute actions from the organization and its agents as favorable, they are likely to replicate by improving performance and affective commitment (Rhoades and Eisenberger, 2002).

Previous studies (e.g., see Cheng and Yi, 2018; Rhoades and Eisenberger, 2002) argued that when employees perceive support from their employers, they are more likely to exhibit meaningful job contributions by displaying higher organizational citizenship behaviors. The support organizations offer workers play a vital role in aiding them to engage in role-resource approach crafting behaviors. For example, the degree to which an employee will utilize more of his skills and capacities for improved productivity may be influenced by the appreciation of previous efforts and the extent to which the employers value their contribution and show care and support. Ding and Lin (2019) and Ding, Yu, and Li (2020) asserted that employees experiencing greater POS are more likely to score high on CSE and innovative behavior and may be willing to alter their work boundaries. Similarly, Leupold, Lopina, and Erickson (2020) found that POS moderates the relationship between CSE and academic burnout among students. High-CSE employees were also found to use POS as an additional job resource to cope with job-related

problems such as stress and burnout (Hsieh, Wang, and Huang, 2019). Although studies have shown that POS offers employees resources, creative and innovative ideas, it is more of a social factor signifying additional resources than motivation. Bruning and Campion (2018) argued that while role crafting incorporates more motivational and personal reasons for job redesign, resource crafting emphasizes resource acquisition and conservation for improved job efficiency. Hsieh *et al.* (2019) further argued that POS is an important resource that can support employees in fulfilling their socio-emotional needs and self-approval. Hence, there is a likelihood that POS offers workers more resources than motivation in job crafting.

We propose that POS moderates the relationship between CSE and job crafting such that the relationship will be stronger for CSE-resource approach crafting than for CSE-role approach crafting. If POS is low, a strong inverse CSE and role-resource approach crafting relation would be expected. An employee with a low level of CSE and low level of POS may not be equipped with the right skills and resources to craft their job for increased engagement. However, suppose the same low-CSE employee reports a more supportive organization (high-level POS). In that case, such an employee may harness the available organizational support as a resource for improved job changes. Conversely, employees who perceive higher organizational support and possess higher levels of CSE may likely craft their jobs using available organizational support as resources. Hence, POS as a resource at the organizational level can offer employees the resources necessary to take over their jobs and craft them as they wish to match their preferences and capabilities for a better person-job fit (Ding *et al.*, 2020; Kim and Beehr, 2019).

Proposition 6: *POS positively moderates the relationship between CSE and approach job crafting such that at high levels of POS, the CSE-resource-approach crafting relationship is stronger than the CSE-role-approach crafting relationship.*

Perceived Social Support

Perceived social support (PSoS) has been conceptualized as the experience of being cared for, assisted, and valued by one's social network (Song, Kong, and Jin, 2013). This network includes both organizational insiders (colleagues and leaders) and outsiders (clients/customers, friends, and families) (Wang, Li, and Chen, 2020). Because we have captured support from supervisors and organizations with the PSS and POS constructs respectively, we conceptualized PSoS as support from team members (work colleagues) and social networks outside the organization. Previous studies (e.g., Li and Takao, 2020; Wang *et al.*, 2020) view PSoS as both work and non-work domain social factors impacting employee job crafting.

Since both role and resource approach crafting are geared towards surmounting work challenges, bettering work situations, and acknowledging and interpreting job stressors as positive (Lazazzara, Tims, and de Gennaro, 2019), PSoS triggers employees to craft jobs using both approaches. Hence, we theorize that while PSoS mediates the CSE-role approach crafting relationship, it moderates the relationship between CSE and resource approach crafting.

For PSoS moderating the CSE-resource approach crafting relationship, we argue following the spillover and conservation of resources (COR) theories that experiences, skills, and emotions in a non-work domain can be employed as additional resources by individuals in the organizational context (Hobfoll, Halbesleben, Neveu and Westman, 2018). Also, arguing from the JD-R theory propositions, team members and colleagues as social support provide employees valuable resources (e.g., timely assistance and important feedbacks) needed for job crafting (Shin, Hur, and Kang, 2018; Wang *et al.*, 2020). Greenglass and Fiksenbaum (2009) showed that employees experiencing higher levels of social support deal with work environmental challenges with proactive strategies. Supportive and not antagonistic behaviors from coworkers towards a job crafter can provide the worker necessary resources needed for job improvement (Tims and Parker, 2020). In their meta-analysis, Wang *et al.* (2020) revealed that positive social factors such as family-work enrichment and support constitute resources for employees to craft their jobs for improved performance. Yan and Su (2013) also found that social support aid employees in utilizing CSE for job involvement and improvement. Hence, we propose that employees with a low level of CSE, in the absence of a supporting impact of PSoS, may not be availed the adequate resources needed for improved job changes.

Proposition 7a: *PSoS positively moderates the relationship between CSE and resource-approach crafting such that CSE-resource-approach crafting relationship will be positive and stronger when PSoS is higher.*

Earlier arguments have shown that employees require higher-level CSE to craft jobs using the role approach. Such employees are willing to take up additional job challenges and increase constructive collaboration to surmount the challenges (Joo *et al.*, 2012). Following the social information processing theory (Salanick and Pfeffer, 1978), individuals adjust their behaviors to their social environment (Chen, Takeuchi, and Shum, 2013; Tims and Parker, 2020), and perceived support from team members is likely to give a clue as to whether the adjustment is needed or not (Tims and Parker, 2020). When evaluating their efficacy, self-

esteem, and locus of control, employees will likely consider their social support before engaging in role-approach job crafting.

Prior studies (e.g., Song *et al.*, 2013) have found positive correlates between CSE and PSoS on the one hand, and (e.g., Audenaert *et al.*, 2020; Li and Takao, 2020; Wang *et al.*, 2020) between PSoS and job crafting on the other hand. Social support from team members motivates and eases employees' efforts to alter their work role boundaries (Wang *et al.*, 2020). Also, McNall, Masuda, Shanock, and Nicklin (2011) posited that individuals with high CSE reported

higher work-family enrichment. This finding implies that higher-level CSE employees are more inclined to positively appraise the social situation for improved job output (Ding *et al.*, 2020). Hence, following the stance of scholars that situational factors are vital mediators in the CSE- performance relationship, we propose that PSoS is a mediating factor in the relationship between CSE and role-approach crafting.

Proposition 7b: *PSoS mediates the effect of CSE on employee role-approach crafting.*

Discussion and Implications

Job crafting is one of the essential ingredients to make employees motivated and engaged in workplaces. Building on the approach form of Bruning and Campion's (2018) model, we argue that role-approach and resource-approach forms of job crafting differentially relate to work engagement under varying individual characteristics and perceived supports. Notably, we propose that, although both role and resource forms of approach job crafting positively relate to work engagement, the relationship of role-approach crafting with work engagement is stronger. Additionally, CSE, a higher-order individual personality trait, relates to work engagement through both forms of job crafting; however, higher-level CSE is likely to strongly relate to role- approach crafting than resource-approach crafting.

Yet, to foster employee engagement through resource-approach crafting, situational factors of perceived supports from within an organization could be enhanced. High levels of perceived supports from an organization (POS), a supervisor (PSS), and coworkers (PSoS) may positively improve the relationship between CSE and resource-approach crafting more than the relationship between CSE and role-approach crafting. Also, employees tend to exhibit role- approach crafting through receiving social support from their colleagues at workplaces. Thus, we contend that organizations should have the right mix of these perceived support constructs to take full advantage of the job crafting potentials of employees in workplaces.

The possible results from the future testing of these propositions will offer exciting insights to organizations. Although Berdicchia and Masino (2018) highlights the dark and

bright sides of job crafting in any organization, it is evident that careful combinations of both personality factors and situational factors can ensure that managers reap the highs rather than the lows of job crafting. As studies (e.g., Rudolph, Katz, Lavigne & Zacher, 2017) keep pointing to the positive outcomes of job crafting and the role it plays in employees' ability to improve work engagement, top personnel in organizations need to be aware of the conditions under which to take advantage

of approach job crafting to drive work engagement. It is noteworthy for organizations to provide

conducive work settings and flexible work environments for employees to exhibit both role-approach crafting and resource-approach crafting in the right mix to drive work engagement.

This paper especially points to how managers can utilize the work conditions of high CSE and perceived supports to drive work engagement. While it is clear that organizations cannot intervene in the provision of higher CSE for employees (other than to recruit people with high CSE) because it is a stable individual characteristic (Zhang, Zhang & Wu, 2014), higher CSE alone does not translate to improved work engagement. Individuals with high CSE will craft jobs more in roles than in resources to be more engaged in their jobs and derive more personal meaning and identity. Unfortunately, these individual needs and motives of employees sometimes go in contrary to the work requirements. To maximize employees' engagement towards performing at the highest level, managers need to increase the work condition of supporting employees so that the resource-approach form of crafting will be augmented (Berg, Dutton, & Wrzesniewski, 2008).

Future Research Directions

Future research could shed more light on the influence of role-approach and resource-approach crafting on other work-related outcomes (e.g., work enjoyment, work conflict, team commitment, organizational citizenship behavior, burnout, and intent to quit) and job characteristics (e.g., skill variety, task variety, task significance, autonomy, and feedback). As work conditions and culture vary across different organizations, understanding these relationships becomes imperative in the light of changing organizational strategies, which impact on the capacities of employees to exhibit either role- or resource-approach crafting. Additionally, it will be interesting to consider the influence of role-approach crafting on resource-approach crafting and vice versa in future research to ascertain how organizations can utilize their scarce resources and capabilities to optimally enrich each form of crafting and manage employees' engagement. To maximize employees' output, more studies of work environment conditions that foster the

right balance of role-approach and resource-approach crafting should be carried out to garner information for developing job crafting interventions.

Conclusion

This conceptual paper highlights the roles of situational and personality factors on employees' development of job crafting behavior. Precisely, the paper builds on the new role-resource approach-avoidance model of Bruning and Campion (2018) to propose the effects of CSE and perceived support constructs on an individual's ability to exhibit either role-approach or resource-approach crafting. Although both forms of crafting relate to work engagement, role-approach crafting is likely to make employees more engaged in their jobs than resource-approach crafting because employees enhance more "meaning of work" and "work identity" from the former than the latter. Importantly, individuals with high levels of CSE, a higher-order personality trait, are likely to exhibit role-approach crafting more than resource-approach crafting. However, perceived supports will moderate the relation between CSE and job crafting such that subordinates who perceive positive support from their supervisor, organization, or coworkers exhibit resource-approach job crafting.

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Organizational Structure and Culture: What Feeds Your Leadership Pipeline?

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Abstract

Organizations across the globe have used the Leadership Pipeline Model proposed by Charan, Drotter, and Noel (2011) as a simple yet proven model for individuals and businesses to strategically develop leadership skills and experience. While moving through the various passages within an organizational structure, members gain the experiences and insights necessary to be confident and competent as they promote upward. The presentation adds another component to the Leadership Pipeline Model by discussing aspects of organizational structure and culture that can “feed” the pipeline. Various aspects, such as selection systems, performance management and feedback mechanisms, promotional processes, and communications, will be discussed that can feed a pipeline with examples.

Comparing the Lifespan and Carbon Footprint of Various Modified Asphalt Binders Based on the Concept of Critical Aging Point

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ABSTRACT

There has been significant emphasis on the carbon footprint of asphalt pavement in an attempt to move toward roads with net zero carbon emissions. Since the materials used to build asphalt roads account for 75% of the CO₂ associated with every lane-mile of pavement, and asphalt binder has one of the highest carbon footprints among materials used in pavements, this study focuses on the carbon footprint of asphalt binder. Among modified asphalt binders, rubberized asphalt binders account for one of the lowest CO₂ equivalents (at the gate) excluding its service life. If the CO₂ associated with asphalt binder is amortized over the life span of asphalt binder, the life span would play a big role, since a longer life span can help reduce the yearly CO₂ equivalent of asphalt binder. Here, we use the concept of critical aging point (CAP) to compare various modified asphalt binders. The objective of this paper is to determine the CAP based on the performance and durability of modified asphalt binder exposed to heat, ultraviolet (UV) radiation, and moisture. To do so, we track the degradation of the cohesion and adhesion properties of each modified asphalt binder during the abovementioned exposures and use the measured degradation to calculate the percentage of loss of life. This in turn will be used to determine the “dead point” referred to as the critical aging point (CAP) of each asphalt binder in terms of hours of exposure to the selected stressor. For instance, an 80% drop in crossover modulus has been used to determine the CAP for neat binder. Here, we use CAP for modified asphalt binders containing crumb rubber, styrene-butadiene-styrene, and polyphosphoric acid. The study outcome provides insights into the contribution of modifiers to an asphalt binder's life span and consequently to the binder's carbon footprint. This supports the movement toward sustainable, long-lasting roads with net zero carbon emissions.

Keywords: asphalt binder, aging effects, thermal aging, UV radiation, moisture damage, crumb rubber, SBS, PPA, DSR, MISTI.

INTRODUCTION

Asphalt binders play a pivotal role in the sustainable development of transportation infrastructure. The longevity and performance of asphalt pavements heavily depend on the aging characteristics of asphalt binder over time. Aging refers to the progressive deterioration of binder properties from exposure to environmental factors such as heat, wind, sunlight, and moisture.

This study focuses on evaluating the effects of various modifiers on delaying thermal aging, UV aging, and moisture damage. Asphalt binder's increasing stiffness with aging causes the asphalt binder to become more brittle, leading to increased potential for cracking [1]. The capability to mitigate in a laboratory the effects of aging caused by environmental factors such as temperature, wind, humidity, and precipitation can contribute to the construction of more resilient and sustainable pavement structures, leading to extended service life and reduced maintenance cost.

The service life of asphalt pavement is determined by environmental factors and the composition of the initial material used [2]. The selection of suitable modifiers for asphalt binder is the key to improving its aging resistance. Materials such as crumb rubber, styrene-butadiene styrene (SBS), and polyphosphoric acid (PPA) have shown potential as modifiers of asphalt binders. These modifiers have unique properties that can enhance the binder's resistance to aging mechanisms, thereby increasing the service life. Crumb rubber, derived from recycled tires, offers the advantages of waste recycling and improved binder elasticity [3]. While SBS and PPA enhance the binder's elasticity, which in turn enhances aging resistance [4]. Investigating the effectiveness of these modifiers in delaying aging is essential for the design and maintenance of sustainable pavement.

Corresponding to laboratory methods that simulate binder aging, there are several test techniques and performance indicators for assessing the degree of binder aging. These tests include rheologic indicators based on the asphalt binder's complex modulus and phase angle. Dynamic shear rheometer (DSR) tests were performed to assess the stiffness characteristics of the modified binders after various aging conditions. The DSR test measures the complex modulus and phase angle of binders, providing insights into their viscoelastic properties. Additional tests of the activation energy, a healing index, and the capability for moisture resistance can be used to evaluate the energy dissipation and recovery capabilities of a modified binder before and after aging.

METHODS

Materials

The bitumen used for this study was PG 64-22, supplied by HollyFrontier Company, Tempe, AZ. Bitumen that is not modified is referred to as neat bitumen. This study considers three modifiers for bitumen: crumb rubber, SBS, and PPA.

Sample Preparation

To prepare modified asphalt binder, specific procedures were followed for each modifier. Neat asphalt binder has no modification. To prepare an asphalt binder modified with crumb rubber, crumb rubber particles in their original state were blended and sieved, using granules passing sieve N.30 and retained on sieve N.50. The crumb rubber was added by 8% dosage of the neat binder weight and mixed for 30 min at 3000 rpm and 175°C [5]. For SBS, a dosage of 3.5% was added to the base binder and mixed for 60 min at 3000 rpm and 175°C [6]. For polyphosphoric acid (PPA), a dosage of 0.5% PPA was added to the base binder and mixed for 30 min at 2000 rpm and 150°C [7].

Laboratory Aging

- Thermal Aging

To simulate the aging of asphalt binder that occurs during the production and construction of asphalt pavement (called short-term aging), a rolling thin-film oven (RTFO) test was performed following the guidelines of AASHTOT240. RTFO aging was carried out at the standard testing temperature of 163°C for 85 minutes. Additionally, to simulate the aging that takes place while the asphalt pavement is in service (called long-term aging), a pressure aging vessel (PAV) test was conducted following AASHTOPP1. The residue from the RTFO aging was transferred to individual pans with 50 gram of binder and subjected to PAV aging for 20 hours, using the standard aging pressure of 2.10 MPa and a temperature of 105°C [8].

- Ultraviolet (UV) Aging

UV aging involved subjecting the samples to controlled UV radiation for 100 hours at a radiation intensity of 0.89 W/m² and a reduced temperature of 45°C. This should simulate the degradation caused by prolonged exposure to sunlight [8].

Dynamic Shear Rheometer (DSR)

An Anton Paar MCR 302 (DSR) was used to measure the stiffness and viscosity of the binder. This was done following ASTM D7175, using an 8-mm spindle and a gap of 2 mm. An aging index based on the crossover modulus, an index of healing capability, an aging index based on activation energy, and the moisture-induced shear-thinning index (MISTI) were found to assess the aging resistance of each modifier. Each of these measures is described below.

- Aging Index Based on the Crossover Modulus

To evaluate the elastic and viscous properties of an asphalt binder after being aged with RTFO, PAV, and UV, the complex modulus (G^*) was measured using the DSR. Frequencies ranging from 0.1 to 100 rad/s were applied at a strain rate of 0.1%. The complex modulus (G^*) was determined; it represents the ratio of measured stress to strain. Additionally, a rheological aging index based on the crossover modulus was calculated. The crossover modulus refers to the value of the complex modulus at which the phase angle is 45 degrees. The reduction over the crossover modulus was calculated using Equation 1.

$$G_{\max}^* = \frac{\tau}{\gamma_{\max}} \times 100 \quad \text{Where } \gamma_{\max} = 1 \frac{\theta r}{h} \quad \tau_{\max} = \frac{2T}{\pi r^3}$$

τ_{\max} = maximum shear stress

γ_{\max} = maximum strain

T =

maximum

torque

applied

0

=

deflection

angle

h = height of

bitumen

specimen r =

radius of

bitumen

specimen

(2)

Aging Index Based on the Crossover Modulus =

$$\frac{|G_{\max}^* - G_{900}^*|}{G_{\max}^*} \times 100$$

(1)

- Index of Healing Capability

Healing properties were assessed by conducting a time-sweep test using the DSR. At a strain of 5% and a temperature of 25°C, the samples were prepared and tested until the complex modulus (G^*) reached 50% of its initial value. Afterward, there was a resting period of 900 seconds at 25°C, and the samples were then retested using the same procedure as in the initial cycle. The healing index was calculated using Equation 2. This quantified the recovery capability, which was used as an aging indicator [9].

$$\text{Healing Index} = \frac{(G_{\max}^* - G_{900}^*)}{G_{50\%}} \times 100$$

G_i = G^* at initial loading cycle

G_{900} = G^* after 900s rest period

$G_{50\%}$ = G^* at 50% of initial value

- Aging Index Based on Activation Energy

Another index that is used to capture the degree of aging is known as the activation energy test.

An increase in activation energy indicates an increase in the degree of aging. Polar molecules increase with aging, leading to increases in the intermolecular forces within the bituminous mixture and consequently a higher aging index [10]. Zero-shear viscosity was measured using the DSR at three temperatures: 50°C, 60°C, and 70°C. The change in the activation energy after aging 23 was measured and used as an index for aging, calculated using Equation 3.

$$\ln \eta = \ln A + \frac{E_f}{R} + \frac{1}{T}$$

η = bitumen's viscosity (Pa·s)

A = constant

R = ideal gas constant (8.314×10⁻³ kJ mol⁻¹ K⁻¹)

T = temperature (kelvin)

E_f = activation energy (KJ/mol)

Aging Index Based on the Crossover Modulus =

$$\frac{\ln \eta_{50} - \ln \eta_{70}}{\ln \eta_{60} - \ln \eta_{70}} \times 100 \quad (3)$$

- Moisture-Induced Shear-Thinning Index (MISTI)

To evaluate the susceptibility of the interface between bitumen and stone to deterioration caused by moisture, a rheometric measurement called MISTI was performed using the DSR. This measurement gives an indication of the level of moisture resistance for each bitumen type. Shear rates ranging from 0.1 to 100 1/s were applied, and the change in viscosity was monitored. Neat binder was tested at 55°C; all other modified binders were tested at 60°C to keep the initial viscosity at the targeted range (1000 Pa. s.). The change in shear-thinning slope after conditioning is a reliable indicator of the effect of water on the bitumen–glass beads interface. A MISTI value closer to 1 indicates better resistance to moisture damage [11]. Two samples for each binder were prepared. Dry samples remained unconditioned, while the wet samples were conditioned in distilled water for 24 hours at a temperature of 60°C. The MISTI value was calculated using Equation 4.

$$MISTI = \frac{\eta_{dry}(\dot{\gamma})}{\eta_{wet}(\dot{\gamma})} \quad (4)$$

RESULTS AND ANALYSIS

Two replicates were tested for each asphalt type, and the standard deviation was calculated based on the variance between the replicates. Samples were prepared and tested using the DSR to calculate the aging index based on the crossover modulus, the index of healing capability, the aging index based on activation energy, and the moisture-induced shear-thinning index (MISTI). Each test had its own standard deviation to assess the reliability of the results.

Aging Index Based on the Crossover Modulus

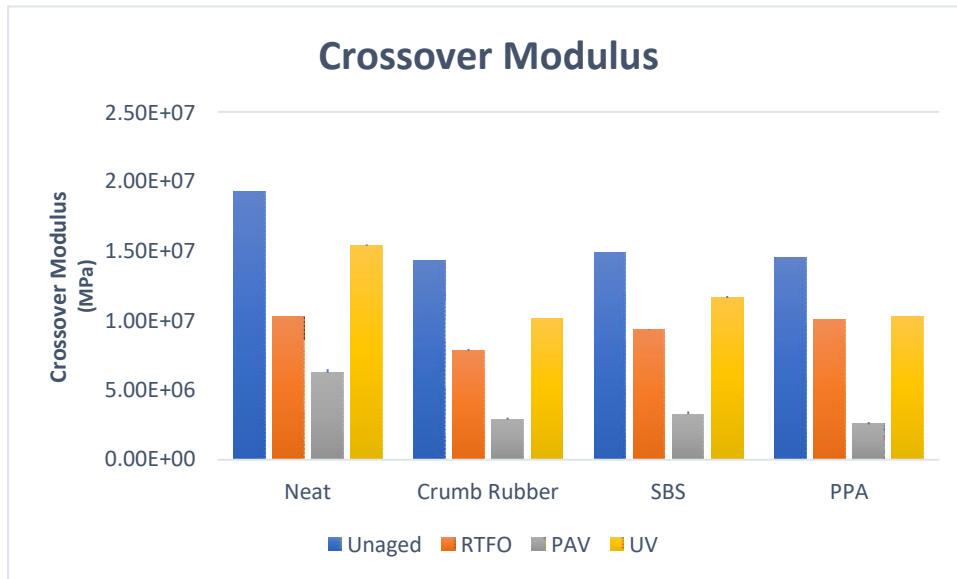


Figure 1. Crossover Modulus After Aging

The aging index based on the crossover modulus was determined by measuring the change over the complex modulus at a phase angle of 45 degrees, which represents what is known as the crossover modulus [12]. The degree of aging in an asphalt binder could be quantified based on changes in the crossover modulus, offering a reliable metric to assess the material's progression of aging. Asphaltene oxidation leads to the formation of nanoaggregates, contributing to polydispersity and a reduction in the crossover modulus [13].

To capture the crossover modulus at specific aging stages, measurements were taken at 6°C before and after RTFO aging, at 28°C after PAV aging, and at 10°C after UV exposure.

These data points provided valuable insight into the aging behavior of the asphalt samples under different environmental factors, facilitating a comprehensive understanding of their performance characteristics over time. Figure 1 shows the crossover modulus for the five scenarios in the

original state as unaged and after being aged with RTFO, PAV, and UV. All modifiers (crumb

rubber, SBS, and PPA) decreased the crossover modulus.

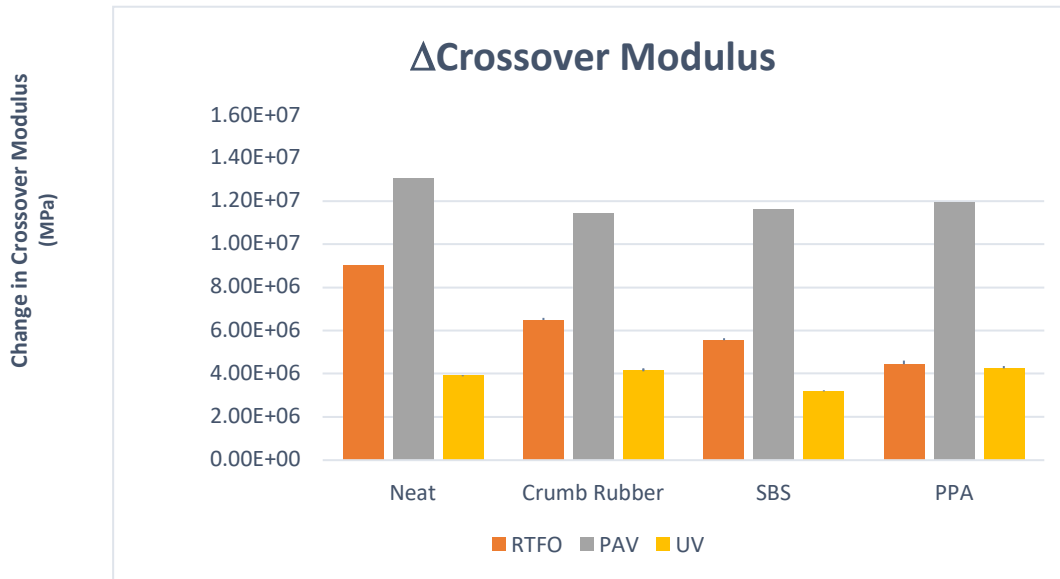


Figure 2. Crossover Modulus Reduction After Aging

Figure 2 shows the crossover modulus after the Rolling Thin Film Oven (RTFO) aging process, asphalt modified with PPA, SBS, and crumb rubber led to a smaller reduction in the crossover modulus of the asphalt compared to the unmodified asphalt. Among all the modifiers, the crumb rubber modified binder showed the best performance in preserving the crossover modulus compared to the unmodified asphalt after RTFO aging. After PAV aging, the modifiers crumb rubber binder performed better than all other modifiers and the neat asphalt in terms of reducing the reduction in crossover modulus. SBS and PPA have also mitigated the reduction of crossover modulus. On the other hand, the results after UV radiation exposure indicate that SBS performed the best among the studied modifiers in preserving the stiffness and mechanical properties of the asphalt after UV aging based on the reduction in the crossover modulus. In terms of UV aging, both crumb rubber and PPA modified binders showed a similar performance to the unmodified asphalt binder.

Healing Index

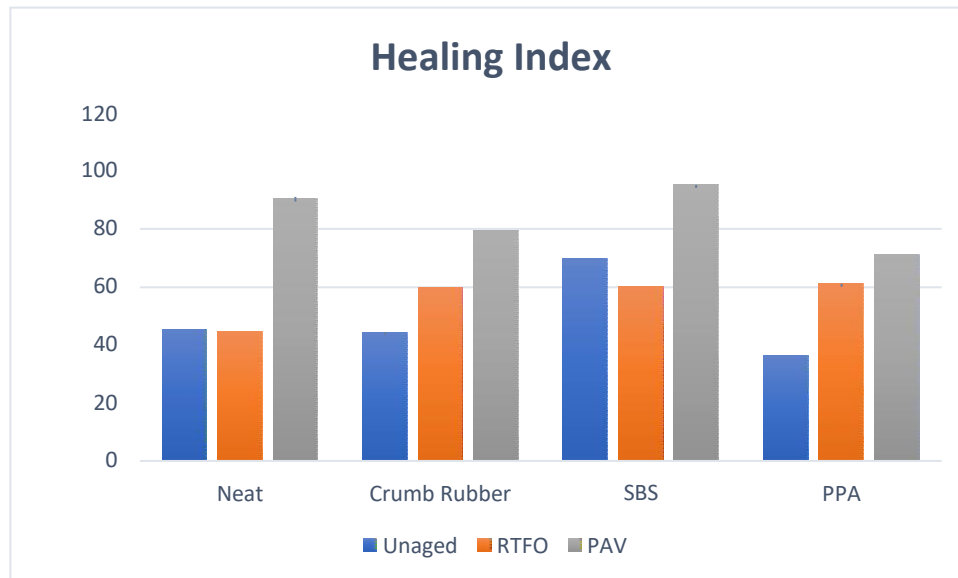


Figure 3. Index Based

Figure 3 shows the healing index for unaged, RTFO, and PAV samples. The values of the healing index for the unaged samples provide insight into the materials' inherent self-healing capabilities in their original states. SBS displayed the highest unaged healing index at 70, indicating strong self-repairing properties. Neat, crumb rubber, and PPA had healing index values of 45, 44, and

36 respectively. Subsequently, we investigated the materials' healing performance after undergoing RTFO aging. SBS had an RTFO-aged healing index of 60, showing consistent self-healing abilities even after RTFO aging. Crumb rubber and PPA matched the performance of SBS with healing index values of 60 and 61, respectively. Neat and exhibited improvements in their RTFO-aged healing index values, reaching 45. However, the most significant enhancement in healing performance was observed when the materials underwent long-term aging, represented by PAV. SBS demonstrated remarkable self-healing capabilities with a PAV-aged healing index of 95, signifying a substantial improvement over both the unaged and RTFO-aged conditions. Neat asphalt also showed a high PAV-aged healing index of 91. Crumb rubber, and PPA displayed aging index values of 80, 84, and 71, respectively.

The healing capacity is related to aromatic content, and self-healing ability will increase with increases in the aromatic content [15]. In short, SBS stands out as a promising candidate for applications that demand exceptional self-healing properties, particularly after undergoing PAV aging. The choice of the most suitable material depends on the specific application requirements, and further investigations are essential to ensure optimal performance in real-world scenarios. Understanding the healing index values of these materials provide valuable insight into their long-term durability and performance, enabling the selection of appropriate materials for diverse engineering and construction applications.

Aging Index Based on Activation Energy

The activation energy changes from aging. In the unaged state, all materials exhibit relatively similar values for activation energy, ranging from 92 to 94 kJ/mol. With aging, both RTFO and PAV processes have varying effects on activation energy. For RTFO-aged samples, the activation energy values increase slightly, ranging from 94 to 96 kJ/mol. The rheological activation energy increases when a bituminous mixture is subjected to short-term aging [16]. PAV aging shows a more pronounced impact on activation energy. For the PAV samples, the values for activation energy increase further, ranging from 96 to 100 kJ/mol.

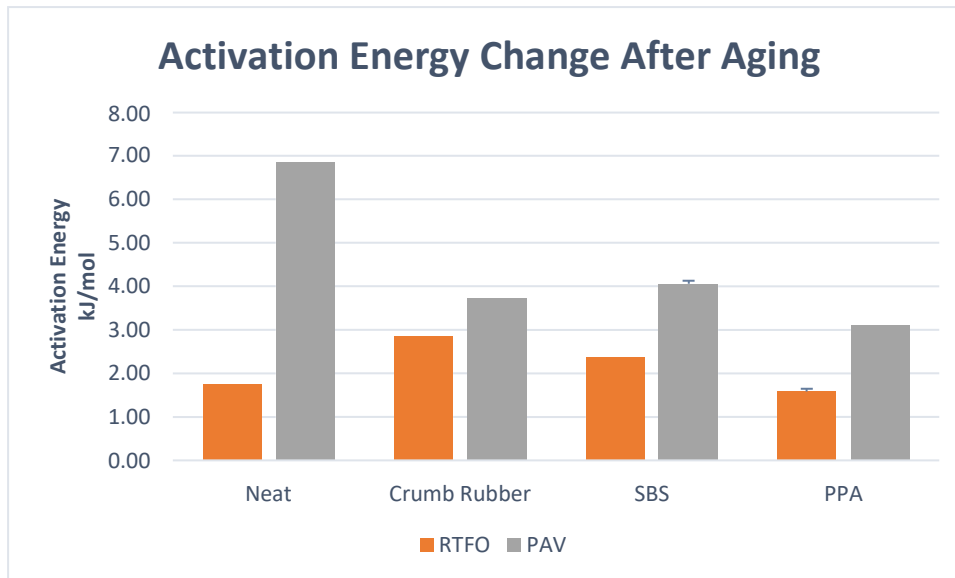


Figure 4. Activation Energy Change After Aging

Figure 4 shows the change in the activation energy after thermal aging (both RTFO and PAV). Asphalt modified with PPA asphalt perform better than the other asphalt in the study after RTFO aging. However, after PAV the neat asphalt was the highest in term of activation energy increase compared to the modified asphalt. Indicating less resistance to thermal aging. SBS perform better than the PPA and the crumb rubber.

Table. 1 Activation Energy-Based Aging Index

Aging Method	Neat	Crumb Rubber	SBS	PPA
RTFO	1.9	3.1	2.6	1.7
PAV	7.4	4	4.3	3.3

Table 1 shows the aging index based on activation energy. After RTFO aging, the values for the activation energy aging index range from 1.7 for PPA to 3.1 for the crumb rubber. The neat and all the other modifiers exhibit similar reactions after aging by having the activation energy raised after each aging process. The increase in the activation energy is clearer after PAV aging. Crumb

rubber, SBS, and PPA all showed less increase in activation energy, indicating that they are less susceptible to long-term aging represented by temperature and wind.

Moisture-Induced Shear-Thinning Index (MISTI)

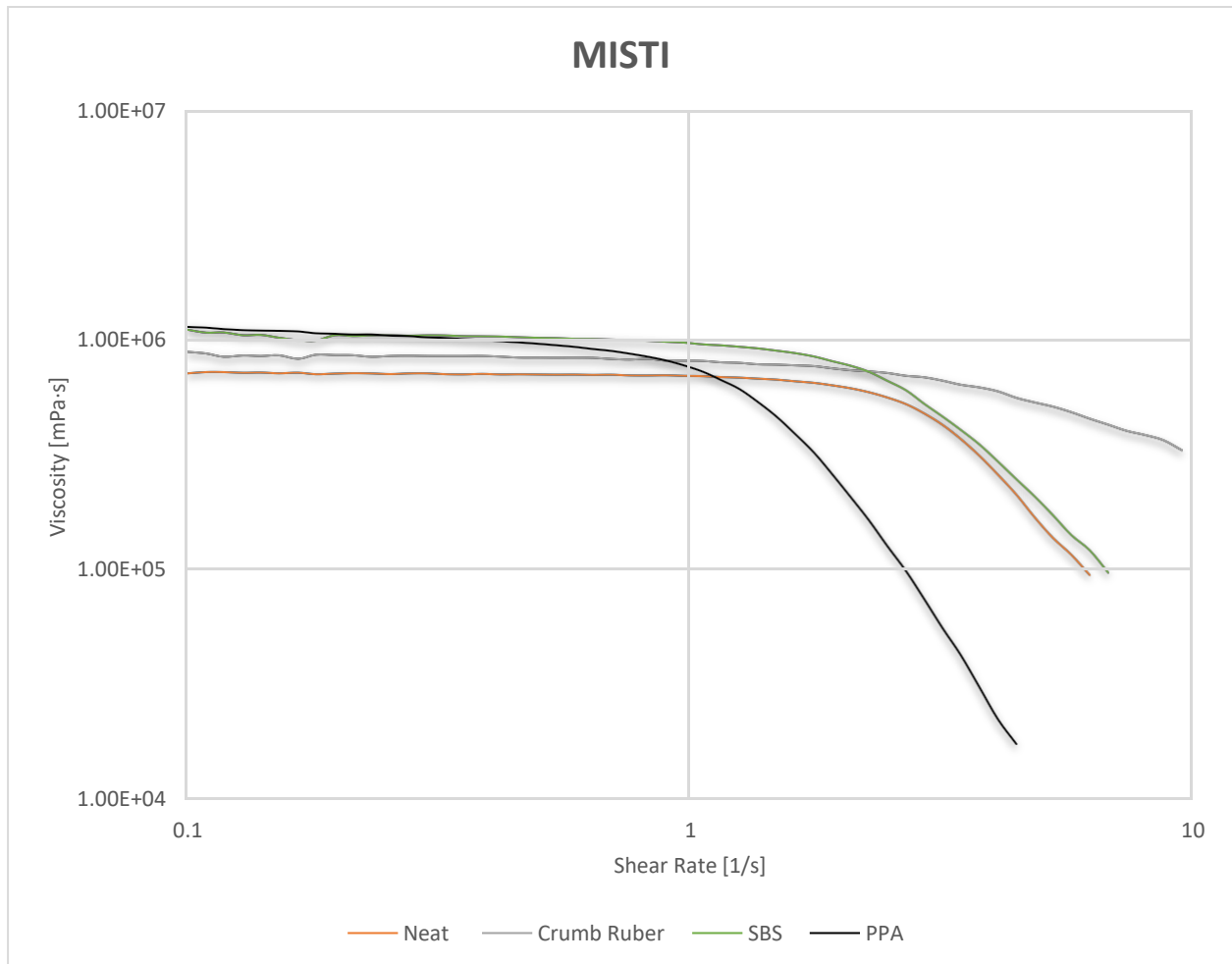


Figure 5. Onset of Shear Thinning and Shear Thinning Rate

The shear-induced thinning test was used to measure viscosity of the neat binder and modified binders [11]. Figure 5 shows the onset of shear thinning, and the shear thinning rate of each scenario in dry condition. The highest slope indicates higher interaction with asphalt matrix.

Crumb rubber shows the highest interaction in dry condition which can be attributed to the swelling of rubber and enhanced binding within the rubber-bitumen interaction zone.

After being conditioned in distilled water for 24 hr. at a temperature of 60C, wet samples are used to capture the slope change between the unconditioned (Dry) and conditioned (Wet)

samples. The MISTI value is then calculated based on the change after being conditioned. A MISTI value closer to 1 means less change occurred at the interface due to the water conditioning, and this in turn means better resistance to moisture damage [11, 17].

Table 2. Slope and MISTI Values

Sample Condition	Neat	Crumb Rubber	SBS	PPA
Dry	1.36	4.40	1.55	0.87
Wet	0.81	1.14	1.03	0.72
MISTI	1.67	3.86	1.51	1.21

Table 2 shows that neat binder has a MISTI value of 1.67, while SBS and PPA have MISTI values of 1.51 and 1.21, respectively. This means that the SBS and PPA would potentially have a higher moisture damage resistance than the neat binder. On the other hand, the crumb rubber has a higher MISTI value than the neat, which indicates less ability to resist the moisture damage caused by environmental factors.

CONCLUSION

The purpose of this paper is to compare the critical aging point (CAP) of modified asphalt binders as a means of comparing their yearly CO₂ equivalent. If CO₂ associated with asphalt binder is amortized over the life span of asphalt binder, a longer life span can help reduce the yearly CO₂ equivalent of asphalt binder. Here, we evaluated the lifespan of each scenario by tracking the degradation of their performance and their durability when exposed to thermal, ultraviolet (UV) radiation, and moisture. A summary of the results is discussed by each test type:

- Crossover Modulus Aging Index: SBS demonstrated the best aging performance, displaying excellent resistance to changes in stiffness even after long-term thermal aging. While neat asphalt binder had the weakest aging resistance. In terms of UV aging, SBS modified binder had the best performance among the ones studied, however, the improving effects of other modifiers (crumb rubber and PPA) against UV aging were negligible.
- Healing Index: SBS stands out as a promising candidate for applications that demand exceptional self-healing properties after thermal aging. On the other hand, polyphosphoric acid (PPA)-modified binder consistently exhibits the lowest values of the healing index among all the tested binders, implying that it has comparatively

weaker self-healing properties compared to the other modified asphalt binders.

- **Activation Energy:** The test results demonstrate that the PPA-modified binder exhibited the best performance in terms of activation energy after short-term aging, indicating stronger resistance to aging. Conversely, crumb-rubber-modified binder displayed the worst performance after short-term aging which can be attributed to the swelling of rubber particles absorbing binder light compounds. This in turn may have promoted loss of light compounds both through volatilization [18] and rubber uptake [5]. Moreover, the modifiers crumb rubber, SBS, and PPA showed better resistance to long-term thermal aging effects, as indicated by a smaller increase in activation energy after PAV aging, compared to the neat asphalt.
- **Moisture Susceptibility:** The results suggest that the SBS- and PPA-modified binders have better resistance to moisture damage compared to neat binder, while the binders modified with crumb rubber showed decreased resistance to moisture damage.

Overall, based on the study results, SBS appears to be one of the best-performing modifiers of asphalt binder among the ones studied, displaying good life span based on the crossover modulus and activation energy, self-healing capabilities, and resistance to moisture damage. However, the CO₂ equivalent of SBS is higher than that of other modifiers. It should be noted that the CO₂ equivalent values for crumb rubber, PPA, SBS, and neat asphalt 0.745, 0.786, 0.918, and 0.766, respectively as reported by the Asphalt Institute [19]. Based on the study results, the lifetime of the above-mentioned asphalt binders is quite different. To properly compare the CO₂ equivalent values, the variation in lifetime should be considered.

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AUTHOR CONTRIBUTIONS

Authors contributions are as follows. Abdullah Aloraini developed the manuscript and conducted the tests and data collection, Kamil Kaloush provided guidance with the conduct of the study and the manuscript. Mahour Parast assisted with data analysis and writing. Elham Fini assisted with conceptualization and interpretation of observations.

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A Data Wrangling Process for Big Data Enrichment in Social Internet of Things

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Abstract

Data wrangling refers to the process of preparing potentially large and complex data sets for further analysis or manual examination (Koehler, 2017). Since data wrangling involves multiple steps and functions, a process of extracting, formatting, and cleaning data is required to produce the desired data for further exploration and analysis (Furche, 2016). In addition to data transformations, enriching existing data with new or secondary datasets can uncover new analytical insights. An enhanced data wrangling process can help provide transparency and improve users' experience. In addition, social network techniques and methods can be applied to potentially aid in the development of new analytical approaches. This research aims to develop a new data wrangling process to enrich existing data related to multiple devices and users of Social Internet of Things (SIoTs). SIoTs can foster interactions between users to create new services and applications due to their location and context aware capabilities (Ortiz et al., 2014). Big data related to users' situational needs, preferences, and other social aspects are collected through smart devices and disseminated with SIoTs. Location information is a key data source in emergencies, such as disaster recovery. Recent research has investigated the usage of social data for coastal resilience decision making (Lee et al., 2022). Previous literature has examined new data classification with machine learning framework to manage a high number of constraints and nodes (Farooq, 2023). In addition, the ownership object relationships have been statistically analyzed to understand the probability distributions of the distance between nodes (Nitti et al., 2015). However, there are limited studies investigating how a data wrangling process can be leveraged to help enrich and analyze the social data of SIoTs. Smart devices and social media data from X (formerly Twitter) will be examined using Python techniques to answer the following research question: How can a data wrangling process enable the analysis of networks in a social internet of things? We adapt the principles of data wrangling and data mining to explore a new data wrangling process that can incorporate multiple users and social datasets. This study can help provide understanding into how big data can be managed for applications with a large network of users. **Keywords:** social internet of things, big data, data wrangling process, business analytics

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Decision-making: Water for Sustainability of Urban Areas

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Abstract

Sustainability is to continue a certain defined behavior indefinitely. Sustainable living might also be defined as a life where the basic rights of existence are respected. “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Definition by World Commission on Environment and Development (the Brundtland Commission, 1987). Water is our largest natural resource and only 3% is freshwater and 1/3 of freshwater is accessible. Most freshwater is used for growing crops and livestock and we have a finite water supply and no substitute for water. Sustainability of urban water is our ability to meet present water needs while planning and implementing programs and projects to assure water for future generations. The world is not short of water; it only lacks accessible potable water. Sustainability of drinkable water is a local concern as well as a community, national, and global issue. Water should be foremost in urban planning. This research explores the concept that water is not scarce in most urban settings; management of water is. Each water user, community organization, businessperson and governmental official must buy-in to immediate and long-term solutions.

Beyond Trial and Error: Automating Delay Generation in Assembly with Algorithmically Calculated For-Loops

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Abstract

This paper introduces an automated approach to generating delays in assembly language, traditionally accomplished through manual estimation of loop counts. The proposed method aims to streamline this process by leveraging algorithmically calculated for-loops. Unlike conventional trial-and-error approaches, this method utilizes precise calculations based on the cycle counts of various instruction opcodes of the microprocessor. Using this data, the algorithm determines the optimal configuration of nested loops, including the iteration count for each loop, and strategically inserts the necessary no-operation opcodes (NOP(s)) within the inner-most loop. Multiple constraints and assumptions are applied in creating the for-loops to facilitate easier calculations. The paper delves into the intricacies of this novel methodology, providing insights into its implementation and highlighting its advantages over manual loop-based approaches. This automated approach not only enhances efficiency by eliminating the guesswork associated with traditional delay generation techniques but also offers easy adaptation to any assembly language.

Local Sports Commissions: Local Players in Sports Tourism and Community Engagement

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Abstract

The purpose of this paper is to shed additional light on the impact of local sports commissions in communities. It explores resources and methods used by local sports commissions (n=56) that are members of the U.S. national organization Sports ETA to improve community involvement, encourage (all ages) participation in sports and increase the potential of sport tourism as a vehicle for sustainable economic growth. According to Higham (1999), even small-scale sports events can contribute to tourism development and sustainability, especially when viewed through the context of three pillars of sustainability: economic, social, and environmental (Gibson et al., 2012). Also, Clement (2023) states that the sports industry helps to “improve the health and economic vitality of communities across the country” (para.12). Using information available on Form 990s (tax returns required for non-profit organizations), organizational websites and social media, this paper offers insights into local sports tourism by comparing the various approaches used by local commissions to promote sports tourism and contribute to its development and sustainability. The paper also highlights the important role that sports commissions play in boosting the economic vibrancy of host towns by arranging sporting events.

Keywords: sports tourism, local sports commissions, sustainability

Resources

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The Process of Negotiation

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Abstract

This research explores the concept of negation and discusses the limitations in the process of negation. In addition, the study examines the different bargaining positions that can take place during negotiation, such as conflicts and legal issues. Furthermore, the research investigates the different phases in the bargaining positions. The final part of the study concentrates on ethical and legal aspects of negotiation.

**Issue Specific Trust in Science: Exploring the Linkages between
Public Trust in Scientific Information on Climate Change and
Attitudes towards Science across Employment Status, Education,
and Gender in the Post Pandemic World**

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Detailed Abstract

Introduction

Science has the potential to improve the quality of human lives by addressing and mitigating the harmful impacts of climate change. Numerous environmental, social, and economic threats are posed by climate change to nations across the globe. However, the public concern about the severity of climate change is low. Many people are misinformed about the science behind climate change. According to a recent globally representative survey, just 56% of people around the world think that climate change poses a “major threat” to life in their country; with an additional 15% claiming to be unfamiliar with the issue entirely (Clements et al, 2021).

Distrust in science, and negative attitudes towards science plays a key role in climate change denial (Merkley, 2020; Motta, 2018). Understanding public perception about the causes of global warming, and public trust in climate change is important for informing policy to mitigate and adapt to the effects of climate change. For example, high levels of public concern about climate change could create an urgency among policymakers to take effective action and develop climate change mitigation and adaptation strategies.

Although distrust in science is seen as shaping public perceptions about global warming and climate change, there has been a recent resurgence in public trust in science attributable to the COVID-19 pandemic. Studies have shown that during the COVID-19 pandemic, acceptance of protective measures depended on the trust in science (Dohle, Wingen, and Schreiber 2020; Battiston, Kashyap, and Rotondi 2021). While the COVID-19 pandemic has highlighted the importance of trust in science and evidence-based decision-making, the extent to which the trust in science spills on issues such as climate change, and global warming has garnered the attention of scholars worldwide. A recent study has found that trust in medical experts’ handling of the COVID-19 pandemic is associated with increased climate change acceptance worldwide (Motta and Benegal, 2023). Perceiving science as essential to

improving the quality of human life is also associated with greater trust in science (Benson-Greenwald et al 2023).

Building on recent research on trust in science, this study contributes to the existing literature in three ways. First, this study posits that trust in science may be issue-specific, meaning that individuals who trusted scientific information and guidance related to the pandemic may not necessarily extend the same level of trust to other issues, such as climate change, global warming, artificial intelligence, genetic modification of plants etc. While this issue of climate change and COVID-19 pandemic share some similarities in their global impact, and reliance on

science; they differ in their temporal dynamics. As a result, the trust in scientific information related to climate change compared to the trust in scientific information related to pandemics may differ. Second, we consider multiple facets of public perception of science such as the perception that science contributes to the well-being of the society, perception that benefits of science outweighs harmful results, positive perceptions of government investments in science, perceptions about colleges and universities, and trust in university professors etc. We recognize that universities occupy a central position in the process and framework of science, by educating future scientists, by conducting research, and by communicating science. Universities are the hubs of innovation, and progress, contributing to the betterment of society. Lastly, we consider the differences in public perception of trust in scientists about climate change across employment status, particularly focusing on the self-employed. Less is known about how self-employed perceive science, and particularly scientific information on climate change. Self-employed often face economic hardships, and the pandemic led to more uncertainties for the self-employed (Patel and Rietveld, 2020). It is important to understand the perceptions of self-employed about trust in science on climate change, and see how these perceptions differ from public, and private employees. We also explore the differences in perceptions of science, and trust in scientific information on climate change across socio-demographics, especially, gender, education levels, and so on.

In this study, we ask the following research questions:

- 1) To what extent trust in scientific information on climate change is associated with perceptions towards science, and confidence in scientists, and university professors?

- 2) Does this association vary across demographics, employment status, education levels, gender, and so on?
- 3) What is the association between views on global warming and trust in scientist's statements on global warming?
- 4) Is the trust in science issue-specific? Specifically, does the strength of correlations between trust in scientific information on specific issues such as climate change, vaccines, artificial intelligence, genetic modification of plants vary?

Data and Measures

To address our research questions, we utilize the data from "Understanding America Study" (UAS) survey conducted by the Center for Economic and Social Research (CESR), at the University of Southern California. The survey was conducted in January and February of 2023. This survey was made available to 10091 participants. Of those 10091 participants, 7579 completed the survey and are counted as respondents. Of those who are not counted as respondents, 57 started the survey without completing it and 2455 did not start the survey. The overall response rate was 75.11%. The survey asked questions on confidence in scientists, confidence in university professors, perceived benefits of scientific research, perceived prosocial quality of science, perceptions of government investments in scientific research, perceived trust in scientific information on climate change, perceived trust in scientific information on artificial intelligence, perceived trust in scientific information on vaccines, trust in social media websites, along with socio demographics such as gender, age, education, employment status, race etc.

The dependent variable for our first research question is trust in scientists on climate change. Respondents were asked, how would you trust scientists for information on climate change. The responses were 1=completely distrust, 2=mostly distrust, 3=neither trust nor distrust, 4=mostly trust, 5=completely trust. The independent variables are confidence in scientists, confidence in university professors, perceived benefits of scientific research, perceived prosocial quality of science, perceptions of government investments in scientific research. Several socio- demographic variables will be used as control variables. The dependent variable for our second research question is views on global warming. The responses to this question were 1=caused by human activities, 2=caused by natural changes, 3=global warming is not happening, 4=none of these. The independent variable is trust on scientists' statement on global warming. The responses to this question were: 1=not sure, 2=not at all, 3=a little, 4=a moderate amount, 5= a lot, 6=completely.

Methodology:

To begin with, we will be examining the frequencies of key variables in our study. We will be examining the socio demographic characteristics of our sample. For our first research question, we plan on performing multiple regression analysis (OLS) to examine the effects of independent variables: confidence in scientists, confidence in university professors, perceived benefits of scientific research, perceived prosocial quality of science on our dependent variable, trust in scientific information on climate change. Two regression models will be estimated. The sociodemographic variables (gender, education, employment status) will be entered in the first model as binary/dummy. All the other variables related to attitudes and perceptions about science will be entered in the second model. Comparing the R-squared values of the regression models will show the degree to which addition of the variables increase the variation explained in trust in scientific information on climate change. For our second and third research questions, we plan to conduct Chi-squared test, and bivariate correlations respectively.

Preliminary Findings

60% of our sample are women; 40% are men. 54% of our sample is currently working (see Table 1). 65% of our respondents agree that science is essential to improve the quality of human lives (see Table 2). 56% of the respondents mostly trust, or completely trust scientists on climate change (see Table 3).

Table 1. Frequencies of Key Demographic variables

	<u>N</u>	<u>Percent</u>
Gender		
Female	4557	60
Male	3078	40
Labor Force Status		
Currently working	4092	54
On sick or other leave	39	1
Unemployed - on layoff	71	1
Unemployed - looking	355	5
Retired	1649	22
Disabled	438	6
Other Labor Force Status	438	6
Mixed	549	7
Employment Status		
Government	822	11
Private (for profit)	2445	32
Private (no profit)	631	8
Self-employed	548	7
Missing	3190	42

Table 2: Frequency of Key Dependent variable

Trust in Scientists about Climate Change		
	N	Percent
Completely distrust	589	8
Mostly distrust	781	10
Neither trust nor distrust	1885	25
Mostly trust	3372	44
Completely trust	939	12
Missing	70	1

Table 3: Frequency of Key Independent variable

Scientific research is essential to improving the quality of human lives		
	N	Percent
Disagree strongly	100	1
Disagree somewhat	306	4
Neither agree nor disagree	1205	16
Agree somewhat	2534	33
Agree strongly	2453	32
Missing	1038	14

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Women's Lived Experiences in Leadership

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Abstract

Women who lead often find themselves at the crux of paternal systems. They seek to lead with intentionality and often experience tension in doing so. This workshop session is based on a narrative inquiry study focused on the lived experiences of women leading in turnaround school settings. This study explored several key questions that illustrated feminist ideas about leadership by showcasing the stories of women who are passionate about change and how it impacts their stakeholders. The study sought to bring to life the experiences of women who are leading for equity and facing barriers in the environments in which they find themselves, such as a lack of agency, masculine approaches, and incongruent practices. Armed with courage, commitment and care, these women reported the challenges of creating warm and collaborative environments for those they serve to thrive. This session will highlight these stories, and participants will engage in activities designed to consider how we might collectively move forward together across multiple disciplines. We will consider our own authentic stories, as well as collectively consider what we want to bring to our various fields of practices to continue to create more equitable spaces.

Assessing the Effectiveness of a Virtual Service-Learning Project on Ageism and Social Competence

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Abstract

This study aimed to assess the impact of a virtual intergenerational service-learning project on undergraduate students' ageism attitude towards older adults and on older adults' social competence. Students were randomly assigned to two groups: the service-learning group and the non-service-learning group (spring 2021 semester). Service-learning students (n=20) were paired with older adults for a weekly virtual conversation of at least 30 minutes per week for eight weeks. Pretest and posttest surveys were used to assess the change in students' ageist attitudes towards older adults. Paired samples t-test was used to assess the change in older adults' social competence levels. Our findings suggest that compared with the students in the non-service-learning group, students in the service-learning group experienced a greater decrease in ageism score after project completion. Service-learning modestly but significantly increased older adults' social competence level (p=.041).

Keywords: service-learning; intergenerational; ageism; virtual service-learning; social competence

Contribution to the Field:

1. This study demonstrates how a virtual intergenerational service-learning project benefits both undergraduate college students and older adults.
2. The benefit for undergraduate students consists of reduced ageistic attitudes toward older adults. The benefit for older adults consists of increased older adults' social competence level.
3. This study corroborates the findings from previous studies suggesting that intergenerational service-learning, either face-to-face or virtual, reduces ageism bias. It is the first study to assess the impact of virtual service-learning on social competence of older adults.

1. Introduction

The US Census Bureau reported that the overall US population is aging, mostly due to in-

creased life expectancy over the last four decades. By 2060, nearly 25% of the US population will be 65 years or older, compared with 15% in 2016, the number of older adults ages 85+ years will triple, and an additional half-million individuals will be centenarians (Bureau, 2020). As people live longer, they are more likely to need frequent visits to health care providers to treat their multiple comorbidities (Bishop et al., 2022; Kadambi et al., 2020).

Furthermore, as people age, they may have reduced or limited social activities and social connections due to loss of mobility, and/or loss of loved ones and friends, which may lead to social isolation (an objective measure of social connections) and/or loneliness (“a subjective feeling of being alone”) (Li et al., 2023). Social isolation and loneliness have been reported as a global pandemic among older adults and found to be associated with adverse physical and mental health outcomes, lower quality of life, high rate of emergency visits, high primary mortality (Barnes et al., 2022; Li et al., 2023; Park et al., 2020; Sneegas, 1985), and depleted perceived social skills or social competence, which is defined as “confidence in social abilities in a given situation”(Li et al., 2023; Sneegas, 1985), page 16. More precisely, social competence refers to a person’s capacity to engage in fulfilling social interactions and relationships (Özdoğan et al., 2023).

Social competence empowers individuals to obtain social support and increase social networks (Özdoğan et al., 2023). As such, individuals with a high level of social competence are more likely to be able to build strong social networks and they are less likely to experience loneliness (Özdoğan et al., 2023). Social isolation and loneliness were more prevalent during the COVID-19 pandemic due to several months of mandatory confinement and quarantine (Cocuzzo et al., 2022; Li et al., 2023; Smith et al., 2020), and older adults were the most affected population (Dahlberg, 2021; Hwang et al., 2020).

Another issue associated with aging is ageism, defined as “a stereotype, prejudice, and discrimination based on age” (Levy et al., 2022). According to this definition, everyone can be a victim of ageism, regardless of age, but older adults are more prone to experience ageism and the

COVID-19 pandemic has played a major factor to the increasing ageism trend worldwide (Levy et al., 2022; Lytle & Apriceno, 2023; Sutter et al., 2022).

Since an aging population will impose additional need for healthcare services, healthcare providers and administrators need to be culturally competent regarding their interactions with the older adult population to avoid ageism bias. Therefore, an adequate awareness of ageism bias through training that involves intergenerational interaction between the younger generations of future health administrators and older adults is crucial. A pedagogical tool that enables this intergenerational-based education is service-learning.

The purpose of this study is to build on prior studies on intergenerational service-learning (Augustin & Freshman, 2016; Bowling et al., 2022; June & Andreoletti, 2020; Parkinson & Turner, 2019; Ramamonjiarivelo et al., 2022; Ramamonjiarivelo et al., 2021; Yamashita et al., 2013; Yoelin, 2022) by assessing the effectiveness of an intergenerational virtual service-learning intervention on undergraduate students' ageist attitude towards older adults and its impact on older adults' social competence during the COVID-19 pandemic using a pre-post design.

2. Literature review Service-learning

Service-learning is defined as “an experiential learning, which integrates community service activities into academic curricula” (Tambaum, 2022) page 10. Service-learning has been found to be an effective pedagogical tool that provides real-life/experiential education with respect to community/civic engagement and social issues. As such, service-learning has been used to simultaneously educate students about social issues such ageism, racism, social isolation, loneliness, poverty, incarceration, and mental health, among others. Service-learning helps the individuals impacted by these social issues, and solve these issues (Bringle & Hatcher, 1995; Warren, 2012).

In addition to the immersive learning experience offered in service-learning-based education, students engaged in service-learning activities are also required to write a diary and a personal reflection of their experience to reinforce learning (Bringle & Hatcher, 1999). These

two aspects of service-learning (experiential learning and diary/reflection writing) differentiate it from just lecture-based traditional education.

Extant literature has demonstrated the effectiveness service-learning on both students and the service-learning recipients with respects to several social issues (Salam et al., 2019). With respect to students, studies have demonstrated that students have a better understanding and assimilation of study materials because they are able to apply what they learned in the classroom in a real-life experience (Simons & Cleary, 2006). Also, students exhibited better awareness and attitudes towards those social issues after service-learning completion (Cline & Bain, 2022; Salam et al., 2019; Simons & Cleary, 2006; Tambaum, 2022; Yoelin, 2022). With respect to service-learning recipients, positive outcomes have been found in terms of free consultations, trainings, mentoring, nutrition guidance, medical check-ups and medicine, natural resources conservation, improved social welfare, as well as decreased social issues (Ramamonjjarivelo et al., 2022; Ramamonjjarivelo et al., 2021; Renick et al., 2006; Salam et al., 2019).

The real-life and immersive learning experience used in service-learning pedagogy was traditionally conducted in a face-to-face environment where students are physically present at the service-learning site. However, the mandatory confinement and quarantine measures to contain the COVID-19 pandemic have made this immersive training difficult to administer. Some instructors have converted in-the-field, real-life, service-learnings into a virtual service-learnings (Bartlett & Scholl, 2023; Meuser et al., 2022; Ramamonjjarivelo et al., 2022).

Intergenerational service-learning

Several studies have used intergenerational service-learning to educate the younger generations (high-school and college students) about the issues associated with aging and also to provide some social support for the older adult population (Chen, 2018; Counts et al., 2022; Horan & Perkinson, 2019; Parkinson & Turner, 2019; Ramamonjjarivelo et al., 2022; Ramamonjjarivelo et al., 2021; Underwood & Dorfman, 2006; Yoelin, 2022). These studies

have demonstrated intergenerational service-learning as an effective means to reduce ageism bias and alleviate social isolation experienced by older adults.

3. Materials and Methods

This project, administered during the Spring 2021 semester, was based on earlier work showing that service-learning projects that place students and older adults from the community in interaction can have a significant positive impact on reducing ageistic attitudes and lowering younger persons negative attitudes toward older adults (Ramamonjiarivelo et al., 2021) and an additional project assessing virtual interactions in such student-older dyads (Ramamonjiarivelo et al., 2022). The primary hypotheses from this project are that: (1) student- older interactions will have a positive impact on student perceptions of older adults (as reflected in significant changes in their semantic differential ratings of older adults); (2) that student-older interactions will decrease student ageism scores (compared to pretest scores) and; (3) students who interact with older adults will report more comfort and confidence in working with older adults than the students who completed a more traditional research paper on aging.

During the prior Spring 2021 semester, students were randomly assigned to a service-learning group (treatment group) and a non-service-learning group (control group) with the main objective of reducing student's ageist attitudes towards older adults. The students assigned to the service-learning group were paired with older adults for a weekly conversation. Non-service-learning students were assigned a more traditional research paper on ageism. Both the service-learning and non-service-learning groups were asked to fill out an online survey to measure their levels of ageist attitudes towards older adults (Ageing Semantic Differential Scale, Ageism scale, and a two-item experimenter created scale of comfort and confidence in working with older adults) at both the pretest and posttest intervals.

The current study attempted to assess the impact of "virtual" interactions between undergraduate students and older adults using an experimental and control group design on older adults' feelings of social competence (as measured by the Short Forms of the Texas Social

Behavior Inventory (TSBI) (Helmreich & Stapp, 1974) and students' ageism bias towards older adults using the same Ageing Semantic Differential Scale (ASD), Ambivalent Ageism scale (AAS), and a two-items scale to measure student's comfort and confidence interacting with older adults, which were used in our prior studies (Ramamonjiarivelo et al., 2022; Ramamonjiarivelo et al., 2021). A copy of these survey instruments is posted in the Appendix. We had different samples of students in the prior two studies and the current study. The current study was also approved by the Institutional Review Board of the authors' academic institution (IRB #7046).

3.1. Study participants:

3.1.1. College students

Undergraduate students enrolled in a course on healthcare history, language, and culture, offered by the Bachelor of Healthcare Administration program, during the Spring 2021 semester were randomly assigned to the service-learning project (n=20) and the non-service-learning project (n=41). Students assigned to the service-learning project were paired with older adults residing in the community. Students were required to engage in a weekly virtual conversation with their older adult partners for at least 30 minutes, for a total of eight weeks. Older adults were allowed to choose the modality of the conversation either via Zoom, text message, or telephone. Students were given some ice-breaking interview guidance (list of potential questions) for the first conversation, then students and older adults were granted the freedom to choose the conversation topics for subsequent weeks. As part of every service-learning project, students were asked to write a half-page diary of each virtual encounter and a one-page reflection of what they learnt after four virtual conversations, for a total of two reflections. Non-service-learning students were asked to write an individual traditional term paper on ageism manifestation in different countries.

3.1.2. Older adults

Convenience sampling was used to recruit the older adults. They were recruited from the neighborhood churches and senior living facilities. Older adult participants were previously engaged in similar service-learning activities but with different students in spring 2020 and fall 2020 semesters. Twenty older adults accepted to participate in the spring 2021 service-learning project. Of these participants, 17 (85%) were female. Participants' ages ranged between 65 and 84 years old. They were from diverse careers such as schoolteacher, college professor, registered nurse, flight attendant, university employee, hospital custodian, pastor, oil company employee, Internal Revenue Service officer, and State Board appraiser.

3.2. Measures

3.2.1. Pretest and Posttest Surveys for Students

Three measures were employed with students in a pre-post method in this study. The Ageing Semantic Differential Scale (ASD) (Gluth et al., 2010), the Cary's Ambivalent Ageism Scale (AAS) (Cary et al., 2017), and a two-item researcher generated Likert-rating of Comfort and Confidence in interacting with older adults based on a 10-point scale (1 = not at all comfortable/confident to 10 = very comfortable/confident). The ASD has been found to have high levels of reliability and validity (Cary et al., 2017). This differential scale, provides an attitudinal dimension (such as Progressive 1-----2-----3-----4-----5-----6-----7 Old Fashioned) that are considered to be opposites (Gluth et al., 2010; Rosencranz & McNevin, 1969).

According to the researchers who created the AAS (a 13-item measure about ageistic attitudes used in this project), "The AAS had good test-retest reliability ($r = 0.80$) and good internal consistency ($\alpha = 0.91$). As predicted, the benevolent and hostile ageism subscales differentially predicted attitudes toward older adults: higher scores on the hostile subscale predicted lower competence and warmth ratings, whereas higher scores on the benevolent subscale predicted higher warmth perceptions" (Cary et al., 2017). Students' pretest and posttest surveys were

virtually administered on Qualtrics.

3.2.2. Pretest and posttest surveys for older adults

Older adults completed a 16-item social competence/self-esteem measure based on the Short Forms of Texas Social Behavior Inventory (TSBI), which is a validated objective measure of self-esteem or social competence (Helmreich & Stapp, 1974). The pretest posttest surveys for the older adults were paper based.

3.3. *Data analysis*

The aggregated mean scores of the ASD scale, AAS scale, and the two-items generated scale by the authors were used for the pretest and posttest student surveys to assess students 'change in ageism attitude towards older adults. In the same vein, the aggregated pretest and posttest mean scores of TSBI scale were used to assess older adult participants' social competence level. The data of the older adults' survey allowed us to conduct a paired-sample t-test. IBM® SPSS® Statistics software Version 28 was used for data analysis.

4. **Results**

4.1 *Participant attrition and missing data*

As is the case with any pre-post design, some participants completed a pretest, and no posttest and others did not complete the pretest but completed the posttest. Since we were aggregating the data and not trying to make pretest-posttest comparisons for any particular student or any particular older adult participant, we only eliminated from analyses those who did not complete both pretest and posttest surveys. In other words, pretest analyses for older adults and students represent the data for all students or all older adults that completed a pretest (the average of their scores on each measure) and the posttest analyses include those who completed posttest measures independent on whether they completed a pretest. Again, this comparison seems justifiable because we were not trying to draw comparisons between any par-

ticular student's or older adult's within subject scores but to compare between groups at pre- test and between groups at posttest.

For missing data, a 5% level was used. If a participant had 5% or less of the data missing, they were included in analyses by using the mean score on that item to replace the missing data point. If the participant had more than 5% data missing, they were excluded from analyses. As a result, 9 of the 61 students (85% response rate) were eliminated from the pretest analyses and 28 students were eliminated from the posttest analyses (54% response rate). For older adults, four (out of 20) older adults (80% response rate) were eliminated from pretest analyses and four were eliminated from the posttest analyses.

As can be seen from Table 4, older adults report moderate self-esteem/social competency levels at both pretest and posttest (the highest possible score is 80). Nonetheless, there is a modest change in TSBI scores when comparing pretest and posttest averages using a paired samples t-test.

4.2. Outcomes of intergenerational virtual service-learning on students

All measures for students (ASD, AAS, and Comfort/Competence to Work with Older Adults) were administered both pre and post interactions with older adults. Additionally, some students (21) assigned to the service-learning group interacted with older adults while the remaining students assigned to the non-service-learning group (41) completed a more traditional research project on ageism manifestation in different countries rather than interacted with older adults. The basic results for the pretest and posttest measures for students are summarized in Tables 1, 2 and 3.

Tables 1 and 2 summarize the data from pretest and posttest for both the service learning and non-service-learning groups. The pattern of means shows that interacting with older adults and completing a more traditional paper on ageism has an impact on students' attitude regard-

ing ageism, their perceived ability to work with older adults and their semantic differential ratings of older adults. We have highlighted with p values those mean comparisons that demonstrated significant change from pretest to posttest scores.

4.3. Pretest results for students

As can be seen in Table 3, the two groups service-learning (SL) and non-service-learning (NSL) do NOT differ significantly on any of the variables at the beginning of the project (Pretest data). This means that the random assignment of the students to the service-learning project and the more traditional research project does not appear to be driven by major differences in attitudes about older adults or ageistic attitudes; sampling bias does not seem to be an issue. Of course, the question of interest (and our hypotheses center on this) is whether there are differences in the posttest results after the service-learning students spent a minimum of four hour, in total, interacting (virtually) with their assigned older adult partners in comparison to the non-service-learning students who completed a more traditional research paper on ageism in different countries.

4.4. Posttest results for students

As can be seen in Table 3, both groups showed a decrease in their ASD scores from pre to posttest, but the scores for service-learning students were significantly lower at the posttest than those for the non-service-learning group, $t(1,31) = 2.041, p = 0.05$. Scores on the ageism scale (AAS) decreased from pre to posttest for both groups but were not significantly different from each other on either the pretest or posttest survey. It appears that interacting with older adults and completing the more traditional research paper on ageism improved students' ageism scores. For example, service-learning students showed a decrease in those AAS scores from 44.75 at the pretest to 36.77 at the posttest, and non-service-learning students showed a decrease from 42.00 at the pretest to 37.70 at the posttest (see Table 1).

Regarding the experimenter generated two-item measure of comfort and confidence in interacting with older adults, virtually no change occurred in either group. Both groups averaged

almost 17 out of 20, on the pretest and posttest data, on this self-rating with higher scores reflecting more comfort and confidence.

4.5. *Outcome of virtual intergenerational service-learning on older adults*

In this study, 16 older adults filled out the paper-based pretest and posttest surveys. The older adults' mean score of the TSBI at the pretest was 53.13 (higher scores reflect more self-assessed social competence and self-esteem) while the older adults' mean score on the posttest was 53.88. This difference is modestly significant at $p=.041$, with a standard deviation of 1.34 and a standard mean error of 0.36.

5. Discussion

The key finding from this study indicates that virtual intergenerational service-learning is effective in decreasing students' ageistic attitude as measured by the ASD. Service-learning students exhibited a greater decrease in ASD measure compared with non-service-learning students at the posttest survey and the difference between the two groups is significant. This finding supports the finding from our prior study administered in fall 2020, which was also administered virtually. In the fall 2000 study, service-learning students also exhibited a greater and significant decrease in the ASD scale, from an average score of 109.56 (pretest) to an average score of 95.61, after service-learning completion, with $t(1, 40) = -2.027, p=0.049$ compared with the non-service-learning group (Ramamonjiarivelo et al., 2022). While the fall 2020 study is shorter (6 weeks) compared to 8 weeks for this current study (spring 2021), our finding suggests that virtual intergenerational service-learning can be an effective tool to educate students and change their attitudes towards older adults. Therefore, students can still benefit from service-learning even if it is administered virtually; the experience is still impactful.

However, this finding is not consistent across the two studies when AAS is used to measure ageism. While the current study suggests that virtual intergenerational service-learning is not effective in significantly reducing ageism score in terms of the AAS scale, the fall 2020 study

suggests that it is effective. The service-learning group in fall 2020 exhibits a significantly lower AAS score, after service-learning completion, compared with non-service-learning group, though the fall 2020 project is shorter than the spring 2021 project.

The changes in the scores of the two-item measures to assess students' competencies/comfort interacting with senior adults are not significant. This result is consistent with the result from the fall 2020 study (Ramamonjiarivelo et al., 2022). Prior to enrolling in the service-learning course, students may already have had some meaningful interactions or relationships with older adults like their great grandparents, grandparents, and other older relatives or neighbors. As a result, a 30-minute virtual interaction with an older adult individual for over six or eight weeks is no longer impactful in enhancing students' competencies/comfort interacting with older adults.

With respect to older adults, virtual intergenerational service-learning significantly increased their social competence score by 0.75 points. This finding indicates that virtual intergenerational service-learning is an efficient and effective way to increase older adults' social competence. As people grow older, retirement and the loss of relatives, spouses, and friends may reduce older adults' opportunities to maintain a healthy social life. Therefore, engaging in virtual interaction with other people may be one of the solutions to keep older adults socially active, especially when confinement due to a pandemic prevents a face-to-face or a physical interaction with others.

5.1. Limitations

This study has some limitations. First, since all the measures used to measure ageism and social competence were self-administered surveys, we could not eliminate social-desirability biases that may have influenced the participants. Second, our IRB prevented us from giving incentives to students and older adults to fill out the surveys. Therefore, not all participants filled out the surveys and there was a decline in the number of completed surveys from the pretest to posttest survey among students resulting in a smaller sample size. That decline in the

number of survey participants prevented us from using paired-sample t-tests. However, we were able to use a paired-sample t-test from the sample of senior adults.

Third, recruiting older adults to engage in virtual interaction with students was challenging. We recruited the same sample of older adults who participated in the spring 2020 study (face-to-face interaction)(Ramamonjiarivelo et al., 2021) and the fall 2020 study (virtual interaction)(Ramamonjiarivelo et al., 2022). Then, for the spring 2021 study (virtual interaction), some of them clearly indicated that they preferred face-to-face interaction over virtual interaction. However, face-to-face interaction was not allowed during COVID-19 pandemic. Also, given to the fact that the older adults in the spring 2021 study were involved in the spring 2020 face-to-face service-learning and the fall 2020 virtual service-learning, the exposure of the older adults to these prior service-learning activities may have some impact on their social competence before they were involved in the spring 2021 study. We might get different results with respect to social competence if the sample older adults for spring 2021 did not participate in the spring 2020 and fall 2020 studies.

6. Conclusions

We examined the impact of a virtual intergenerational service-learning on undergraduate students' ageistic attitude and on older adults' social competence. We found that the intergenerational service-learning mostly benefited the students as they exhibited a decrease in ageism score after service-learning completion based on ASD scale. This finding supports the finding in our previous study. As such, this finding highlights the usefulness and effectiveness of virtual service-learning as it pertains to giving students the opportunity to engage in immersive learning when on-site or face-to-face interaction is not allowed or not possible. We call for future studies to validate the use of intergenerational virtual service-learning for online courses.

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Data Availability Statement: The IRB approval to conduct this study requested the authors to ensure strict confidentiality of study participants. Therefore, we do not have the authorization to make our survey data available to third parties.

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Appendix

Aging Semantic Differential Scale with 7-point Likert Scale Assessing Students' Ageist Attitudes toward Older Adults

Most older adults are:

Scale	1	2	3	4	5	6	7	
Progressive								Old-fashioned
Consistent								Inconsistent
Rich								Poor
Generous								Selfish
Productive								Unproductive
Busy								Idle
Secure								Insecure
Strong								Weak
Healthy								Unhealthy
Active								Passive
Handsome								Ugly
Cooperative								Uncooperative
Optimistic								Pessimistic
Satisfied								Dissatisfied
Expectant								Resigned
Flexible								Inflexible
Hopeful								Dejected
Organized								Disorganized
Happy								Sad
Friendly								Unfriendly
Neat								Untidy
Trustful								Suspicious
Self-reliant								Dependent
Liberal								Conservative
Certain								Uncertain
Tolerant								Intolerant
Pleasant								Unpleasant
Ordinary								Eccentric
Aggressive								Defensive
Exciting								Dull
Decisive								Indecisive

Ambivalent Ageism Scale (AAS) - Assessing Students' Ageist Attitudes toward Older Adults

1-----2-----3-----4-----5-----6-----7
 Strongly disagree disagree moderately disagree slightly neutral agree slightly agree moderately agree strongly

1. It is good to tell old people that they are too old to do certain things; otherwise, they might get their feelings hurt when they eventually fail.
2. Even if they want to, old people shouldn't be allowed to work because they have already paid their debt to society.
3. Even if they want to, old people shouldn't be allowed to work because they are fragile and may get sick.
4. It is good to speak slowly to old people because it may take them a while to understand things that are said to them.
5. People should shield older adults from sad news because they are easily moved to tears.
6. Older people need to be protected from the harsh realities of society.
7. It is helpful to repeat things to old people because they rarely understand the first time.
8. Even though they do not ask for help, older people should always be offered help.
9. Even if they do not ask for help, old people should be helped with their groceries.
10. Most old people interpret innocent remarks or acts as being ageist.
11. Old people are too easily offended.
12. Old people exaggerate the problems they have at work.
13. Old people are a drain on the health care system and the economy.

Competency/Confidence Scale (students)

Rate from a scale of 1 to 10 your comfort in interacting with individuals of older generation.
 Rate from a scale of 1 to 10 your confidence in interacting with individuals of older generation.

**The Short Forms Texas Social Behavior Inventory (TSBI)
Assessing Older Adults' Social Competence**

Scale:

Not at all characteristic of me	Not very characteristic of me	Slightly characteristic of me	Fairly characteristic of me	Very much characteristic of me
---------------------------------------	-------------------------------------	-------------------------------------	-----------------------------------	--------------------------------------

- 1) I am not likely to speak to people until they speak to me.
- 2) I would describe myself as self-confident.
- 3) I feel confident of my appearance.
- 4) I am a good mixer (I mix in with others well).
- 5) When in a group of people, I have trouble thinking of the right things to say.
- 6) When in a group of people, I usually do what others want rather than make suggestions.
- 7) When I am in a disagreement with other people, my opinion usually prevails.
- 8) I would describe myself as one who attempts to master situations.
- 9) Other people look up to me.
- 10) I enjoy social gatherings just to be with people.
- 11) I make a point of looking other people in the eye.
- 12) I cannot seem to get others to notice me.
- 13) I would rather not have very much responsibility for other people.
- 14) I feel comfortable being approached by someone in a position of authority.
- 15) I would describe myself as indecisive.
- 16) I have no doubts in my social competence.

Tables

Table 1. Pretest and Posttest Results for students in the non-service-learning group (control group)

	n	Mean	Std. Deviation	Std. Error Mean	p-value*
Aging Semantic Differential Scale Pretest	32	115.88	15.17	2.68	ns
Aging Semantic Differential Scale Posttest	20	113.60	20.23	4.52	
Ambivalent Ageism Scale Pretest	32	42.00	9.34	1.65	.034
Ambivalent Ageism Scale Posttest	20	37.70	12.16	2.72	
Competence interacting with older adults Pretest	32	17.06	3.58	0.63	ns
Competence interacting with older adults Posttest	20	17.25	3.13	0.70	

*Statistically significant at $p \leq 0.05$

Table 2. Pretest and Posttest Results for students in the service-learning group (experimental group)

	n	Mean	Std. Deviation	Std. Error Mean	p-value*
Aging Semantic Differential Scale Pretest	20	121.05	18.42	4.12	.006
Aging Semantic Differential Scale Posttest	13	98.38	21.98	6.10	
Ambivalent Ageism Scale Pretest	20	44.75	14.54	3.25	.040
Ambivalent Ageism Scale Posttest	13	36.77	14.08	3.90	
Competence interacting with older adults Pretest	20	16.40	4.69	1.05	ns
Competence interacting with older adults Posttest	13	16.15	3.39	0.94	

*Statistically significant at $p \leq 0.05$

Table 3. Combined Pretest and Posttest Results for Students in the Non-Service-Learning and Service-Learning Groups

	Group^a	n	Mean	Std. Deviation	Std. Error Mean	P-value*
Aging Semantic Differential Scale Pretest	NSL	32	115.88	15.17	2.68	ns
	SL	20	121.05	18.42	4.12	
Aging Semantic Differential Scale Pretest	NSL	32	42.00	9.34	1.65	ns
	SL	20	44.75	14.54	3.25	
Competence Interacting with older adults Pretest	NSL	32	17.06	3.58	0.63	ns
	SL	20	16.40	4.69	1.05	
Ambivalent Ageism Scale Posttest*	NSL	20	113.60	20.23	4.52	.05
	SL	13	98.38	21.98	6.10	
Ambivalent Ageism Scale Posttest	NSL	20	37.70	12.16	2.72	ns
	SL	13	36.77	14.08	3.90	
Competence Interacting with Older adults Posttest	NSL	20	17.25	3.13	0.70	ns
	SL	13	16.15	3.39	0.94	

^a NSL= non-service-learning group, SL = service-learning group. *Statistically significant at $p \leq 0.05$

Table 4. Older adult Pretest and Posttest TSBI Average – Paired Samples Statistics

		Mean	n	Std. Deviation	Std. Error Mean	p-value*
Pair 1	TSBI	53.13	16	18.79	4.70	.041
	TSBI2	53.88	16	18.06	4.51	

*Statistically significant at $p \leq 0.05$

Environmental Impacts and Responses: The Swing of the Moral Pendulum in the Oil Industry

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Abstract

“Environmental ethics is the discipline in philosophy that studies the moral relationship of human beings to, and also the value and moral status of, the environment and its non-human contents.”ⁱ Businesses, with their reach and scope over humans and ecology alike, have a keen obligation to pay a close attention to environmental ethics.

The oil industry around the globe is responsible for many disasters with significant environmental impacts. The players in the global oil industry include corporations, as well as state-owned enterprises. Even though the industry players respond to such disasters with a focus on the environment, the extent of their moral commitment tends to be shaped by the structure of the business organizations and their attitude towards the environment as a part of the broader stakeholder group.

Two such environmental incidents are British Petroleum’s (public corporation) Deepwater Horizon oil spill, the largest marine oil spill in historyⁱⁱ in the US (2010); and Indian Oil Corporation’s (State owned corporation) blowout at the oil refinery in Baghjan in Assam, India (2020), known as one of the biggest “onshore blowouts” in an oil refinery. ⁱⁱⁱ

A comparative case study approach will be used to analyze the nature of the moral relationship to the environment as exhibited in their responses.

Keywords: environmental ethics, stakeholders, corporate structure, moral obligation

i Brennan, Andrew, and Norva Y. S. Lo. “Environmental Ethics.” Stanford Encyclopedia of Philosophy, Stanford University, 3 Dec. 2021, <https://plato.stanford.edu/entries/ethicsenvironmental/>.

ii “Deepwater Horizon Oil Spill.” Encyclopædia Britannica, Encyclopædia Britannica, Inc., <https://www.britannica.com/event/Deepwater-Horizon-oil-spill>.

iii Ghosh, Sahana, and Roopak Goswami. “Baghjan Oil Blowout: Report Indicates a Long Road to Recovery and Ecological Restoration.” Mongabay, 5 July 2021, <https://india.mongabay.com/2021/07/baghjan-oil-blowout-report-indicates-a-long-road-to-recovery-and-ecological-restoration/>.

Inflation Reduction Act 2022

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Abstract

In 2022, the Inflation Reduction Act (IRA) went into law. This act includes provisions, such as a 15% minimum tax on corporations with financial accounting profits over 1 billion US dollars (USD) and a 1% excise tax on stock buybacks. The Act also contains numerous clean energy tax incentives related to electricity production, alternative vehicle fuels, and residential and commercial energy efficiency. This paper focuses on the issues related to the Inflation Reduction Act 2022.

Evaluation of the Implementation of National Standard for Youth-Friendly Health Services (Pkpr)

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Abstract

Teenagers are a valuable asset for future national development. Adolescents in Indonesia face various challenges, including risk behavior, knowledge and access for information. To create healthy teenagers, one of the Indonesian government's efforts is to provide youth-friendly health services known as the PKPR program in Indonesia. Cimahi City reports the highest number of youth problems among cities in West Java. All Community Health Centers in Cimahi have implemented the PKPR program but have never been evaluated. This research aims to evaluate the implementation of National PKPR Standards in Cimahi City. This research uses a qualitative method with a narrative approach. Sample criteria were determined using purposive sampling and data collection through focus group discussions, interviews, observations, and document review. Results obtained: health human resource standards: trained program managers conduct employee counseling and reorganization; Health Facility Standards: youth services are still integrated with general services, integrated counseling rooms; Youth standards: use of audiovisuals in the form of videos broadcast in public spaces, involving peer counselors during counseling at school; Network standards: network functions are school-wide and cross-program; Health management standards: compliance Documents related to PKPR are still limited, recording is only carried out by the Community Health Center, and there is no evaluation and supervision policy that is facilitative and specific to PKPR. Therefore, it is hoped that there will be standardization of services according to national PKPR standards, and program policies, as well as continuous monitoring and evaluation.

Keywords: Evaluation, Adolescents, Adolescent Health Services, PKPR

Best Paper Award in Contribution to Application of Theory
An Experiential Questionnaire Investigating Architecture Undergraduates’
Alternative Conceptions on Building Physics: Preliminary Observations

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Abstract

The urgency of the global warming crisis demands that building designers and buildings users, among others, be capable of making greener choices grounded in a sound understanding of the indoor and outdoor environment. Yet, basic literacy of thermal physics is far from widespread; the general public lacks an understanding of heat flows within their home and even of the working of their heating systems [Goodhew et al., 2017]. Equally worrying, even science students, physics students or teaching trainees hold numerous misconceptions or alternative conceptions of physics according to the literature.

The paper examines an experiential questionnaire (“v2”) intended to help qualitatively assess the understanding of buildings physics by architecture students. The qualifier “experiential” is employed here to signify that the questionnaire asks the student to recall everyday life experiences, as for example, in the first part of the two-part question (Q8): “Have you noticed early morning dew on a car roof? Why is there condensation on the roof and windshield but not on the hatchback or the side windows?” Twenty three of the 30-question instruments prompts the student for a written explanation, Other question are multiple choice. The instrument has been administered to 67 undergraduate architecture students in a course on building systems. Students took the questionnaire twice, first, on day one of the course, and second, immediately after the mid-term exam.

The research question addressed in this paper is: what hints of alternative conceptions held by undergraduate architecture students can we uncover in the responses to our v2 questionnaire on everyday thermal-physics-related experiences, including indoor and outdoor thermal comfort and environment?

Our analysis of student responses focuses on two topics: radiation and condensation. On radiation, we point to the “asymmetry” in the way students conceptualize received radiation such as solar radiation vs. emitted radiation such as radiation emitted by the body, an object or the earth surface: incoming solar radiation gains appear to be much better understood than outgoing radiative losses to a clear night (or day) sky, for example. On condensation, we identify three alternative conceptions: a condensation-working-backwards one, a condensation-concentration and sweat-equivalent one, and a condensation-as-deposition-of-fog one. The paper also lists briefly other biased viewpoints or alternative conceptions that caught our attention in the architecture students’

responses to the questionnaire.

The paper contributes to both the literature on alternative conceptions of physics in student populations, as well as our reflection into improving the questionnaire to better align with the objectives of the course and identify the students most in need of support.

Keywords: Questionnaire, thermal literacy, building physics, architecture, misconceptions, alternative conceptions.

Introduction

Relevance

To provide thermal comfort to its occupants, the prevailing paradigm in post-World War II architecture has unfortunately cast aside many building integration-based lessons from the past centuries such as natural ventilation, tall spaces, thermal mass, reasonable amount of glazing, to name a few, and has relied instead on energy-consuming mechanical machinery add-ons. Such an attitude has massively contributed to the acute global warming predicament we are in today. Implementing well-conceived, innovative, site- and program-specific green energy concepts for buildings requires, among other things, a certain level of understanding of thermal physics and the environment around us on the part of all involved: developers, architects, engineers, building managers, and users. In academia, better understanding students' alternative conceptions on building physics can help the authors, and the architecture teaching community at large, to teach more effectively. A questionnaire comprising questions on thermal physics, human thermal comfort, and indoor and outdoor environment-related topics is thus worth developing to gain insights into architecture students' alternative conceptions. The mix of questions in the instrument discussed here is fairly unique compared to the more physics-centric instruments found in the literature. A number of questionnaires in the literature do focus on everyday scenarios, but our instrument, arguably, emphasizes the dimension of the real-world individual experience somewhat more.

Difficult to sense...

Understanding heat and energy is not easy. In Western cultures, sensing heat is not "canonized" as the other accepted 'five senses' are. Becoming finely attuned to the energy flows in one's surroundings requires commitment, awareness and attention to one's environment. And, some thermo-physical phenomena are kind of counterintuitive: for example, the fact that the temperature plateaus during phase change despite heat being added or removed. Thermal conductivity plays tricks on us: touching the metal leg of a table invariably make us think that its temperature is lower than that of its wooden top (see Questionnaire's question Q16 & Q17) when it is not, both leg and tabletop being typically at room air temperature. Emissivity is confusing as well: the polished stainless-steel pan heated on the stove does not feel as warm to the hand hovering one inch above it as the black cast-iron skillet. Similarly, if the table metal leg has a polished shiny finish, a reading

of its surface temperature given by an entry-level non-contact infrared thermometer (IRT) will be off. Finally, energy is hard to comprehend as a concept; it has application in numerous domains of various abstraction levels and requires us to use metaphors to help us conceptualize it... And choosing a good metaphor is far from obvious. [Amin et al., 2015].

... and language difficulties, alternative conceptions

Numerous studies in the literature describe instances of misconceptions of notions of “heat” and “energy” in various populations, for example, in primary school teacher trainees [Luera et al., 2006], and in physics major students [Alwan, 2011]. [Stylos et al., 2021]’s Thermal Concept Evaluation (TCE) “test for university student’s misconceptions of thermal concepts in everyday contexts.” They and others note how misconceptions on the part of students remained solidly in place despite years of high school or university education.

In everyday language: “temperature” is often improperly used in place of the thermal physics science concept of “heat”. This, arguably, is stemming from the tension between our experiences, that what our body has been sensing since the day we were born, and the theory we are taught later on at school. Undoubtedly, individuals form their own personal notions of “something feeling warm” long before they are confronted with the notion of heat taught in school physics. It is probably fair to say that the conceptual, academic scientific theories never completely replace the substrate of early individual embodied conceptualizations but, arguably, hybridize with them. On alternative conceptions. [Georgiou & Sharma, 2012] showed “(...) that concepts were favoured based on a student’s everyday experience and their curriculum through high school (...)”. Similarly [Wong et al., 2015] state that “(...) alternative conceptions may be traceable to linguistic usage or definitions in textbooks.” Thus, [Wong et al., 2015] warn that researchers are not immune to instances of “misinterpretation of students’ alternative conceptions.” Wong et al. find that “it could be difficult to understand the alternative conceptions when there is disagreement on the definition or description of heat.” and underscore that “(...) educational researchers should clearly define the physical concept that they investigate in their empirical study. They should interview students with more questions designed to clarify, instead of inferring alternative conceptions from the use of a single word”.¹ [Georgiou & Sharma, 2012] also confirm prior studies and show that “students have a variety of ideas about heat transfer and related processes and that merely communicating what appears to be an alternative conception does not necessarily amount to incongruent reasoning.”

Context: architecture studies and ”Experiential Journal”

The paper examines a 30-question instrument created to assess qualitatively architecture students’ understanding of buildings physics. The “experiential” qualifier is employed here to signify that the questionnaire asks the student to recall everyday life experiences, as for example, in the first part of the two-part question (Q#8) “Have you noticed early morning dew on a car roof? Why is there

¹[Wong et al., 2015]’s paper “analyzes the alternative conceptions of heat based on five categories: “residing in object,” “ontological category,” “movement,” “cause and effect,” and “condition.”.”

condensation on the roof and windshield but not on the hatchback or the side windows?” The second part of the question elicits a written attempt by the student at explaining the phenomenon in her own words.

This paper expands on two earlier papers by the same author(s). One paper dealt with developing thermal literacy in architecture students via the use of so-called “Experiential Journals”, i.e. individual diaries maintained by students to log sensations, evaluations and measurements of air and surface temperatures, relative humidity and air flow velocities in their surroundings [Charles, 2022]. There, “thermal literacy” was defined as “knowledge—embodied and conceptual—and competency in the area of heat and thermal comfort”. In the Experiential Journal, students try to feel/sense their thermal environment as well as use some basic notions of physics to attempt to explain the phenomena they are experiencing. In a subsequent paper, [Charles, Greenstein-Himle & DeFranza, 2023] endeavored to develop a thermal literacy-focused questionnaire (v1.0) for architecture students and considered the way the day-one questionnaire could be “laddered” with subsequent mid-term and final exams. The backbone of this first version was the instrument created by [Yeo & Zadnik, 2001]. The second version (v2) of the questionnaire discussed in this paper strives to be more consistent with the “embodied and conceptual” mantra of the course in general, and more linked to the spirit of the Experiential Journal in particular.

Building systems course

The context is the same as in the previous two papers by the authors(s), i.e. a 15-week semester-long architecture course on building systems that introduces natural ventilation, mechanical ventilation, heating systems, air conditioning and the vapor compression cycle, fire safety systems, plumbing, electricity, and vertical transportation systems. The first few weeks of the course introduce and/or review some notions of thermal physics, psychrometrics, climate and sky radiative temperature, thermal comfort, solar radiation, steady-state vs. transient modeling², thermal transmittance calculation, and an overview of heating and cooling load calculation methods’ approach.

In its Fall 2023 instance, the course was attended by approximately 75 students distributed across two sections. The attendees were mostly 4th year undergraduate students. A few (7) were 1st year graduate Master of Architecture students, a minority of whom did not have an architecture-focused undergraduate background. Prior to taking the course, students typically had taken a required generic intro university physics course during their first or second year. Such course typically emphasized mechanics and, at most, included a week or two on the topic of heat near the end of the semester. The students’ prior exposure to physics while in high school has not been researched but

² Still imagery output from LBNL’s Therm software was used to visualize steady state conduction in simple wall assemblies. Video clips output from WUFI (Fraunhofer Institute for Building Physics (IBP) and Oak Ridge National Laboratory) were used to visualize transient Heat and Moisture Modeling of 2-D wall assemblies.

would appear to vary quite a bit in light of the variation/spectrum of quality among the collected responses.

Qualitative insights

With its limited number of respondents (approx. 70 per year, as mentioned above), the questionnaire was intended to help the instructor and her graduate teaching assistant, the author and co-author respectively, gain some **qualitative insights** on individual students, more so than to be the basis for generalizations.

The questionnaire itself and the way it was administered were both intended to evolve. As already alluded to earlier, v2, the questionnaire discussed here was already an evolution of the v1.0 questionnaire. That evolution arose after coming to the realization that our one-stage multiple choice v1.0 that re-used some—arguably, sometimes intimidating—questions of [Yeoh & Zadnick, 2001] and others, did not go far enough in feeling less like a physics test and, instead, like a simple questionnaire on personal everyday experiences. As one of the course’s day-one activities, v2 contributes to setting the tone for the class. V2 ought to foster curiosity about understanding one’s thermal environment and comfort, as well as to attempt to connect everyday experiences with rudiments of thermal physics theory, consistent with the course’s subsequent “Experiential Journal” assignment.

The v2 questionnaire: Work-in-progress

V2 is a work in progress and is appended in the annex. This early stage of development includes testing of questions and their wording. Within v2’s 30 questions, 23 elicited responses by students in plain written text, and seven were multiple-choice questions (MCQ). The written answers, short-essay, format lets us peak into the student’s thinking. Students’ alternative conceptions evident in answers to v2 can become candidate distractors in future MCQs or simply help us refine the wording of particular questions in a future questionnaire. While not completely random, the order in which v2’s 30 questions appeared, was not the subject of extensive refinement. No testing has been made to see if ordering questions in different ways had an impact on student responses.

Themes and foci

Table 1 paraphrases the questions and details 1) the themes to which the questions in v2 belong to, 2) the written answers vs. MCQ questions (signaled with “MCQ”) nature of the questions, and, 3) a categorization of the questions in “theoretical” (8 questions, grey background) vs. “experiential” (22 questions, white background). Assuredly, this “theoretical” vs. “experiential” categorization is quite subjective insofar many questions both first ask to recall a personal experience, and then, asks for an explanation, a “theory”. In essence, this debatable categorization is based on a simple practical “test”: for a question to land in the “theoretical” bin, it would have to feel a little bit like “I remember this from a physics course”. For example, the plain language Q19 question “When the

gas stove stays on under a pan of boiling water at 100°C, where does the added heat³ goes?”

satisfies this in our view such a “test”.

Conduction	Convection	Radiation	Human thermal comfort	Miscellaneous themes (in italic and parentheses)
Q1 Q2		Q3	Q4: Hot & humid day	Q1: bike pump (<i>pressure increase</i>) Q2: deflating balloon (<i>pressure drop</i>) Q3: Dark-painted wall (<i>absorption</i>) Q4: (<i>Phase change/ evaporation, Psychrometry</i>)
Q5: Bsmt wall T.		Q6: Glass	Q7: why sweating?	Q6: Glass (<i>absorption, emissivity</i>) Q7: Sweating (<i>Phase change/ evaporation, Psychrometry</i>) Q8: Dew on car roof (<i>condensation</i>) Q9: (<i>condensation</i>)
	Q9: Dew on grass +/- wind Q10 Q11	Q8: Dew on car roof Q9 Q10 Q11: Fall day (<i>incoming solar, outbound rad.</i>) Q12	Q11	Q10: Fog accumulation (<i>density</i>)
Q12: West wall interior T		Q13 (<i>visible</i>)		Q13: car headlights (<i>angle of incidence, flux</i>) Q14: wind around building (<i>pressure, momentum</i>)
Q15: Touch radiator vs. radiant floor Q16 & 17: Touch table top & leg		Q15	Q15 Q16 & 17 (<i>feels vs. actual Temp.</i>)	
				Q18: Fog: vapor or droplet? (<i>Condensation</i>) MCQ Q19: Boiling water on stove (<i>phase change, evaporation</i>)
Q20	Q20	Q20	Q20: Sunny winter sunbathing	
		Q21 & 22: solar captor orientation Q23 & 24 Solar on wall and roof (<i>angle of incidence</i>) [MCQ] Q25: Reflection on glass (<i>incid= transmit. + reflect. + absorb.</i>)		Q26: Mrs Focker’s advice (<i>water saving, social norms</i>)
Q29: Δ Temp. across materials (<i>conductivity</i>) MCQ	Q27: picture convection MCQ Q28: Fan cools air? (<i>convective heat transfer</i>) MCQ		Q28: (<i>evaporate. cooling, endotherm. process</i>)	Q28: (<i>motor waste heat</i>)
			Q30: (<i>psychological aspects of comfort</i>)	Q30: Thermostat ramp up (<i>mental model of heating system, full vs. part load</i>) [MCQ]

Table 1: Classification of questions per categories and specific themes indicated in italic between parentheses. Questions perceived as theory-based questions are highlighted in light grey, while questions perceived as experientially-based have white background. MCQ

based question are labelled as such.

Table 1 shows the relatively large number of questions on the topic of radiation. It is a deliberate choice based on the assumption that the U.S.-based students have an “air bias” in their conceptualization of the

³ We are aware that the “added heat” wording employed here might feel very unfortunate or possibly even sacrilegious to some readers because of its hinting at the “heat-as-substance” metaphor. However, such wording was chosen to sound like a simple, everyday-like, question, that does not preclude congruent reasoning in itself, as per [Georgiou & Sharma, 2012]’s argument mentioned earlier.

thermal environment and thermal comfort stemming from their prior life experience [More on this later].

Administration

V2.0

V2 was administered via the quiz tool of the online course management system, a customized version of Sakai LMS by the Apereo Foundation. The first instance of v2, “v2.0”, was administered during the last 20 minutes of day one of the course, with students invited to complete it at home, with no time limit imposed but simply the advice to complete in approx. 30 minutes total. We were not able to actually verify the compliance on that point. Students were able to navigate back to any questions at their leisure. We were not able to track the extent to which this occurred. It appears that a spelling autocorrect capability was turned on, sometimes leading to some confusing or comical responses: “night” for “light”, “angle of innocence” for “angle of incidence” for example.

Varying degrees of feedback

Broadly speaking, there was three levels of feedback post v2.0.

- 1) no feedback: it was decided to not provide students with feedback on the entire v2.0 questionnaire after taking it on day one to preserve “freshness” towards administering it again later on during the semester— hereafter referred to as “v2.1”.
- 2) “connect the dots”: in a few instances, a topic was discussed but the existence of a related question in the questionnaire was not highlighted, leaving to the student the responsibility to “connect the dots” by themselves. An example of such “stealth” feedback concerns v2 Question #2 about the rapidly deflating balloon: besides being possibly feeling alerted by immediately preceding question in the instrument, Q1 about the raise in temperature associated with compressing the air inside the bike pump, students could have connected Q2 with the “cloud-in-a-bottle” demo that was part of an assigned video by the Royal Meteorological Society on global air circulation. The notion of cooling via decompression was only brought in class long after v2.1 when introducing the vapor compression cycle of air conditioners or chillers.
- 3) full feedback: yet in other instances, as the course unfolded, students were reminded that a new lecture topic was related to a question they had encountered in v2.0. In such a case, the correct answer to the question was presented in class.

V2.1

The v2.1 questionnaire was administered in the minutes that followed students completing the mid-term exam. Its modalities were globally the same (recommended 30 minutes, online with possibility to navigate back to any question), but this time, students were encouraged to be more precise in the vocabulary they use. We should note that students written answer to v2.1 were often shorter than those the same student had provided in the v2.0; such short v2.1 answers sometimes only actually made sense when read alongside the v2.0 answer to that same question. That is particularly the case when a v2.1 answer does not deviate or correct from that given in v2.0. That arguably speaks to, 1) “questionnaire fatigue” perhaps on the part of the student reading the exact same questions again (as well as taking the questionnaire just after the mid-term

exam), and/or, 2) the persistence of alternative conceptions documented in the literature.

Analysis of responses

Method

Our dataset comprised the answers by the 64 undergraduate students who completed both v2.0 and v2.1. We basically looked at all answers to one question, compared with answers to related questionnaire questions, and, in three instances, to answers to related mid-term exam questions. As the previous paragraphs indicates we also moved back on forth between responses in v2.1 and v2.0 to try to make sense of the student thinking. When a student's answer to a specific question raised a flag that an alternative conception might be involved, we looked at the answers to all the questions by that particular student. In the following sections, we discuss two topics successively: radiation and condensation.

A) What about radiation?

Radiation is a significant part of the material being presented in the introductory lectures. One of our assumptions about our American architecture student audience is that radiation is not “part of the landscape” for most of them. We think that the experience of growing up in spaces that 1) have low heat capacity (the lightweight platform stud construction typical in the U.S., made of thin plaster board on wall, suspended ceiling (that insulate from thermal mass, if any), and 2) rely on comfort solutions such as forced-air heating (or convectors) and air conditioning, has primed the majority of our students to be “air-biased” instead. The questionnaire gives us a chance to gage the level of knowledge by the students in the area of radiation and the potential existence of alternative conceptions on radiation.

In the next few paragraphs we analyze answers at questions in which radiation is received (questions 12, 20-24 on incoming solar radiation) vs. questions in which radiation is emitted (questions 6, 8, 9, and 11).

Standing in the sun

Question 20 is about sunbathing on a sunny winter day. A statement to the tune of ‘thermal comfort is achieved because the heat gain from incoming solar radiation offsets the heat loss to the cold air’ is considered correct. A majority of students get that.⁴ There is a noticeable evolution of the lexicon used in answers between v2.0 and v2.1. from words like “warmth”, “heat”, or “sun rays” in v2.0 to “solar radiation” in v2.1. This indicates that adoption of vocabulary on the part of most students is underway. Some remain committed to the term “sunlight” in v2.0 and v2.1. We'd argue that this suggest that students understand the direct solar beam (and its binary counterpart, shade) at a personal embodied level, which could be paraphrased by: “I feel warm when standing in the sun”.⁵ The nuances of the solar spectrum are not fully known by all questionnaire takers, as illustrated by one of them who persists in mentioning UV in relation to feeling warm.

Orientation

Two questions had the student picture in their mind the direct solar beam hitting a surface near-normally, a

⁴Some students are a bit puzzled by the sunbathing aspect, interpreting it as laying flat on a deck thus introducing conduction consideration, other correctly stipulate that there should be no wind.

⁵We'd argue the understanding of diffuse solar radiation is weaker, but v2 is not testing that well.

West-facing wall around sunset (Q12), and an optimally-oriented south-facing⁶ fixed solar collector (Q21). Q22 was admittedly a bit tautological: it asked to confirm that shifting the optimally-oriented solar collector in Q21 significantly off its optimal angle would indeed result in a reduced output. As expected, the vast majority of students answered these correctly, drawing from prior knowledge reinforced during architecture studies.

Flux and angle of incidence

Two questions, Q23 and Q24, were focused very directly on the angle of incidence-dependent flux received by a south-facing facade vs. the flux received by a flat, i.e. sky zenith-facing, roof in winter and summer at mid-latitude. Q23 and Q24 are MCQs each offering a choice between two answers. The setup did not let the students explain their choices.

Tallying the number of students who responded incorrectly to both Q23 and Q24, we find 25 instances in v2.0 and still 14 instances in v2.1, out of which, nine instances of repeat v2.0 and v2.1 incorrect answer. Five students answered correctly in v2.0 but then answered incorrectly in v2.1. We also looked at the results of a mid-term exam question (Qmt#22) that touched on the same issue than Q23 and Q24 but presented the information in a graph form. Qmt#22 asked students to identify which the three curves in the graph in figure 1 below is the South Vertical Façade, the East- or West Vertical Façade, and the Horizontal Roof respectively.

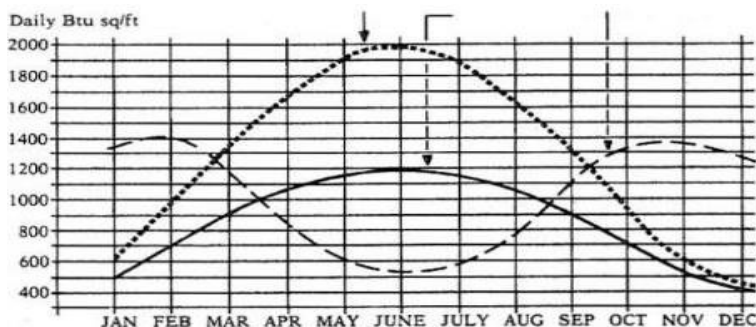


Figure 1: Idealized monthly average solar radiation received by various vertical facades and the horizontal roof of a building located at 40 degree N latitude

Ten students responded incorrectly to Qmt#22, five of whom also responded to Q23 & Q24 incorrectly in v2.1. This left 5 students who responded correctly to Q23 and Q24 but whose response to Qmt#22 was incorrect, arguably who had trouble making sense of the graph⁷. Five students responded correctly to Qmt#22 but incorrectly to Q23 and Q24, arguably who had memorized class content⁸ but were not able to draw correct conclusion from it and be able to correctly answer Q23 and Q24. Overall, considering the various items discussed throughout this section thus far, one could perhaps argue that the student understanding of orientations appears

⁶ “In the northern hemisphere” or “tracking the sun” are welcomed precisions offered by some students.

⁷ Perhaps, these students improperly interpreted the curves as projection of the apparent path of the sun in the sky.

⁸ The fact is this graph received a lot of attention in class and had been explicitly designated as “exam material”.

firmer when the sun hits a surface normally on facades, but appears shakier regarding a flat roof, and, perhaps, when the solar angle of incidence is much greater than zero degree.

Arguably, the conceptions held by some students conflate the three propositions “sun is the highest due South”, “sun is high in summer”, and “summer is the warmest season” in a way that prevent them from considering that the solar radiation flux on a South façade is less than that on a flat roof in the summer when the angle of incidence is the greatest relative to a south façade and the least relative to the flat roof. In other words, it could be as if the sense of elevated ambient air temperature experienced by the human body in summer and the knowledge that South is the direction where the sun is at its strongest, combine to override the realization that a vertical South-facing⁹ façade receives less direct beam solar radiation flux in summer due to the high angle of incidence. Alternatively, is it perhaps simply the case that prior knowledge on solar orientation is limited to vertical facades, and does not include roofs and flat roofs?

The paragraphs that follow discuss radiation that is emitted (questions 6 (&25), 8, 9, and 11).

Reflection vs. emission

Question 6 and question 25 have similar set ups: glass receiving incoming solar radiation, part of which is transmitted through the glass, part of which is reflected (Q25), and part of which is absorbed by the glass (Q6, more below). All we will say here about Q25 is that a good number of students answered the question correctly in v2.0 using their own words; in v2.1, more students responded correctly by referring to lecture material on the balance in transparent media, citing, for example, $\text{incident} = \text{transmitted} + \text{reflected} + \text{absorbed}$. Four students forgot to mention or consider the transmitted part. Three students forgot about the absorbed part. A number of student mangled the new vocabulary, resulting in answers in v2.1 that are less clear than those in v2.0. There are also a number of students who phrased their answers weirdly in a way that implied effects having an impact on causes. The wording of the question might have been a source of confusion.

The theory says that the portion of the incident solar radiation that is absorbed by the glass is part-conducted through the glass, frame and beyond, part-convected at the surfaces of the glass pane, and part re-radiated indoors and outdoors in the simple case of single glazing between cool indoors and outdoors. The focus of Q6 is on the latter, the heat emitted by the glass in the far infrared.

Looking at the answers, students who provided good answers¹⁰ were those who mentioned recalling an experience such as standing under a skylight or inside a greenhouse, or near large windows after the sun had stopped shining on them or simply standing in front of a large glazing element but outside of the transmitted beam.

A significant number of students acquiesced to having had that experience but did not provide an explanation. Other students mentioned noticing that a pane of glass was hot to the touch, indicative of how a conduction-based experience came to the fore in their reasoning on a radiation-based

⁹ Again, at mid-latitude in the Northern hemisphere.

¹⁰ Such answers had the benefit for us of making it clear that the students had understood the question and its setup.

question setup. Equally puzzling, a good number of students used the term “*reflect*” or “*reflection*”— which the question is not about— in v2.0, as well as in v2.1, although decreasingly so. Other used “*magnify*”, which is at best, an overstatement. A number of student answers are hard to interpret in term of the conception of radiation, for example, “*Glass has a tendency to radiate heat from the sunlight.*”; similarly, “*the glass reflects some of its radiation, somewhat radiating heat itself.*” We compared individual students’ answers to Q6 and Q25 as well as other questions for clues to gage if the above are case of poor wording or the sign of alternative conceptions. We have not conclusively reached an opinion on this, but we see the need, on one hand, to clarify conceptually in class the difference between reflection off a pane of glass (at an angle) and the radiation emission of the pane of glass normal to its plane, and, on the other hand, to refine the wording of Q6.

To many students, the concept and understanding of radiant heating appears fairly new. Radiation emission by objects at room temperature or by living things can thus take second place to prior knowledge on vision and reflection of light on surfaces. We see evidence of such prioritization via a MCQ that had not been included in the v2 questionnaire but was used live during class. Asked in what wavelengths range of the electro-magnetic spectrum does the human skin emit, many students incorrectly responded “visible” instead of “infrared”. Arguably this shows a confusion between reflecting and emitting that might have its origin in material learned in high-school.

Radiative sink, outbound radiation

In-class live lectures covered topics on climate, radiation, electromagnetic spectrum, and radiative sky temperature. An individual homework doubling as an Experiential Journal entry asked students to make three sets of observations and measurements under different weather, overcast and clear sky, conditions. The first measurement in each set was the dry bulb ambient air temperature. The second and third measurements in each set were done with the infrared non-contact thermometer (IRT) to capture a sense of the temperature of the sky vertically overhead, and of the temperature “of the horizon”—a mix of ground temperature and horizon sky temperature. Students could see by themselves that the clear sky radiative temperature as captured with the IRT is much chillier than the radiative temperature of the horizon and that of the ambient air’s dry bulb temperature at eye level.

Very much directly related to that hands-on homework was mid-term exam multiple-choice question Qmt#12 that read: “Choose the statement below that is consistent with the following data: IRT-measured zenith sky temperature (i.e. pointing vertically overhead) = 40°F (~4°C) and Tamb ambient dry-bulb temperature = 76°F (~24°C). A. The air felt very muggy; B. The rain had just stopped; C. The storm had weakened momentarily; D. The night sky was starry. Only 16 students out of 67 responded correctly, that is, correctly deducted that seeing the stars at night meant the sky

was clear, a necessary condition to explain such a large difference between dry-bulb ambient air temperature and radiative sky temperature.

Question Q11 is about the thermal sensation on a fall day (or night) under clear vs. overcast sky. The question has some flaws, one of which is arguably to mention “air temperature” specifically instead of the more vague “temperature” only. Nevertheless, it is interesting to analyze how the students interpreted the question. Broadly speaking, a majority of students’ v2.0 answers emphasized the incoming solar radiation as the primary factor. This type of answer—let’s call it “clear=solar gain, cloud =block”—considered that a clear sky meant more solar and therefore warmer conditions during the day, and viewed an overcast sky as blocking the sun rays, thus resulting in cooler conditions. In v2.0, a small minority of students, 5, to be precise, viewed the question differently, arguing that on that fall day or night, an overcast sky would provide a buffer against outbound radiative losses thus resulting in a sense of a milder temperature—let’s call it “clear=outbound loss, cloud= buffer”.¹¹ A small subset of students balanced both perspectives, considering both the day and night cases, and the fact the earth was warm after the summer had ended.

Responses to Q11 in v2.1 compared to v2.0 evolved in an interesting way. On one hand, approximately half of the students either persisted in the “clear=solar gain, cloud=block” view or provided an answer we could not interpret. More interestingly, on the other hand, the other half was comprised of students who persisted with their initial “clear=outbound loss, cloud= buffer” answer plus another 15 students who shifted perspective to espouse this view. Changes in views by individual students from v2.0 to v2.1 only occurred in favor of the “clear=outbound loss, cloud= buffer” perspective. We would arguably attribute this in part to lecture teaching and to experiential learning from the Journal’s three sets of radiative sky temperature entry.

We also compared answers to Q11 with answers to Qmt#12—the “starry (clear) sky” question mentioned above that, arguably, has the “clear=outbound loss, cloud= buffer” view very much built into it. Ten students out of 16 who answered Qmt#12 correctly had chosen the “clear=outbound loss, cloud= buffer” perspective to answer, six of which had changed perspective between v2.0 and v2.1.

Finally, we looked how the 16 students who satisfactorily answered both Qmt#12 fared with questions Q8 and/or Q9—two questions on dew on car roofs and lawn induced by the outbound radiation under clear sky conditions. Six students answered these questions clearly satisfactorily, the rest providing ambiguous, incomplete or outright incorrect answers. The “clear=solar gain, cloud =block” vs. “clear=outbound loss, cloud= buffer” viewpoint expressed in v2.1. Q11 was equally represented among correct Qmt#12 - Q8 or 9 pairs.

The results above would seem to suggest that only a small number of students understand the clear

¹¹ The “clear=outbound loss, cloud= buffer” view is correct at nighttime when the earth warm from the previous summer radiates outbound massively. Either one of the two views can occur during daytime depending on conditions.

sky outbound radiation issue in multiple contexts or scenarios. A group can be wrong in one context and right in another context, possibly the outcome of rote learning. A larger group provides answers that are inconclusive, ambiguous or off-target.

The results discussed in this section suggest that the students' notion of received radiation is more engrained than that of emitted radiation. This could be seen a quite common-sense if one considers the power density of the phenomena involved: a strong incoming sunbeam or a campfire, both point-sources, deliver massive concentrated radiative heat. Conversely, the chill due to heat loss to the clear summer night sky and the environment around us, itself experiencing outbound far infrared radiation as well, does not feel as strong, concentrated, but more subtle and "diffuse". Such "asymmetry" might explain the way "incoming" radiation appear prioritized conceptually over "outgoing" radiation in students.

While anecdotal, the prioritization of the **incoming** radiation over the outgoing one might be at play in the following student answer to Q11 that mistakenly posits a **received** 'inbound cold' radiation: "*Fall clear sky is cooler because there is more radiation **from** deep space (...)*"

B) What about Condensation?

Like radiation, moisture is also a significant part of the material being presented in the course introductory lectures. The answers to questions Q8, Q9, Q10 and Q18 of the questionnaire give us hints on the nature of potential alternative conceptions on condensation held by some students. The majority of the 64 undergraduate architecture students who took the questionnaire twice appear equipped with a correct basic macroscopic theory of condensation that hinges on the expectation that something cold brought out of the kitchen refrigerator will experience condensation buildup on it. In spite of this, the questionnaire appears to point to the existence of some alternative conceptions.

Condensation working backwards alternative conception

Similarly to how Q11 showed that some students have a misconception—or sloppy physics language—of how "cold" radiation is received from the clear night sky, there are a few students who believe that condensation can form on warm surfaces due to their misunderstanding of the travel direction of radiation. Q8 asked the students to reflect on why condensation may form on the windshield and roof of a car but not on the sides. A number of students considered the temperature difference causing condensation much like a cold can on a warm day, sometimes stating that their experience was to witness condensate on all surface of the car, which indeed can occur but less frequently so than the scenario offered in Q8. A small subset of respondents considered that the difference in distribution of condensate on the car surface was or "could be" attributable to a localized cooler temperature. Some among them pointed to the cold sky. This occurred in increasing numbers in v2.1, but not the point of becoming a majority. In contrast, many of the

students kept their reasoning centered around gravity causing the condensation to fall off of the more vertical surfaces.

As yet another illustration of the centrality of the “air” in student conceptualizations, in both v2.0 and v2.1, around a dozen students responded that the condensation forms on the top of the car (wrongly) conceived as the warmest surface subjected to the **cold air**. While the acknowledgement of a relationship between condensation and a temperature differential is valid, these students have the understanding of condensation backwards, much like those students who believe radiation can be “cold”.

Much of this misunderstanding appears rooted in the “heat rises” generalization that some students apply indiscriminately to many physics-related concepts outside of the convective context.

Although incorrect, the “heat rising” proposition appears very central to some students’ thinking and quite malleable to alterations or “contortions” used to rationalize temperature differentials in multiple inappropriate contexts. As teacher, we face the difficulty to guide the students into considering this or any other notion only in the relevant context, rather than as an overarching concept.

Condensation-concentration and sweat-equivalent alternative conception

The phrasing of answers by a number of students used condensation and concentration almost interchangeably, thus suggesting that the two notions have some degree of conceptual overlap in their mind. Confirming this would warrant further interviews, but short of that, one could nonetheless contemplate that, 1) everyday language might be misleading, as in “condensed milk”, for example, and, 2) to someone who does not possess a dedicated physical concept of “condensation”, the condensate on a cold container just out of the fridge can indeed be perceived as some kind of “concentration”, as in bringing together, of the previously invisible vapor molecules in the air into now visible droplets of water. It could also very well be the case that students chose their wording poorly and/or, are simply still not mastering new physics vocabulary and concepts, something that appear to be arguably the case in the following point on the related topic of evaporation.

Q7 asked students to consider why they sweat on hot days and how a 90°F [$\sim 32^\circ$]-warm and muggy day affects the amount they sweat. In v2.0, the majority of students showed that they possess both prior conceptual knowledge that sweating is the body’s way of cooling itself down through the release of moisture, and, embodied knowledge that one feels more “sticky” on muggy days. After the lectures, in v2.1, a third of students used “evaporation” explicitly in their answers, in a display of proper adoption of a physical concept as well as of the ability to make the connection between the release of water and its evaporation, i.e. the endothermic phase change

process responsible for cooling¹². Among instances of answers in which convective cooling was considered but its evaporative cooling companion in human thermal comfort was forgotten, were answers that stated that adding sweat to the surface of the skin can then cause a passing breeze to feel cooler. A couple of students gravely misused in both v2.0 and v2.1 the image a cold can covered in condensate to compare it to the droplets on the sweating body. In one such case, a preceding basically correct “common sense” v2.0 answer seems to point to a difficulty to master new vocabulary—particularly “dew point” to be specific—in the v2.1 answer. In the other case, despite the very unfortunate comparison made with “condensation”, the wording between v2.0 “(...)we are exercising and letting off a lot of heat. This, in turn, will make the **water in the air stick to our bodies** like the condensation on a cold drink” and v2.1 “(...) the body is trying to cool itself off and it does this by **releasing sweat**, almost like condensation” indicates progress away from the view of sweat-as-condensate view. In the Q8 question, the same respondent also stated that heat rising to the top of the car causes condensation, which shows a misunderstanding of how condensation formation and temperature are related.

Condensation-as-deposition-of-fog alternative conception

Question Q9 called on a scenario of dew forming on the grass early morning and whether a breeze would impede or facilitate dew formation. A number of students failed to transpose the experience of the can being taken out of the fridge to the context of the outdoors. They did not see that the dew forms on the blade of grass that is radiatively-chilled by the clear sky above. They proposed instead an explanation based on the air near the ground being chilled and the moisture contained in the air condensating into fog that subsequently settles on the blades of grass. While such mechanism also occurs, it is distinct from that of the condensation on the chilled blade of grass surface itself. In v2.0, there are many students who have some general understanding that fog likely forms because of a “*temperature drop*” and “*higher density compared to the air above*”, but few are able to make the connection to the air’s relative humidity and the convective cooling of the air layer in contact with the radiatively-chilled ground surface being the deciding factors to fog formation. In Q10, here too, some students continue to misuse the notion that “heat rises” to rationalize why fog settles in lower-lying areas, but fail to realize that the humidity in the air condensates into droplets because the air has cooled below the dew point in large part due to the convective exchange with the radiatively chilled ground. Interestingly in our view, students who relied on “heat rising” for their reasoning were more likely to incorrectly answer that fog is water vapor rather than water droplets in Q18; this, arguably, shows how the over-simplified preconception led to a misunderstanding of the concept. This pattern is also noticeable in v2.1, as the students who

¹² Along the same line, a significant number of respondents who do not include the word “evaporate” in their answer to Q7 concomitantly indicate “sweating more” as an alternative explanation to the hindered drying out of sweat caused by the elevated relative humidity.

understood that the relative humidity of the cooler air and the saturation leading to condensation tended to answer Q18 correctly.

C) Listing a few other alternative conceptions...

In this section, we briefly mention a few of the various alternative conceptions we encountered in the responses to the v2 questionnaire.

“Dense, moist air”: an alternative conception in which the student maps a bodily experience of thermal discomfort to the domain of physics. The everyday mental representation of more moist air is “more water (heavier stuff than air) added to the air” Counterintuitively, at equal temperature, air containing more moisture is less dense than dryer air.

“Heat rises”: as touched upon on several occasion above, in this alternative conception, the student expands the domain of convection, warm air rising, to the category of heat at large. Could the reason why some students jump from the factually correct “warm(er) air rises” to the problematic “heat rises” be explained by the “air-bias” mentioned earlier, or is it just sloppy language?

“Sun heats the air”: this alternative conception and its companions, *radiates the air around it*” or *“(…) the clouds are trapping the warm air radiating off the warm earth”* would deserve a whole paper. To us, they speak to the preeminence, or centrality, of “air”, convection, forced-air heating and air-conditioning in these students’ life experience of conceptualizations.¹³ Another meaning for the term “central air”!

An alternative conception prioritizes the domain of friction over that of rapid pressure drop to conclude that (paraphrase) “the friction of the air exiting a deflating party balloon held between one’s fingers makes it feel warm”. One could argue that friction is very everyday and experiential, thus easily conceivable, while the rapid pressure drop is not so. In addition to the “cloud in a bottle” demo video already mentioned above, one could bring a compressed air can in class, or show pictures of the ice buildup at the outlet of compressed industrial gasses tanks outside science buildings to shine a light on this topic.

“Wind means (necessarily) cooling” is grounded in personal experience shaped by the local environment in our mid-latitude climate. Arguably, the fact we are animals who sweat to regulate their body temperature might make it difficult to conceive that a breeze can actually warm up the grass proposition otherwise chilled by the outbound radiation to the clear sky—the premise in question Q9.

Finally, conductivity¹⁴ plays tricks on us when it comes to estimating an object’s temperature by touch. This one is found in the literature [Georgiou & Sharma, 2012]. As question Q16 and Q17 in

¹³ Note: the authors of these quotes however matched correctly the modes of heat transfers with the medium in mid-term exam Qmt#1: A. Convection, B. Conduction, C. Radiation, to, 1. Solid matter, 2. Air, 3. Vacuum of space. This exam question is trivialized by its being addressable by process by elimination.

¹⁴ Or diffusivity to be more precise...

our instrument revealed, the students in one section of the course grasped this much less than those in the other section. Is it a case of being less awake and engaged at 8:00 in the morning or an instance of variability in the feedback each section received?

Concluding remarks

The paper has examined alternative conceptions of building physics by undergraduate architecture students at an U.S. institution. The instrument used is v2, a questionnaire with 30 questions, the majority of the which related to everyday life experiences and called for a written answer. Students answers were analyzed to gain qualitative insights towards two goals: 1) uncovering alternative conceptions in architecture students, and, 2) feeding our reflection on how to improve the questionnaire, in terms of, for example, improving its wording and in identifying potential distractors in potential future multiple-choice questions.

Two topics in particular, radiation and condensation, were presented in some depth. The section on radiation established that not all that is related to radiation is equally well understood by students. The powerful near-infrared incoming radiation from the sun is easier to grasp conceptually than the less powerful, less obvious (both sensorially and conceptually) far-infrared radiations by objects, living things around us—and the loss of radiation to the clear sky above.

The section on condensation showed that while the students were able to apply some of the basic physics principles to rationalize how condensation works in different forms, these principles are often misleading and can cause a misunderstanding of how condensation and moisture affect their everyday lives. The relatively little improvement between the two questionnaires on the condensation questions points to the difficulty to overcoming alternative conceptions that appear to be constructed on a narrow but quasi impregnable base in which “gravity”, “air” are two central and outsized pillars.

V2, the experientially-inclined questionnaire has complemented the building systems’ course’s exams and homework in a positive way and has helped us identify potential students’ alternative conceptions on everyday physics; it has provided us with valuable insights on areas in need of more attention to help raise our architecture students’ literacy in building physics matters.

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Annex

Questionnaire v2.1, 2023, Charles & Greenstein-Himle: see next page.

Questionnaire V2.1 (30 questions)
Fall 2023

- 1 Have you noticed something when holding the body of a hand pump in your hand while inflating bike tires?
- 2 Have you noticed the sensation in your fingertips when holding a deflating party balloon?
- 3 Have you noticed a difference between dark-painted walls vs. light-colored ones when hit by sunlight?
- 4 Why are hot and humid days so uncomfortable? What would make them more comfortable and why?
- 5 Have you noticed something about the temperature of the concrete walls in an unfurnished basement in the summer?
- 6 Have you ever sensed the hotness of a sunlit glass surface from a distance away (the glass receives the solar radiation but you yourself are standing feet away from the sunlit patch)?
- 7 Why do you sweat when you are warm?
Have you noticed how your sweating changes in a muggy 90°F day?
- 8 Have you noticed early morning dew on a car roof? Why is there condensation on the roof and windshield but not on the hatchback or the side windows?
- 9 Why is there dew on the lawn some summer mornings and not others? Can convection/wind velocity explain the absence or presence of dew on the grass under identical clear sky summer early mornings?
- 10 Have you noticed fog concentrating in lower-lying areas of the landscape? Why?
- 11 Have you noticed a difference between the air temperature in the fall under clear sky and overcast sky conditions? What causes it?
- 12 Have you ever noticed how the interior face of a West-facing exterior wall feels warm to the touch in the evening in summer? Explain.
- 13 Have you noticed how your car's headlights shine brighter on the garage wall than when "smeared" on the driveway surface? Why?
- 14 Name two or three elements of the pattern you experienced along the perimeter of a building with the wind blowing on it.

15 Have you touched a radiator? Have you touched a radiant floor with the radiant heat on? How do the temperature of each compare?

16 Touch it and estimate the temperature of the top of the desk in front of you.

17 Touch it and estimate the temperature of the metal leg of the table in front of you.

18 Is fog water vapor or water droplets?

- A. Water vapor
- B. Water droplets
- C. Something else

19 When the gas stove stays on under a pan of boiling water at 100°C, where does the added heat go?

20 Have you ever experienced relaxing sunbathing on a deck on a cold but sunny winter day? Explain what phenomena balanced each other out so as to make you feel thermally comfortable.

21 How would you orient a water-heating solar captor relative to the sun to maximize its thermal output?

22 If you turn the solar captor 45 degree up or down from the optimal angle, do you expect to get more, less or equal hot water output compared to the optimal position?

23 Which is receiving the most solar radiation in winter per unit area?

- A. one square foot of vertical south façade
- B. one square foot of the horizontal roof

24 Which is receiving the most solar radiation in summer per unit area?

- A. one square foot of the vertical south façade
- B. one square foot of the horizontal roof

25 You probably have experienced being blinded by the glare of the sun reflecting off a house window while walking outdoor. Do you think that the part of the sunbeam that was reflected had an impact on the amount of light passing through the glass?

26 What's your view on Mrs Fockers' quote: "if it's yellow, let it mellow; if it's brown, flush it down"? Do you practice it at home? In public toilets (on campus for example)?

27 What mode of heat transfer is made visible by this particular imaging technique?



Photo courtesy of Gary S. Settles, Penn State

- A. Conduction
- B. Convection
- C. Radiation

28 Does a ceiling fan in a room cool down the room air?

- A. Yes
- B. No

29 Which material would have the biggest temperature difference on the outside vs inside surfaces if the outside and inside temperatures were vastly different?

- A. Wood
- B. Insulation
- C. Concrete
- D. Steel

30 A person who likes 70F as indoor temperature returns evenings to a cold house. What would your advice to that person be to get the house indoor temperature back to 70F quickly?

- A. Turn the thermostat first to 65F, and, after a while, adjust up to 70F
- B. Turn the thermostat precisely to the desired end temperature, 70F
- C. Turn the thermostat to 82F, and, after a while, adjust back down to 70F

Aquaponics: The Most Closed Loop Food Production System in the World

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Abstract

The Circular Economy, like Nature, creates no waste because everything is designed to last longer, to be reused and then recycled. The Circular Economy closely imitates nature by valorizing and cascading “waste” into useful products and services. For example, food “waste” can be taken to a commercial compost facility and made into compost which is a wonderful soil amenity. This soil amenity can be used to grow more food and demonstrates nature’s way of recycling or “closing the loop”. The Circular Economy has a Biology side to it called the Bioeconomy. The Bioeconomy refers to such Biology related activities as growing food, designing new vaccines, and/or developing new medicines from nature. A very good example of the Bioeconomy is Aquaponics. Aquaponics uses three interdependent keystone communities: fish, plants, and microbes, to grow food. It is a good example of the Bioeconomy because it heavily relies on nature’s design whereby the fish, plants and microbes keep each other healthy by using each other’s waste. These are symbiotic relationships whereby each community helps the other. Subsequently, Aquaponics is the most “closed loop” Agricultural Food Production System in the world!

Exploring the Evolution of Financial Advisory Services in Western Massachusetts: A Decade-Long Analysis

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Abstract

Purpose This study aims to provide a comprehensive analysis of financial services and brokerage firms in Western Massachusetts by analyzing a local business directory. It seeks to understand the sector's trends by focusing on the distribution, market share, and service offerings of financial advisory firms. By examining the geographic spread of firms, the evolution of services provided, and the market's competitive structure, the study endeavors to offer a granular understanding of how the financial advisory sector has adapted to changing economic conditions, regulatory environments, and technological advancements. **Methodology** The study analyzed data from Business West Magazine's Resource Guides and information from financial regulatory bodies and industry associations. Data collection utilized an optical character recognition technology to transform data into a machine-readable format. Using both quantitative and qualitative research methodologies, it involved geographic analysis, examination of firm size, market share, and the variety of services offered, and key analytical methods such as time series and text analysis. **Results** The analysis revealed significant variations in the number of financial advisory firms across cities, with a general trend towards consolidation in key locales and diversification in service offerings that align with market demands. The study observed a significant decline in the number of firms in 2015, followed by a recovery that peaked in 2022. Additionally, market share analysis highlighted the dominance of established firms while also indicating room for growth among smaller entities. The service shifted towards planning, insurance, and retirement services, reflecting changing consumer needs. The impact of technological advancements, particularly the adoption of robo-advising, suggests an ongoing transformation in how advisory services are delivered.

Keywords: Financial Advisory Services, Market Analysis, Western Massachusetts, Service Diversification, Technological Advancements, Business West, Financial Sector Trends, Competitive Dynamics, Robo-Advising

Combating Money Laundering in the Luxembourg Financial Market

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Abstract

The global financial market is complex and is an ever-changing system that must be properly supervised and regulated in order to maintain investor and stakeholder trust and confidence, as well as preventing financial crime. This research focuses on Luxembourg as the second largest financial services market in the world and its economy and much of Europe is highly dependent on this sector. Trust and security are elements critical to the continued success and growth of these markets. The size and complexity of the global financial market makes it an ideal target for money laundering. As a result, it is as crucial to maintaining the security and safety of the global financial markets. These markets are continually evolving in scope and technology and the defensive mechanisms implemented must continue to evolve to meet these challenges, if these markets are to maintain their reputation as trusted and secure havens for the world's money. Luxembourg is one of the principal countries leading the battle against money laundering and financial crimes. The strict laws and regulations that govern the country's financial sector, as well as the steps taken by the European Union and the rest of the world, have been, and continue to be, leading factors in the continuous development of the country. This research examines the strategies that Luxembourg has taken in development and implementation of new technologies and strategies that are critical to combat the new and ever more creative waves of money laundering.

A Statistical Perspective on Equity in Sports Officiating

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Abstract

Major sports leagues are morally bound to preserve fairness and equity in officiating. Nevertheless, analysis of published data suggests that the rules stated in the rulebooks are not enforced fairly and consistently. We will analyze some apparent examples of unfairness from a stoical perspective, including examples drawn from the National Basketball Association (NBA).

The Artificial Intelligence and Business Analytics Skillset: Evaluating Employer Needs in the Springfield Massachusetts Job Market

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Purpose

This research investigates the job market in Springfield, Massachusetts, focusing on jobs requiring artificial intelligence (AI) and analytics skills. The purpose of this research is to understand the current skills and knowledge demand regarding these topics in the job market.

Methodology

The analysis includes a review of 120 job advertisements published in fall 2023 on Indeed, focusing on jobs related to AI and business analytics. We used an AI-based text analysis to categorize and analyze job requirements. The categorized data were analyzed by using Python for pattern recognition and trend analysis to understand the qualifications and skills most in demand.

Results

Our findings indicate a demand for employees with at least a bachelor's degree (55%). Among the preferred majors, STEM (43%), analytics (23%), and business majors (10%) are the most popular. In-person jobs (70%) are primarily offered despite the recent remote work trends. Key skills that employers are looking for include management, communication, and modeling. Additionally, specific technical skills such as SQL, SAP, Oracle, cloud, Excel, and Python are frequently listed. Most of the job openings (59%) are entry-level positions.

Keywords

Artificial Intelligence, Analytics, Job Market Trends, Springfield, Massachusetts, Higher Education, Skills Gap, Workforce Development, STEM, Bachelor's Degree, In-Person Work, Entry-Level, Technical Skills

Homeownership Trends among Young Adults in Hampden County, Massachusetts: A Decade in Review

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Purpose

This study investigates homeownership trends among young adults aged 15-34 in Hampden County, Massachusetts, from 2010 to 2021. By examining historical data, the study provides a comprehensive overview of homeownership rates among various household types. The insights gathered seek to inform future research and policymaking better to support young adults in their pursuit of homeownership.

Methodology

This research conducts a time series analysis of homeownership trends, analyzing data from the United States Census Bureau. Focusing on young adults in Hampden County, the study disaggregates data by family and non-family household types, including married couples, male and female householders without a spouse present, and householders living alone or not living alone.

Results

The study uncovers homeownership patterns across various household types in Hampden County. Homeownership rates for young married couples have varied between growth and decline in different regions. The analysis reveals gender disparities in homeownership, particularly among householders without a spouse present, with female homeownership rates consistently lower than those of males. Comparative analysis of Massachusetts and the United States demonstrates regional peculiarities in homeownership trends, highlighting the influence of local economic conditions and housing market dynamics. Furthermore, the research identifies significant local stories of homeownership surges and declines across different towns, illustrating the diverse and dynamic nature of the housing market within the county.

Keywords

Homeownership, Young Adults, Hampden County, Census Bureau Data, Family and Non-Family Households, Gender Disparities, Local Economic Conditions, Housing Market Dynamics

Springfield's Decade of Transformation: The Dual Impact of MGM Springfield and Covid-19 on the City's Economic, Social, and Cultural Shifts

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Purpose

This study investigates the economic, social, and cultural trends in Springfield, Massachusetts, from 2013 to 2023. This research aims to analyze how significant events, such as the opening of the MGM Springfield casino and the COVID-19 pandemic, influenced the city's employment, income, poverty rates, and racial disparities, providing a comprehensive understanding of their economic, social, and cultural implications.

Methodology

The research employs a quantitative analysis of Springfield's financial data, MGM Casino's economic contributions, and demographic statistics, including income, employment, poverty, and race. Data sources include the U.S. Census Bureau, Massachusetts Gaming Commission, and Springfield's City Comptroller's Office. A literature review was conducted to contextualize the findings within broader trends of urban casino impacts and the socioeconomic effects of the COVID-19 pandemic.

Results

Findings highlight that the MSG Casino positively influenced Springfield's economy by creating jobs and increasing local revenues, particularly in the year following its opening. However, COVID-19 significantly disrupted employment and income distribution. The pandemic also aggravated existing racial disparities in employment and poverty, disproportionately impacting Hispanic and Black communities. Despite these challenges, Springfield showed economic resilience and recovery, which is reflected in improving unemployment rates and median household incomes.

Keywords

Springfield, Massachusetts; MGM Springfield; COVID-19; Economic Impact; Social Disparities; Cultural Shifts; Urban Casino; Employment; Income; Poverty Rates; Racial Disparities

Business Listing Trends from 2017-2023 in Springfield, Massachusetts

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Purpose

This study aims to analyze a business listing to examine sectoral growth and decline within Western Massachusetts from 2017 to 2023. By examining industries ranging from restaurants to healthcare and technology, the research seeks to identify underlying trends that signify evolving consumer preferences, economic dynamics, and industry-specific challenges.

Methodology

Our research employed statistical and trend analysis methods to assess the business listing dataset. The methodology included utilizing image analysis tools for data conversion, data cleaning, and statistical methods for trend assessment and visualization. The study covered 36 business categories, with data available across all seven years.

Results

The findings reveal diverse trajectories across different sectors. The number of Behavioral Health Centers in business listings increased by 6% annually from 2017 to 2023, likely due to the demand for mental health services during the COVID-19 pandemic. On the declining end, the restaurant industry experienced a notable decrease of 5% annually. The study also noted declines in Office Equipment Dealers and Credit Unions while highlighting growth in areas such as Finance and Manufacturing.

Keywords

Western Massachusetts, Business Trends, Economic Dynamics, Consumer Preferences, Industry Challenges, Growth and Decline, COVID-19 Impact, Behavioral Health, Restaurant Industry, Statistical Analysis.

The Dominican Republic-Central America Free Trade Agreement

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Maxine Martinez, Roger Williams University, USA
Demir, Dirik, Roger Williams University, USA
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Abstract

This research examines the free trade agreement (CAFTA-DR) composed of Dominican Republic, several Central American countries, and the U.S. CAFTA-DR was established in 2005 and the current members are Dominican Republic, El Salvador, Cost Rica, Guatemala, Honduras, Nicaragua, and the U.S. This research examines this trade pact along several dimension, goals and objectives, functions, rules and regulations, and the trade impacts. Our research indicates that U.S. exports of poultry meat and products to the CAFTA-DR member countries have increased by more than \$200 million since 2011. In addition, the rules regarding intellectual property rights have strengthened. The research shows that the exports of the member countries of CAFTA-DR to the U.S. have also doubled since 2005. In addition, the study explores the impact of CAFTA-DR on sustainability practices in Dominican Republic and other Central American countries member of CAFTA. Furthermore, “Due Diligence”, the observance of human rights, in the above countries is studied. Based on the findings, CAFTADR does not require the member countries’ labor laws to conform or observe the basic international labor laws that have been established by the International Labor Organization (ILO) of the United Nations. Our research indicates that there are anti-union practices, not allowing labor strikes, sexual harassment, and pregnancy-based discrimination. The research concludes with the accomplishments of this trade pact and the areas that need more attention to enhance sustainability and human rights.

A Study towards Supply Chain Resilience Management of New Energy Vehicles Based on Blockchain Architecture

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Abstract

Amidst the rapid development and proliferation of new energy vehicles, a novel supply chain management framework centered on these vehicles increasingly garners attention. The continuous breakthroughs in electric vehicles and autonomous driving technologies, along with the application of the Internet of Vehicles (IoV) and artificial intelligence (AI) or generative AI (GenAI), have emerged as both a cutting-edge and increasingly crucial research area in the supply chain management of new energy vehicles. On the other hand, the ongoing integration of digital technologies such as the IoV and AI (GenAI) introduces numerous risks and challenges within supply chain operations. Additionally, the escalating uncertainty of international situations (e.g., the Russo-Ukrainian War and conflicts in the Middle East) and the sudden occurrences of supply chain disruptions caused by regional natural disasters (e.g., earthquakes and pandemics) significantly undermine the traditional frameworks for sustainable supply chain development. Based on long-term observations and analyses of supply chain resilience, this study incorporates a decentralized network architecture based on the blockchain mechanism. Focusing on new energy vehicles, it endeavours to create an innovative, intelligent supply chain architecture that spans from R/D and manufacturing to sales, maintenance, and the recycling and reuse within the secondary market. Moreover, it explores the integration of metaverse mechanisms to navigate the challenges posed by increased risks and emergencies in the physical world, which impede normal supply chain operations. Utilizing the decentralized autonomous organizations (DAOs) supported by blockchain technology, this study gradually replaces traditional centralized operational models, enabling the supply chain to respond flexibly and intelligently to emergencies and truly enhance resilience. This research provides a clear theoretical framework for the aforementioned content, outlining the fundamental elements and conditions necessary to achieve these objectives. It concludes with several case studies that analyze and validate the practicality and applicability of the theoretical framework, thereby offering clear and effective planning measures for future challenges and topics.

The Comprehensive Economic and Trade Agreement: Canada and the European Union

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Abstract

Amidst the rapid development and proliferation of new energy vehicles, a novel supply chain management framework centered on these vehicles increasingly garners attention. The continuous breakthroughs in electric vehicles and autonomous driving technologies, along with the application of the Internet of Vehicles (IoV) and artificial intelligence (AI) or generative AI (GenAI), have emerged as both a cutting-edge and increasingly crucial research area in the supply chain management of new energy vehicles. On the other hand, the ongoing integration of digital technologies such as the IoV and AI (GenAI) introduces numerous risks and challenges within supply chain operations. Additionally, the escalating uncertainty of international situations (e.g., the Russo-Ukrainian War and conflicts in the Middle East) and the sudden occurrences of supply chain disruptions caused by regional natural disasters (e.g., earthquakes and pandemics) significantly undermine the traditional frameworks for sustainable supply chain development. Based on long-term observations and analyses of supply chain resilience, this study incorporates a decentralized network architecture based on the blockchain mechanism. Focusing on new energy vehicles, it endeavours to create an innovative, intelligent supply chain architecture that spans from R/D and manufacturing to sales, maintenance, and the recycling and reuse within the secondary market. Moreover, it explores the integration of metaverse mechanisms to navigate the challenges posed by increased risks and emergencies in the physical world, which impede normal supply chain operations. Utilizing the decentralized autonomous organizations (DAOs) supported by blockchain technology, this study gradually replaces traditional centralized operational models, enabling the supply chain to respond flexibly and intelligently to emergencies and truly enhance resilience. This research provides a clear theoretical framework for the aforementioned content, outlining the fundamental elements and conditions necessary to achieve these objectives. It concludes with several case studies that analyze and validate the practicality and applicability of the theoretical framework, thereby offering clear and effective planning measures for future challenges and topics.

COMESA: Common Market for Eastern and Southern Africa

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Abstract

The Common Market for Eastern and Southern Africa (COMESA) is composed of 21 countries. This research discusses the history, the foundation, the rules and regulations, and the goals and objectives set for COMESA. Some of the major goals of COMESA is to reduce the tariff and non-tariff barriers, to share trade information, to increase the exports of the member countries, develop resources and establish common monetary union and free movement of people. These goals and objectives are very similar to the foundation of the European Union. This research delineates the major destinations for exports/imports and the trade partners of COMESA. The major trade partners of COMESA are the U.S., China, France, Italy, and the United Arab Emirates. This study explores the extent of the accomplishments of the goals and objectives of COMESA. Furthermore, it discusses the major hurdles in regards to the implementation of the goals and objectives of COMESA. Some of these hurdles include global warming, political instability, energy availability, sustainability practices, food insecurity, and human rights violations. The study proposes some strategies and remedies that can lower the hurdles in accomplishing the goals and objectives of COMESA.

Swiss-U.S. Free Trade Agreement

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Abstract

This research examines the history of the relationship between Switzerland and the U.S. going back to 1829 when the consular relation was established. In 2006, U.S. and Swiss formed the “Trade and Investment Cooperation Forum”. In 2008, a joint declaration on e-commerce was signed. Currently, since 2018, the Free Trade Agreement (FTA) between Swiss and the U.S. are under discussion. The study presents the goals and objectives of the trade agreement between Swiss and the U.S. that include promoting economic growth in both counties, enhancement of diversification of their markets, creation of new jobs, reduction of tariffs, and legal certainty. In addition, the study concentrates on the functions, which include a joint “Economic Commission” to deal with money laundering, counterterrorism, intellectual property rights, and enhancing U.S.-Swiss investments. The agreement also deals with visa wavering and major exports. The major exports of Swiss-U.S. include gold, pharmaceutical, medical instruments, and aircrafts. The rule and regulations of this agreement include several points such as elimination of tariffs, rules of origin, dealing with non-tariff barriers, and protection of patents, copyrights and trademarks. Furthermore, the research explores the problems and issues in regards to labor and environmental standards. The final part of the study discusses the accomplishments of the agreement and what else needs to be considered.

World Trade Organization

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Abstract

This research presents the history of World Trade organization (WTO), its goals and objectives, rules and regulations, and function. In addition, the study explores the accomplishments of WTO. Furthermore, the research focuses on China as a member of WTO since 2001. The research examines WTO policies and if China has observed these policies since becoming a member of WTO. A major focus of this examination is WTO policies on sustainability and human rights. The study presents issues along sustainability and human rights. Environmental sustainability issues such as, logging, plastic wastes, fishing, and wildlife trafficking in addition to the violation of human rights are discussed.

Net-Zero Carbon Emissions: The Amazon Climate Pledge

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Abstract

The Climate Pledge that was founded in 2019 has now been signed by 380 companies from 34 countries (1). These companies commit to achieving net zero carbon emissions by the year 2040, a decade ahead of the Paris Accord's goal of 2050. This research focuses on the pledge by the Amazon's CEO to achieve net zero carbon emission operations by the year 2040. Considering the size of the operations of Amazon, supply, delivery, product range, and distribution, such pledge requires major decarbonization of Amazon's operations. The pledge by Amazon entails electrification of its 100, 000 delivery vehicles, investment of \$100 million in reforestation, and utilization of non-fossil fuel energy by the year 2030 and net zero carbon emission operations by the year 2040 (2). This study examines the operations of Amazon and its pledge along different stakeholders: customers, suppliers, employees, immediate community, and other impacted groups. The results of the research indicate that Amazon has taken major strides towards achieving its pledge in the U.S. and Europe. In addition, the research discusses areas that Amazon needs to concentrate further to deliver its pledge of net zero carbon emissions by the year 2040.

South Africa: FDI & CSR

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Evan Fuller, Roger Williams University, USA
Brendan Loughran, Roger Williams University, USA
Katelyn Pattison, Roger Williams University, USA
Matthew Turchiano, Roger Williams University

Abstract

This study concentrates on comparative advantages, different industries, trade barriers, and the cultural aspects of South Africa. The research discusses the competitive advantages of South African companies in several industries: Agriculture, Mining, Manufacturing, Energy, Transportation, and Tourism. The study discusses the major foreign companies that have operations in South Africa, such as auto companies, clothing, agriculture, and chemicals. The final parts of the research explore the sustainability practices of domestic and foreign companies in South Africa. In addition, the principles of responsible business conduct and due diligence are examined in regards to human rights. Furthermore, the economic opportunities and the future potential trade of South Africa are discussed.

Best Paper Award in Application of Theory

Dow Jones Sustainability Indices and ESG Scores: Do They Tell the Same Story?

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Edward Daughtery, Salve Regina University, USA

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Abstract: The focal point of this research is to compare two of the largest global organizations' sustainability indices and scores, Dow Jones Sustainability Indices (DJSIs) and the Standard & Poor's Global (S&P Global) ESG scores (Environmental, Social, Governance) that rank the companies based on their sustainability practices and to learn if they correspond to each other. Considering that Germany is the hub of large companies from the leading global industries, this research compares the ESG scores of the German companies that appear on the Dow Jones Sustainability Indices. Several statistical analyses are conducted to determine if the German companies on the DJSIs correspond with high ESG scores. The years under consideration are 2018 through 2023. The results of this research indicate that DJSIs and ESG scores are not telling the same story and there are discrepancies regarding the sustainability practices of the studied companies that are added to the DJSIs and the assigned high ESG scores by the S&P Global.

Key Words: ESG Scores, Dow Jones Sustainability Indices, Correlation, German Companies

1. Introduction

Dow Jones Sustainability Index (DJSI) that started in 1999 traces the publicly traded companies from the leading global industries denoted on the S&P Global 1200 Index and its subsets and examines their performance along three dimensions of sustainability: economic, social, and environmental. As a result, every year, DJSI signifies the companies that are committed to sustainable practices along social, environmental, and economic factors while deleting the companies from the previous list if they are no longer meeting the standards of sustainability practices. Several studies have utilized the DJSIs to explore the impacts of the appearance of the companies on the DJSI lists along different dimensions, such as the companies' financial performances and their stock prices [1,2,3,4,5].

The ESG concept started in the 1960s when companies boycotted trade with South

Africa [6]. In 2005, the ESG evolved into ratings along environmental, social, and governance, which was established by the United Nations Global Compact (UNGC) [7]. The ESG scores rank the companies as high (70 and above), average (below 70 to 50), and low (below 50). Both DJSI and ESG use the top largest firms on the S&P Global Broad Market Index (BMI) [8].

Several studies have examined the impact of implementing the ESG principles of environmental, social, and governance on the performance of the companies [8,9,10,11,12]. The main focus of this study is to investigate the correlation between the companies appearing on the DJSI lists and their ESG scores and to determine if the companies on the DJSIs indicate high ESG scores (70 and above). Since Germany is the hub of large firms in top industries, such as auto, technology, sportswear, service, and financial institutions [13,14,15] and in addition being part of the European Union with the goal of net-zero carbon emission economy by the year 2050, the German companies provide data that can address the focal point of this research. As a result, the German companies on the DJSI lists for the years 2018-2023 were selected for this study [16, 17,18]. The ESG scores of the German companies that appeared on the DJSI lists for years 2018-2023 were examined to determine if they indicated high ESG scores (70 and above). In addition, the ESG scores of the German companies that were deleted from the DJSI lists of the previous years were inspected to see if they showed lower ESG scores (below 70) to establish the extent of the correlation with being deleted from the DJSI lists.

2. Literature Review

2.1. *DJSI Impact on Listed and Deleted Companies*

Research studies on the impact of being listed on the DJSIs and deleted from these lists provide different discussions [1,2,3,4,5]. Kılıç et al. [1] studied the impact of the appearance on the DJSI lists on the financial performance of the companies in two countries, South Korea, a developed country, and Turkey, a developing country. According to the result of their study, the impact of sustainability practices on the financial performance of the companies in a developed country versus a developing country differed. In South Korea, appearance on the DJSI lists resulted in a positive impact on the financial performance of the company, but not for the Turkish companies [1]. In addition, the authors concluded that the size of the company was a major moderating factor [1].

Schmutz et al. [2] studied the impact of the appearance of the European and the U.S. companies on the DJSI lists (2015-2018). According to their findings, there was a negative impact on the market values of these companies when they appeared on the DJSI lists and no impact when they were deleted from the lists during the studied years except for the petroleum companies [1]. An important finding of this research was that the European Union and all the governmental policies regarding sustainability did not indicate any positive impact on the market value of the companies appearing on the DJSI lists [2].

Yilmaz et al [3] in their study of the impact of appearance on the DJSI lists or deletion from the lists in Bosra Istanbul, Turkey, during the years 2014-2017 did not indicate any impact on the market value of such companies. The authors also found that the companies that were included on the DJSI lists had a reduced risks of severe decline in their market value when faced with serious economic crisis [3].

In another study by Lee et al. [4] regarding the South Korean companies and the addition to the DJSI lists, the authors concluded that the investors positively reacted to the companies when first appearing on the DJSI lists [4]. However, this positive reaction was not from all investors, but only from the investors of the public pension companies. The authors also concluded that promotion of corporate social responsibility by the government had a very limited impact and it only enhanced the market value of the public pension companies [4].

Searcy and Elkhawas (2012) studied the Canadian companies on the DJSI lists and how these companies use being listed on the DJSI [5]. According to the authors, these companies take steps to stay on the DJSI list and highlight the inclusion on the DJSI list on their sites [5]. The authors recommend that improvements are needed as far as questionnaire, increasing transparency, and also more synchronization with other agencies that report sustainability scores [5].

As indicated by the above studies, being listed on the DJSIs or deleted from the lists does not indicate a consistent impact on the market value of the companies.

2.2. ESG Scores

As mentioned above, the ESG ratings were developed by the United Nations Global Compact in 2005, measuring the extent of the engagement in sustainability practices of the companies along three dimensions: environmental, social, and governance [7]. Several studies have examined the ESG performance of the companies and the impacts on performance of the companies such as, financial, resource efficiency, and marketing capabilities [8,9,10,11,12].

Clément et al. [8] discuss the inadequacy of the ESG scores to measure the concepts of sustainability. The authors propose that with the popularity of ESG scores, these scores should be based more on sustainability concepts and in addition their measurement and collection methodologies need to be improved [8].

Clementino and Perkins [9], in their study of Italian companies and ESG scores, conclude that the companies react very differently to the ESG ratings. The authors discuss the issues with ESG scores, such as ratings not being clear as far as how companies respond to the surveys [9]. The authors also conclude that the response of the companies to the ESG scores depends on the beliefs of the companies' managers [9]. In addition, the study questions the claim that ESG ranking has a positive impact on the sustainability strategies of the companies [9].

In their research, Hu et al. [10] explore how the ESG scores relate to the efficiency in investments by companies and also their marketing capabilities. According to their findings using a sample of the U.S. companies (1991-2019), the higher marketing capabilities are associated with enhanced engagement in environmental, social, and governance activities and as a result, a higher ESG score is a result of more efficient investment activities [10].

Rajesh [11], in a study of thirty-nine Indian companies along the ESG scores from 2014 to 2018, investigated the impact of ESG scores on improving the implementation of sustainability strategies in companies [11]. According to Rajesh, achieving high ESG scores requires contribution of other scores, such as corporate social responsibility. However, other

scores, such as scores given by shareholders, management, and human rights organizations do not affect the ESG scores for studied Indian companies [11]. The author concludes that for the Indian companies the governance should be a major focus for enhancing the ESG score and sustainability practices [11].

The study by Tarmuji et al. [12] found support for the positive impact of ESG scores and the economic performance of the studied companies in Malaysia and Singapore [12]. According to the authors, non-financial data of the selected companies in the two countries indicated a strong relationship between social and governance ESG scores and economic performance of the selected companies [12].

As evident by the reviewed literature, the results of studies on the impacts of companies listed on the DJSIs or with high ESG scores are not well defined. Some studies [1,4] support the positive impact of being listed on the DJSI lists on the market value of the companies, but some other studies have not found such support [2,3]. Regarding the ESG score, some research support that ESG scores indicate engagement in sustainability practices of the companies [10,12] and some do not support such impact [9,11]. In addition, the research on the relationship between ESG scores or being listed on the DJSIs and the financial or economic performance of the companies in developed and developing countries are not consistent [1,2,11,12].

This study approaches this issue from a novel angle: Do high ESG scores correspond to the companies on the DJSI lists? And when the companies are deleted from the DJSI lists, do their ESG scores indicate such deletions? Considering that both DJSI and ESG scores are highly prominent global sustainability indicators of the companies, comparing these two global indicators is essential in exploring the impacts on sustainability practices by the companies.

3. Research Goals

This research concentrates on the two global organizations, Dow Jones and S&P Global, and their global sustainability indicators. The research studies the companies that appear on the Dow Jones Sustainability Indices and their S&P Global ESG scores that indicate sustainability and corporate social responsibility (CSR) practices of large global companies.

ESG scores provide rankings based on how firms treat their employees, if the board practices shared governance in decision-making, and if the environmental issues are taken into consideration [8]. DJSIs provide information in regard to the economic, social, and environmental stance of the largest firms that are publicly traded across the globe. The Information made available by both the DJSIs and ESG scores provide data for the investors

for the global publicly traded firms.

To examine the correlation between being on the DJSI lists and having high ESG scores, we selected the German companies on DJSI lists within the years 2018 to 2023. As mentioned above, Germany is the hub of some of the largest publicly traded firms in the world and as a member of the European Union, Germany is to achieve the net-zero carbon emission economy by the year 2050. This data for this research includes:

1. *Selection of the German firms on the DJSI lists for years 2018 through 2023.*
2. *Examining the ESG scores of the German firms on the DJSI lists for the years 2018 through 2023.*

Comparing the firms on the DJSI lists with their ESG scores is a novel approach to investigate the validity of the information provided by these two global organizations, Dow Jones and S&P Global, which indicate sustainable and CSR practices of the large publicly traded global firms. The major focus of the research is:

Investigating if the German companies that have appeared on the DJSIs correspond to high ESG scores (70 & >), which is an indication of the extent of the sustainability practices of these firms.

4. Data and Methods

The ESG scores take into consideration the strategies of a company along environmental, social, and governance dimensions. It ranks the companies based on how thorough the companies deal with the health and the welfare of the employees, CSR, carbon emission, and climate change in addition to respecting diversity, equity, and inclusion (DEI) [8].

As explained previously, German firms are among the top largest companies in the global industries. As a result, the German firms appearing on the DJSI lists from 2018 through 2023 are selected for this research. The list of the German firms that appeared on the Dow Jones Sustainability lists from 2018 through 2023 and their ESG scores are presented in **Tables 1–6** [13-18].

Table 1. German firms on the DJSI list and the ESG scores, 2018.

#	2018 – DJSI List	ESG: High 70 & >	ESG: Avg <70 - 50	ESG: Low <50
1	SAP SE	70		
2	Adidas		64	
3	Allianz	85		
4	Bayerische Motoren Werke (BMW)	74		
5	Deutsche Bank		53	
6	Deutsche Börse AG		63	
7	Deutsche Post AG	73		
8	Deutsche Telekom	83		
9	Infineon Technologies AG	78		
10	Hugo Boss AG	80		
11	Lanxess AG	84		
12	Metro AG	76		
13	Munich RE	76		
14	Siemens AG	79		

Table 2. German firms on the DJSI list and the ESG scores, 2019.

#	2019 – DJSI List	ESG High 70 & >	ESG Avg <70 - 50	ESG Low <50
1	SAP SE		69	
2	Adidas	85		
3	Allianz	88		
4	Bayerische Motoren Werke (BMW)	78		
5	Deutsche Börse AG		63	
6	Deutsche Post	72		
7	Deutsche Telekom	86		
8	HOCHTIEF AG	76		
9	Infineon Technologies AG	79		
10	Lanxess AG	85		
11	Metro AG	82		
12	Munich RE	79		
13	Siemens AG	79		

Table 3. German firms on the DJSI list and the ESG scores, 2020.

#	2020 – DJSI List	ESG High 70 & >	ESG Avg <70 - 50	ESG Low <50
1	SAP SE	74		
2	Adidas	82		
3	Allianz	85		
4	Bayerische Motoren Werke (BMW)	80		
5	Deutsche Börse AG		67	
6	Deutsche Post	70		
7	Deutsche Telekom	89		
8	HOCHTIEF AG	75		
9	Hugo Boss AG	86		
10	Infineon Technologies	81		
11	Lanxess AG	87		
12	Metro AG	81		
13	Munich RE	80		
14	Siemens AG	81		

Table 4. German firms on the DJSI list and the ESG scores, 2021.

#	2021 – DJSI List	ESG High 70 & >	ESG Average <70 - 50	ESG Low <50
1	SAP SE	79		
2	Allianz SE	89		
3	Bayerische Motoren Werke (BMW)	74		
4	Deutsche Börse AG	73		
5	Deutsche Post	70		
6	Deutsche Telekom	91		
7	Infineon Technologies	83		
8	Munich RE AG	86		
9	Siemens AG	81		
10	HOCHTIEF AG	76		
11	Hugo Boss AG	86		
12	Metro AG	77		
13	Lanxess AG	88		

Table 5. German firms on the DJSI addition list and the ESG scores, 2022

#	2021 – DJSI List	ESG High 70 & >	ESG Average <70 - 50	ESG Low <50
1	SAP SE	80		
2	Allianz SE		60	
3	Deutsche Börse AG	79		
4	Deutsche Post	71		
5	Deutsche Telekom	94		
6	Fresenius Medical Care AG & Co. KGaA	72		
7	HOCHTIEF AG	76		
8	Hugo Boss AG	88		
9	Infineon Technologies	83		
10	Lanxess AG	85		
11	Metro AG	78		
12	Munich RE AG	80		
13	Siemens AG	81		

Table 6. German firms on the DJSI addition list and the ESG scores, 2023

#	2023 – DJSI List	ESG High 70 & >	ESG Average <70 - 50	ESG Low <50
1	SAP SE	71		
2	Allianz SE	82		
3	Deutsche Börse AG	71		
4	Deutsche Post		66	
5	Deutsche Telekom AG	90		
6	GEA Group Aktiengesellschaft	75		
7	HOCHTIEF AG	72		
8	Hugo Boss AG	88		
9	Infineon Technologies	77		
10	Lanxess AG	79		
11	Metro AG		66	
12	Munich RE	N/A		
13	Siemens AG	78		

As presented in **Tables 1-6**, two firm, Deutsche Bank and Hugo Boss AG, on the DJSI 2018 were deleted from the list on the DJSI 2019. No firm was deleted from the listed firms on the DJSI 2019 to the listed ones on the DJSI 2020. One firm, Adidas, listed on the DJSI 2020, was deleted from the listed firms on the DJSI 2021. BMW listed on the DJSI 2021 was deleted from the listed firms on the DJSI 2022. For the DJSI 2023, Fresenius Medical Care AG & Co. KGaA on the DJSI list of 2022 was deleted. Munich RE did not have any ESG scores and according to the company, they no longer take part in the ESG evaluation [16].

We then examined the German firms' ESG scores that were on the DJSI lists in 2019, 2021, 2022, and 2023 and had lower than 70 ESG scores and also the ESG scores of the German firms that were deleted from the DJSI lists throughout the years under study. These results are presented in **Tables 7 - 8**.

Table 7. German firms on the DJSI lists of 2019, 2021, 2022, 2023 and their corresponding ESG scores for the same years.

Table 7. German firms added to the DJSI lists, 2019-2023, and their corresponding ESG scores.

#	On the DJSI Lists	ESG High 70 & >	ESG Avg <70 - 50	ESG Low <50
1	Adidas (2018)		64	
2	Deutsche Bank AG (2018)		53	
3	Deutsche Börse AG (2018)		63	
4	SAP SE (2019)		69	
5	Deutsche Börse AG (2019)		63	
6	Deutsche Börse AG (2020)		67	
7	Allianz SE (2022)		60	
8	Deutsche Post (2023)		66	
9	Metro AG (2023)		66	

Table 8. German firms deleted from the DJSI lists, 2019-2023, and their corresponding ESG scores.

#	Deleted from the DJSI Lists	ESG High 70 & >	ESG Avg <70 - 50	ESG Low <50
1	Deutsche Bank AG (deleted in 2019)			48
2	Hugo Boss AG (deleted in 2019)	77		
3	Adidas (deleted in 2021)	82		
4	BMW (deleted in 2022)		58	
5	Fresenius Medical Care AG & Co. KGaA (deleted in 2023)		62	

As indicated in **Tables 7** several companies on the DJSI lists do not indicate high ESG scores 70 & >. In addition, **Table 8** indicates that Hugo Boss AG deleted from DJSI list in 2019 and Adidas deleted from DJSI list in 2021 show high ESG scores, 77 and 82 respectively. Statistical analyses including bar graphs, cluster bars, and scatter plots are used to investigate if the German firms on the DJSI lists correspond to high ESG scores (70 & >).

5. Results

Several bar graphs for the years 2018 through 2023 were plotted. The results of these analyses are presented in **Figures 1-6**. The X-axis in each table represents the German firms on the DJSI and the Y-axis represents the corresponding ESG scores. The bars in green indicate companies with high ESG scores (70 & >), the orange bars represent average ESG scores (69 to 50), and the reddish bars indicate low ESG scores (below 50).

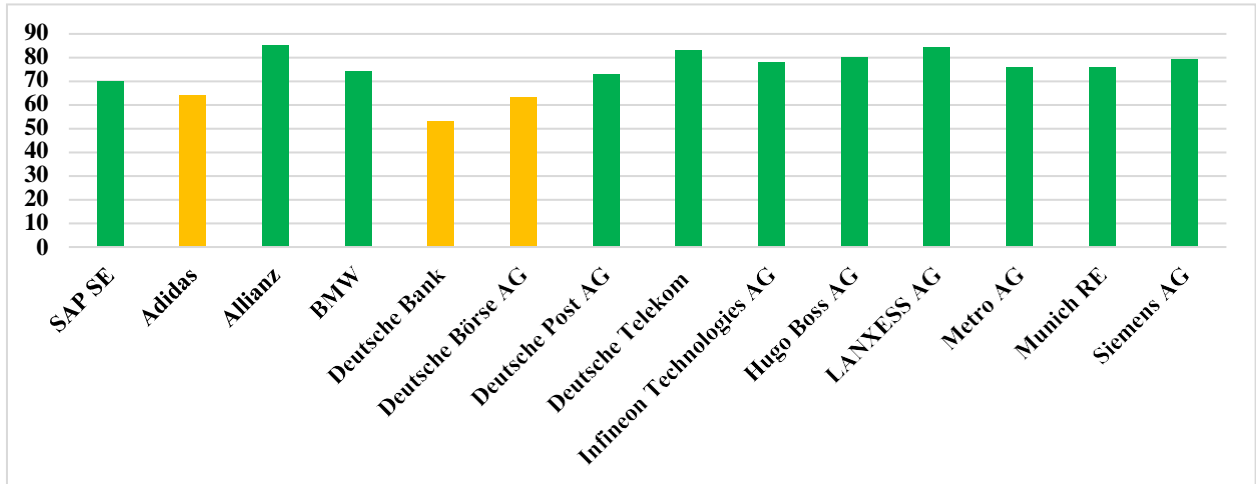


Figure 1. DJSI & ESG Score Bar Graph: 2018

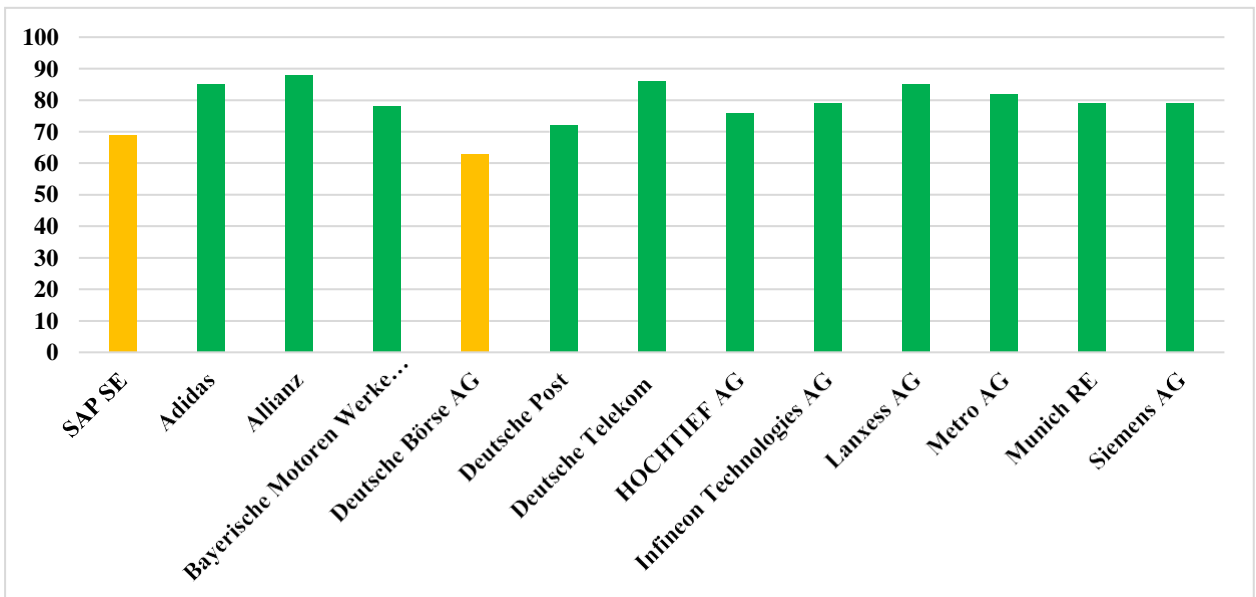


Figure 2. DJSI & ESG Score Bar Graph: 2019

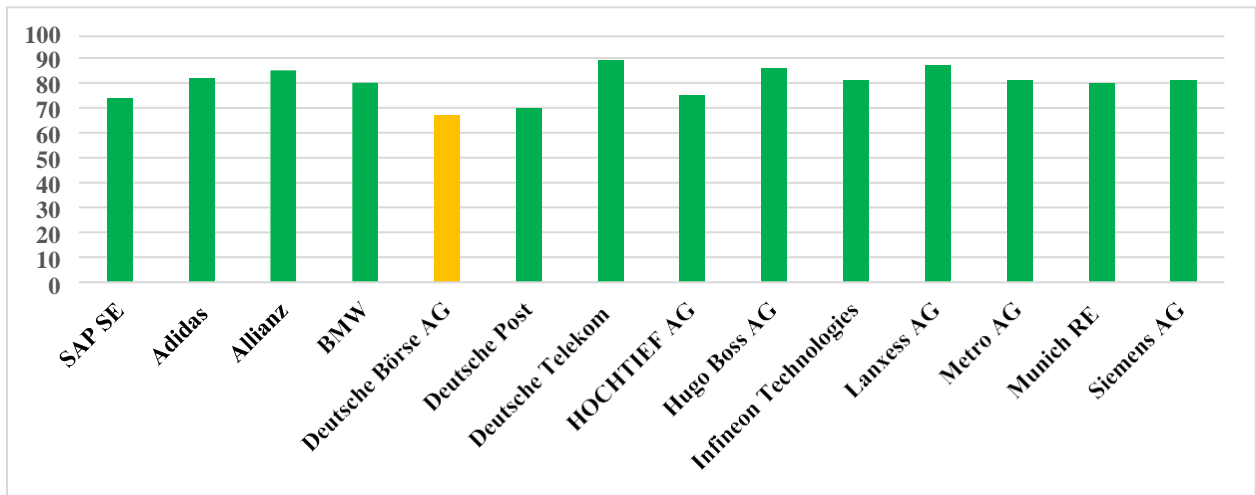


Figure 3. DJSI & ESG Score Bar Graph: 2020

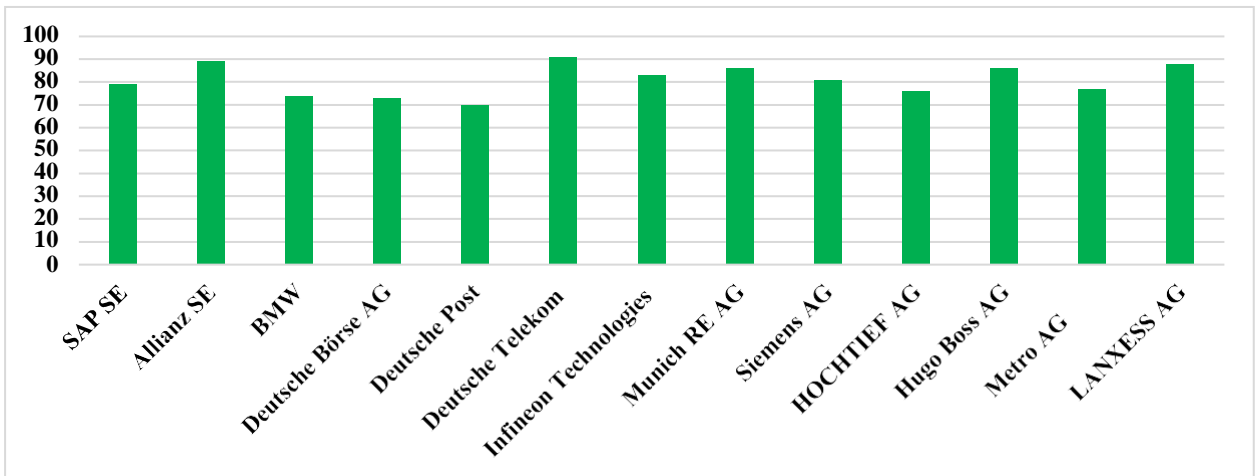


Figure 4. DJSI & ESG Score Bar Graph: 2021

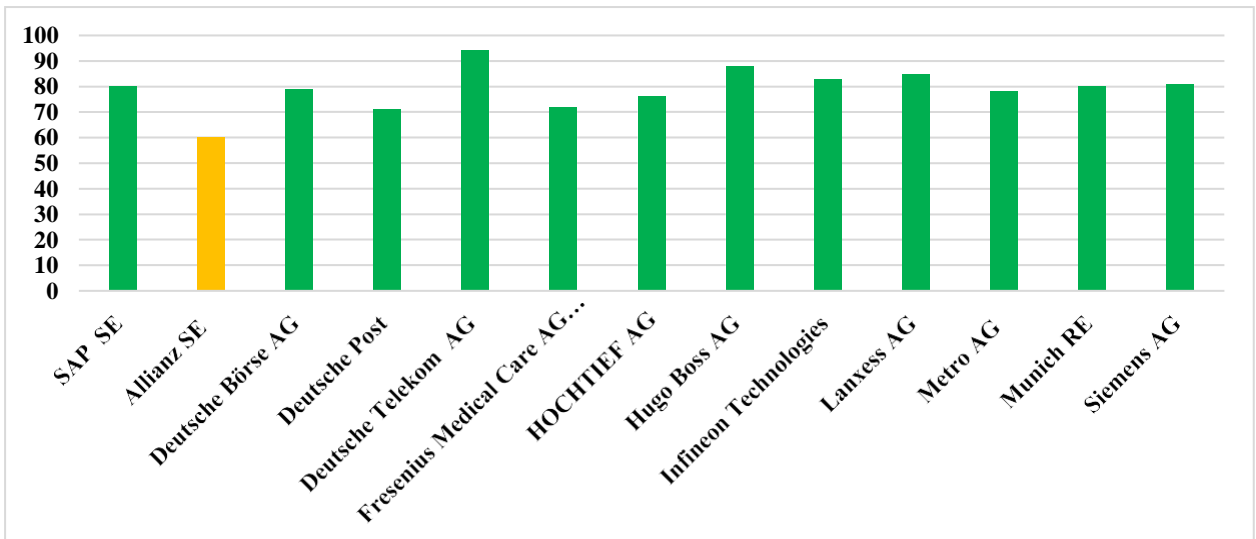


Figure 5. DJSI & ESG Score Bar Graph: 2022

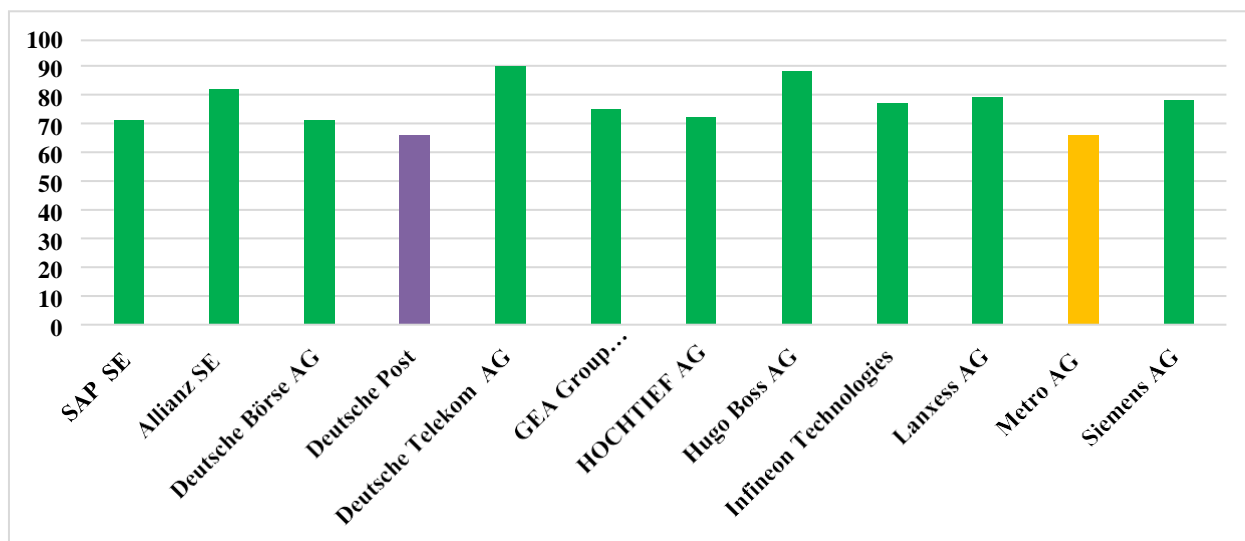


Figure 6. DJSI & ESG Score Bar Graph: 2023

As indicated in **Figures 1-6**, the only year that the firms on Dow Jones Sustainability Indices lists match ESG high scores starting at 70 and above is the year 2021 (**Figure 4**). In 2018 as indicated in **Figure 1**, three firms on the DJSI list, Adidas, Deutsche Bank, and Deutsche Börse AG, do not indicate high ESG scores (orange bars). Investigating if the companies that did not indicate a high ESG score while on the DJSI list belonged to a particular industry, our research indicated two industries, financial services and textile footwear [19,20,21].

Figure 2 indicates that in 2019 two firms, SAP SE and Deutsche Börse AG, on the Dow Jones Sustainability Index list do not have high ESG scores (orange bars). The industries related to these companies that were on the DJSI list in 2023 but did not indicate high ESG score were financial services and tech industries [20, 22]. **Figure 3** for 2020 shows that one firm, Deutsche Börse AG, on the DJSI list indicates a score lower than 70 on the ESG (orange bar) belonging to the financial services industry [20].

Figure 4 for the year 2021 indicates ESG high scores (70 & >) for all the German firms on the DJSI list.

Figure 5 for the year 2022 indicates that one firm, Allianz SE (financial services and insurance industry) [23], on the DJSI list does not show a high ESG score, 70 or above, but only an ESG score of 60.

Figure 6 for the year 2023 indicates that two firms, Deutsche Post (shipment industry) [24] and Metro AG (wholesale food industry) [25], on the DJSI do not have high a ESG score (70 & >). From these results, it appears that firms on the DJSI lists and high ESG scores do not fully correspond with each other.

Figure 7 presents the bar graphs based on the information on **Table 7** that shows several German companies that were on the DJSI lists from 2018 through 2023 all indicated ESG scores below 70.

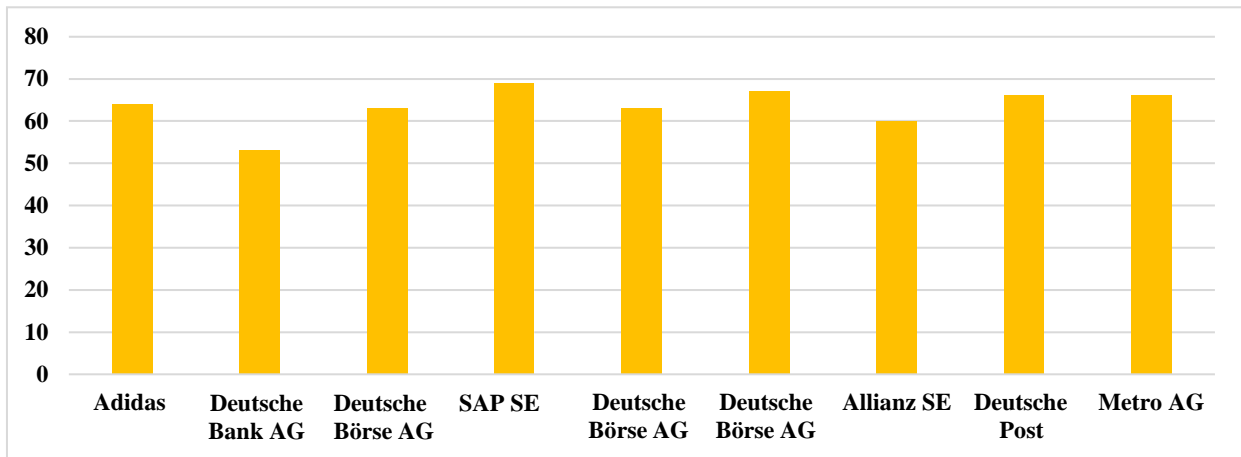


Figure 7. Bar Graphs for the German Firms on **Table 7** that Were on the DJSI Lists with ESG Scores Below 70: 2019, 2021, 2022, 2023

Figure 8 provides bar graphs for the German firms on **Table 8** that were deleted from the DJSI 2019, 2021, 2022, and 2023 list.

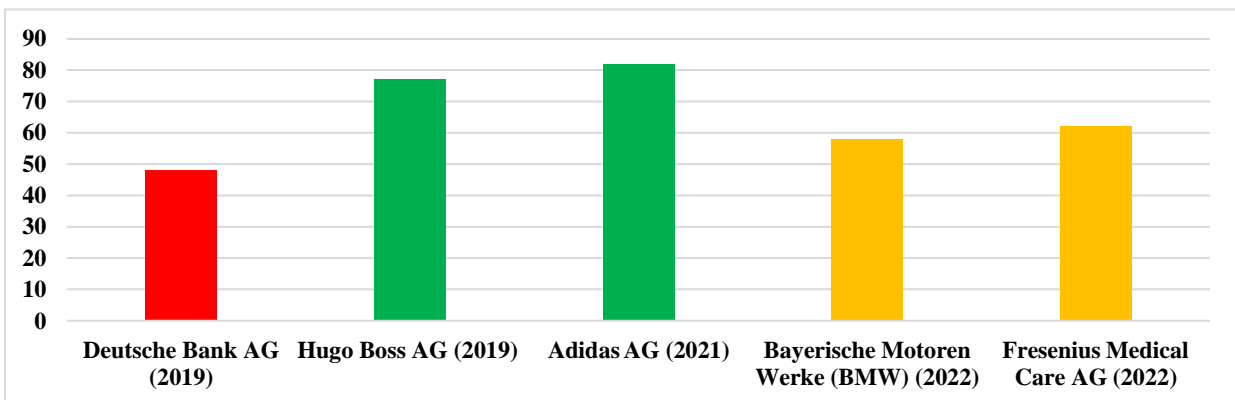


Figure 8. Bar Graph for the German Companies on Table 8 that Were Deleted from DJSI Lists & Their ESG Scores: 2019-2023

As indicated in **Figure 8**, the two firms that were deleted from DJSI list, Hugo Boss AG deleted in 2019 indicate a high ESG score of 77 and Adidas AG deleted in 2021 show high ESG score of 82. Three companies deleted from the DJSI lists in 2019, 2022, and 2023 show low ESG score: Deutsche Bank AG with ESG score of 48 deleted from the DJSI list in 2019, BMW with ESG score of 58 deleted form the DJSI list in 2022, and Fresneius Medical Care with ESG score of 62 deleted from the DJSI list in 2023. However, two firms (Adidas AG and Hugo Boss AG) that have been deleted from DJSI list still indicate high ESG scores (77 and 82).

To further investigate the discrepancies between companies' ESG scores and appearance on the DJSI lists, we conducted clustered bar visualization charts of the German firms on the DJSI lists for the years 2018-2023 and their corresponding ESG scores. The results are presented in **Figures 9-14**. The high ESG scores (70 & >) are indicated in blue (X) and the average ESG scores (69 to 50) are represented by the orange bars (Y).

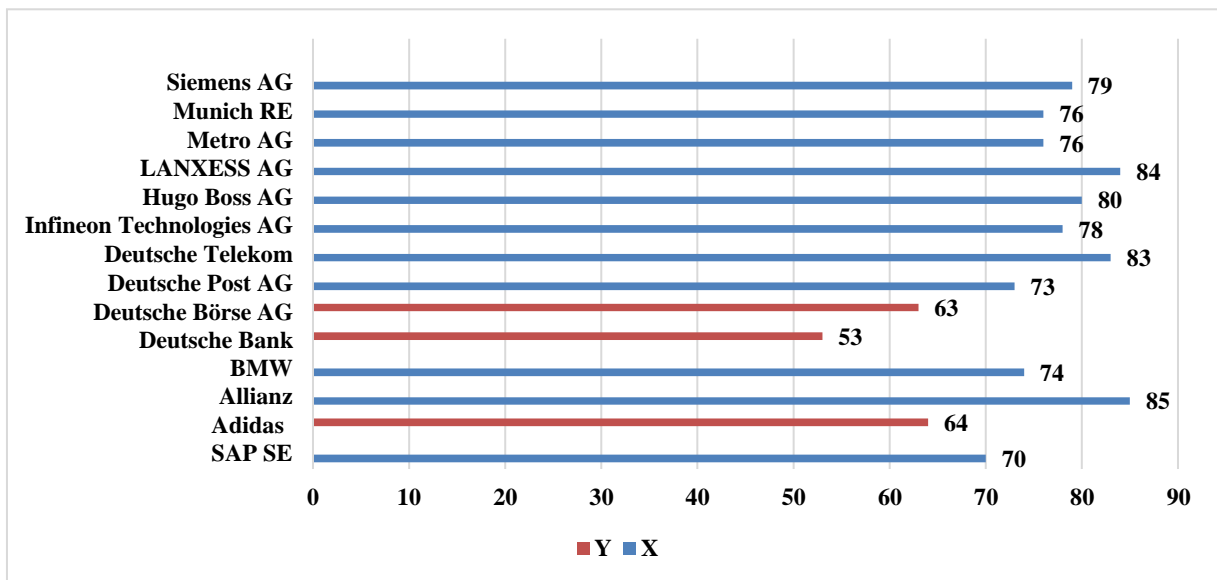


Figure 9. Clustered Bar Chart: German Firms on the DJSI List & Their ESG Scores 2018

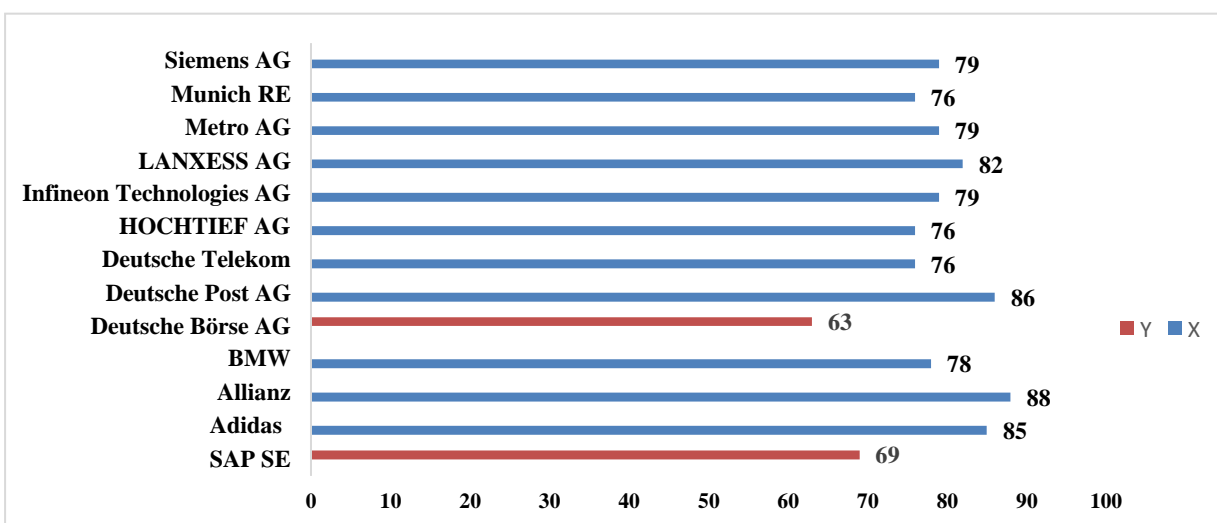


Figure 10. Clustered Bar Chart: German Firms on the DJSI List & Their ESG Scores 2019

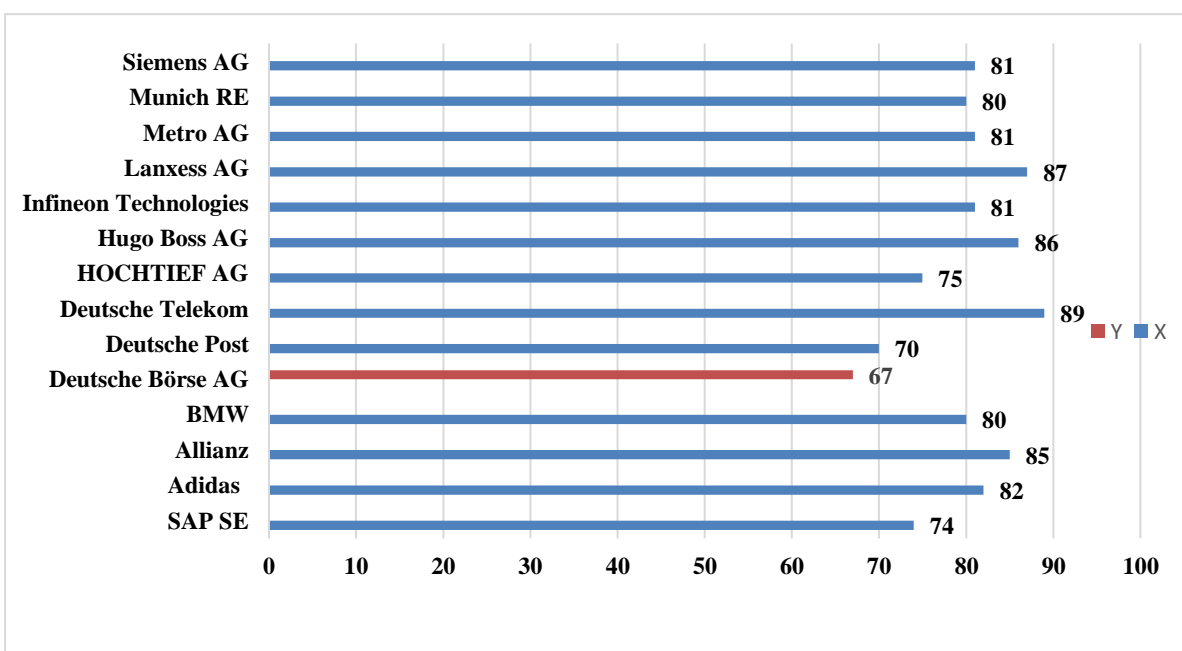


Figure 11. Clustered Bar Chart: German Firms on the DJSI List & Their ESG Scores 2020

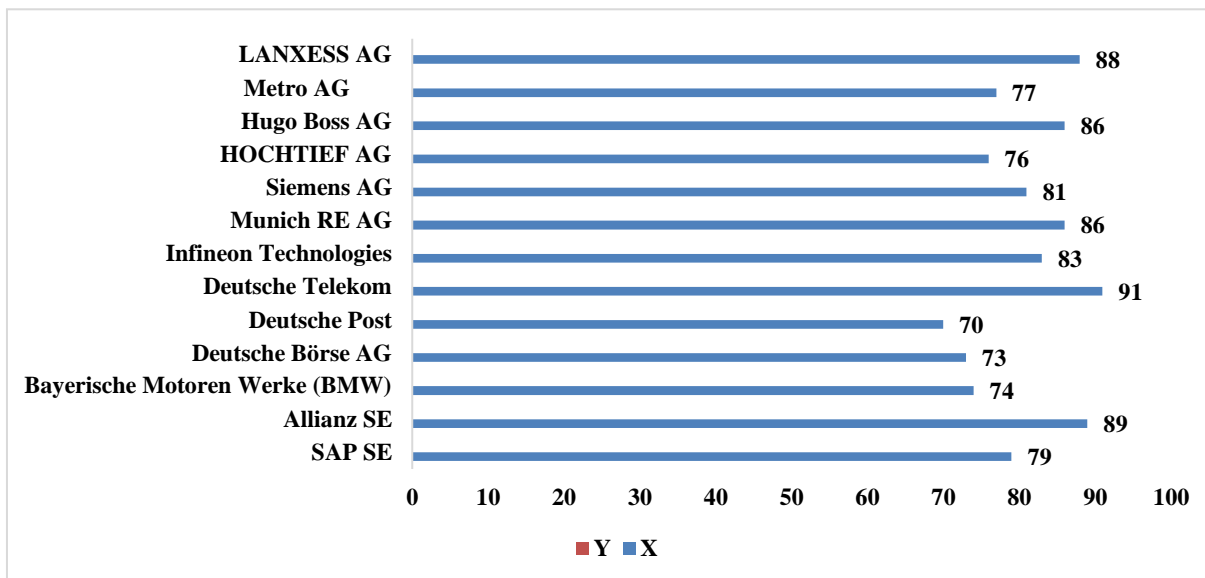


Figure 12. Cluster Bar Chart: German Firms on the DJSI List & Their ESG Scores 2021

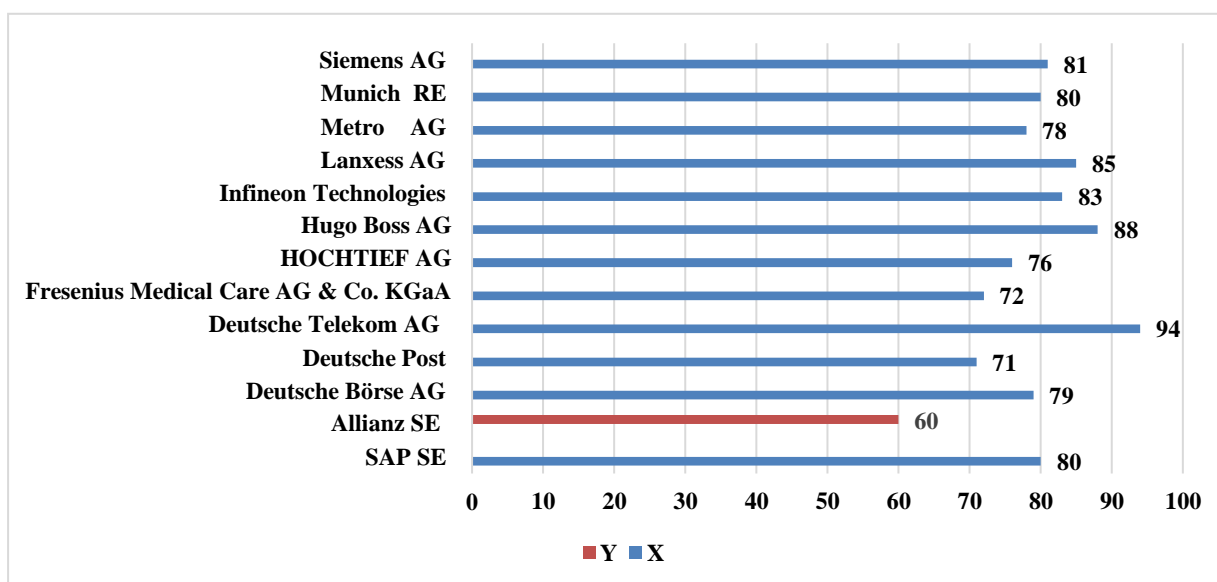


Figure 13. Cluster Bar Chart: German Firms on the DJSI List & Their ESG Scores 2022

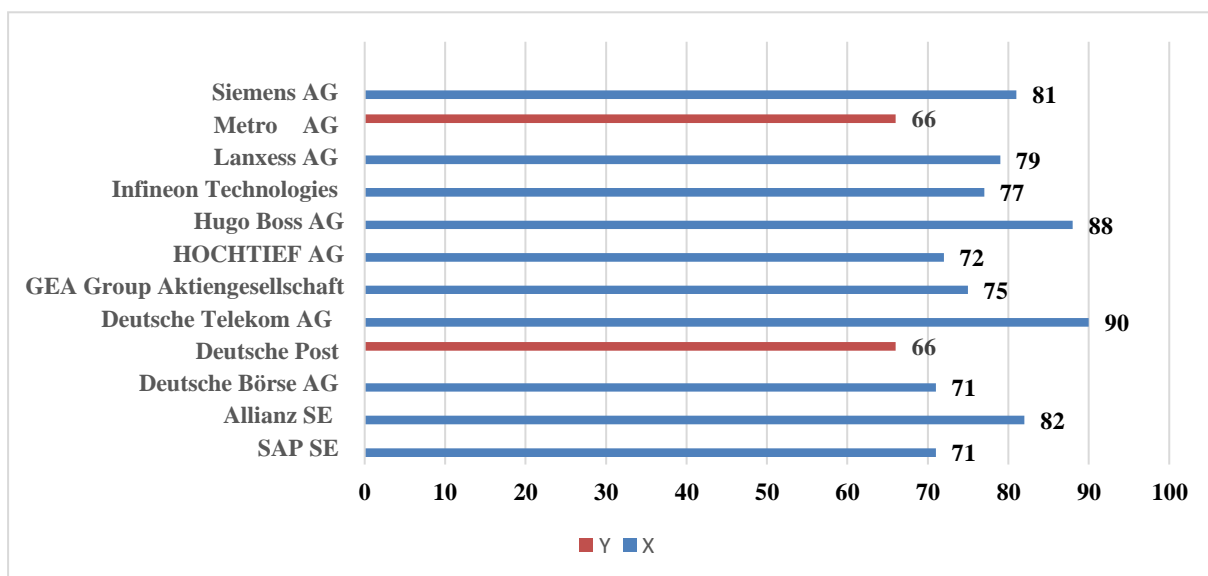


Figure 14. Cluster Bar Chart: German Firms on the DJSI List & Their ESG Scores 2023

As indicated in Clustered Bar Charts in **Figures 9-14**, only the companies on the 2021

DJSI list all indicate high ESG score of 70 & > as indicate by blue bars. The other DJSI lists, 2018, 2019, 2020, 2022, and 2023, all indicate that some of the companies on the lists do not have high ESG scores (70 and above). The companies with lower than 70 ESG scores on the DSJI lists during these years are indicated by orange bars. As a result, appearance on the DJSI lists does not fully correlate with high ESG scores.

To provide an aggregated comparison, we used Python to show scatter plot clusters as presented in **Figure 15**.

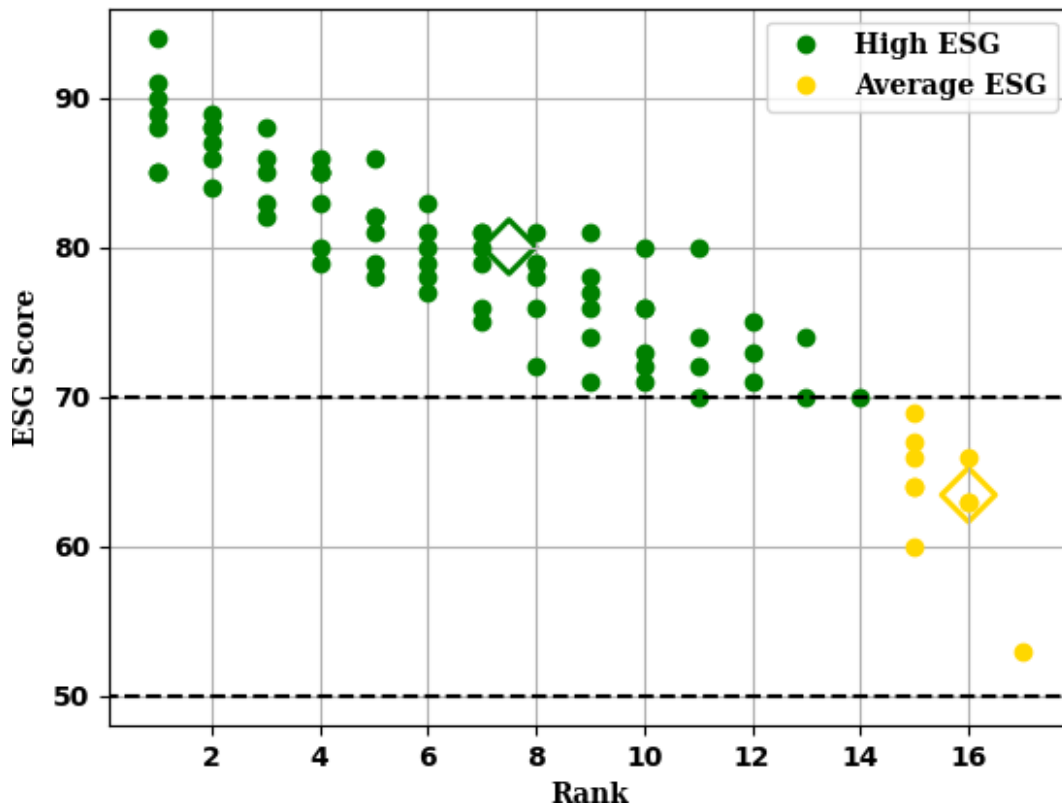


Figure 15. ESG Scores Scatter Plot for the German Firms on the DSJIs: 2018-2023

As shown in **Figure 15**, the ESG scores are color coordinated and the diamonds represent cluster centroids and the Y-axis indicates the ESG scores of the German firms on the DSJIs and their corresponding ESG scores. The X-axis represents the ranking of the ESG scores (high ESG score to low) for the years 2018-2023 for the German firms that appeared on the DSJIs. The cluster green dots indicate high ESG scores (70 & >), yellow represents average ESG scores (<70 – 50). There are seven duplicate scores between the years 2018-2023 that are not reflected on the cluster, which provides 67 data points.

6. Conclusions

In this research, we selected German firms on the DJSI lists for the years 2018 through 2023 and delineated their ESG scores for the same years, 2018 through 2023. As indicated in the above figures, except for the year 2021, the results of the statistical analyses indicate that not all German firms listed on the DJSI correspond to high ESG scores (70 & >). As a result, the extent of the sustainability practices, such as environmental, social, and governance indicated by high ESG scores (70 & >) and the appearance on the DJSI lists does not clearly correlate with each other. The potential of Dow Jones Sustainability Indices and ESG rankings of companies conducted by the Standard & Poor's Global regarding sustainability and providing information about environmental, social, and governance practices of companies across the globe are extremely important to enhance the education of general public and different stakeholder groups, such as stockholders, customers, and environmental groups.

The major goal of this research was to investigate if the appearance on the DJSI list was correlated with high ESG scores for companies. This research is a novel approach in exploring if the two major sources of data indicating sustainability and CSR of the largest global companies tell us the same story.

The findings of this research indicate that there are discrepancies regarding the sustainability practices of the studied companies that are added to the DJSI lists and the assigned high ESG scores by the S&P Global (70 & >). They are not telling the same story. This study indicates that more accurate information is needed to highlight the sustainability practices of the companies.

As some of the reviewed literature indicates [8,9,11], how these scores are collected needs more scrutiny. Are the average ESG scores (69 – 50) sufficient for the companies to be added to the Dow Jones Sustainability Indices? How are these scores gathered? Is there any research conducted by the S&P Global regarding the provided information before ESG scores are designated for the companies?

Future research on accurate indices and ESG scores, how they are collected, and which criteria are used to rank these companies are highly important to clarify and unify the very important information regarding the sustainability and CSR practices of the largest companies within the top industries across the globe.

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Workplace Happiness for SDG#3 Wellness, #4 Knowledge Transfer, #8 Economic Impacts #9 Innovations and #17 Partnership

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A quantitative research was conducted to decide the factors potentially related to Happiness in Workplace. **Thirteen related articles published from 2002 to 2023 were found.** By analyzing these articles, numerous relatable factors are identified to the topic, including **Set Up a New Competency Inclusive Management Framework, Development of Non-cognitive Ability – Social and or Emotional Skills, Policy to Reduce Mismatch, Training on New Mindset on Wellness, Foresight Mindset, Socially Conscious Leadership, Flexible Future-Proof Workplace, Life Time Attitude, Circulation Design, and Changes Are Welcome.**

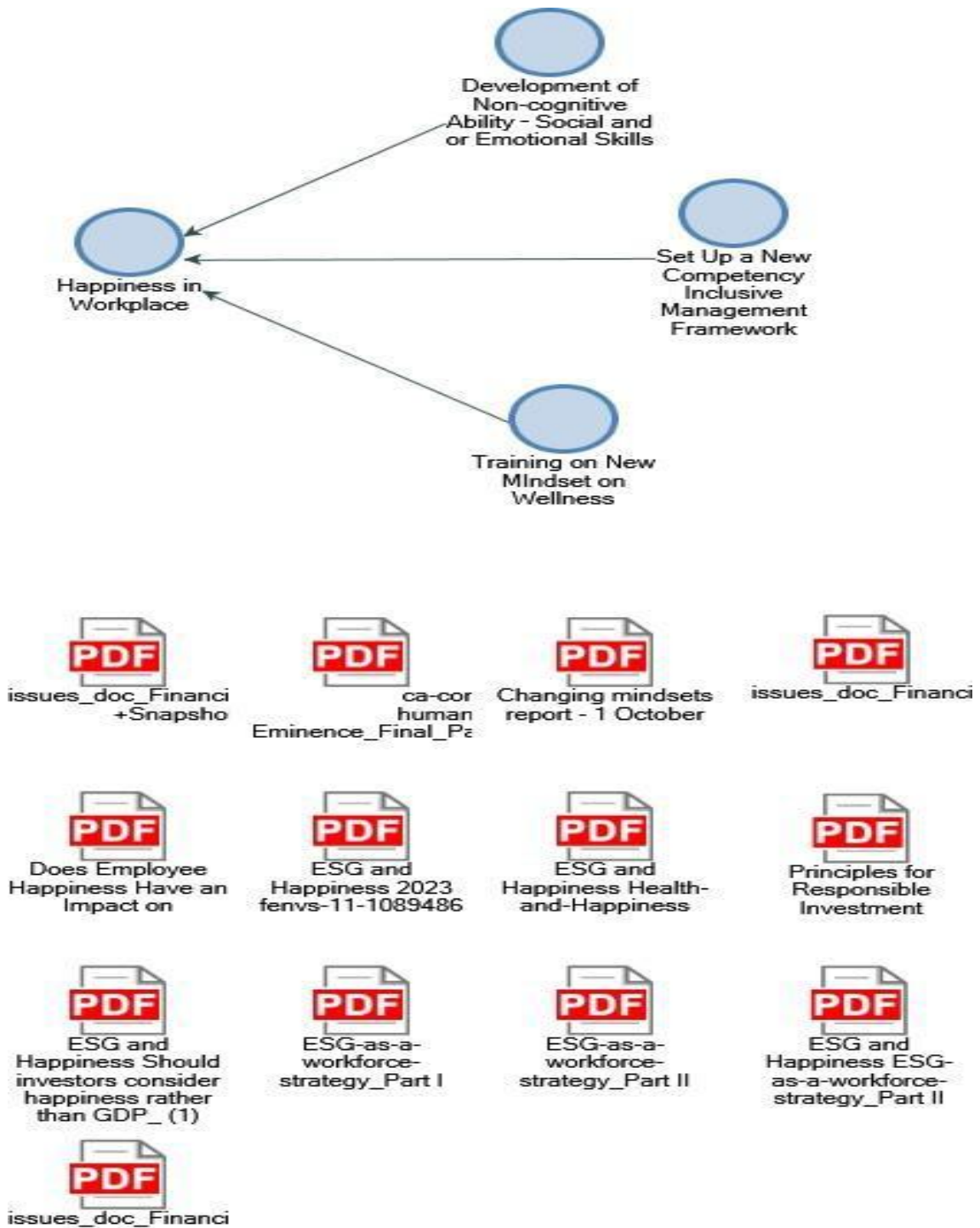
To identify their relationship to the topic, by using Nvivo, a text search was performed for the mentioned keywords. The search result showed that some of the factors such as Development of Non-cognitive Ability – Social and/or Emotional Skills, and Set Up a New Competency Inclusive Management Framework were cited the most frequently with 1212 and 1012 times correspondingly, while Changes Are Welcome was cited less frequently in comparison. (Table 1).

Table 1. Findings of the keywords search

Factors	Sources	References
<i>Development of Non-cognitive Ability – Social and or Emotional Skills</i>	13	1212
<i>Set Up a New Competency Inclusive Management Framework</i>	13	1012
<i>Training on New Mindset on Wellness</i>	12	829
<i>Policy to Reduce Mismatch</i>	9	307
<i>Foresight Mindset</i>	1	284
<i>Socially Conscious Leadership</i>	9	255
<i>Life Time Attitude</i>	9	220
<i>Flexible Future-Proof Workplace</i>	5	94
<i>Circulation Design</i>	10	89
<i>Changes Are Welcome</i>	7	61

Further speculating the relationship among the factors, it was concluded that factors including Development of Non-cognitive Ability – Social and or Emotional Skills, Set Up a New Competency Inclusive Management Framework, and Training on New Mindset on Wellness contribute to the topic of Happiness in Workplace the most. Based on such findings, a graphical model was generated with the data. (Figure 1).

Figure 1. Model on the factors



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