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RESEARCH ARTICLE

The Preliminary Step Towards Conceptual Model for the Artificial Intelligence-Neuro-Green Marketing in the Architectural Engineering and Construction Industry

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ABSTRACT
Innovation has fostered and enabled Industry 5.0, Society 5.0, and Marketing 5.0. It has also affected competition and marketing dynamics in all industries, including architectural engineering and construction industry (AEC). Intensified competition in AEC, alongside the accelerated innovations fostering and enabling changes in AEC's supply-and-demand dynamics, highlights the importance of time and how cost-effective, strategic, tactical, and innovative marketing has further influenced AEC's supply-and-demand aspects, which need to be sustainable to reduce its embodied environmental footprint mostly due to the climate crisis humanity is experiencing. Based on an in-depth literature review, this study aims to suggest the preliminary conceptual model's step towards artificial intelligence (AI)-neuro-green marketing in AEC as a potential key for a sustainable built environment. This study emphasizes potential of the AI-neuro-green marketing to foster competition by design (including architectural and interior design), to enhance the effectiveness of neuro-green marketing in fostering sustainable built environment, and to reduce AEC's embodied environmental footprint, outputs, and services. Furthermore, this study emphasizes the potential contribution of the AI-neuro-green marketing in AEC to Construction 5.0 and Society 5.0. This study is expected to contribute to the literature through the concept of AI-neuro-green marketing.

Keywords: Artificial intelligence, green marketing, Marketing 5.0, neuromarketing, neuro-green marketing

1. Introduction

Technological transformation has affected competitiveness in the market (Yau et al., 2021). Industry 4.0 has enabled digitalization in process and management facilities through the integration of operations with information and communications technologies (ICT)(Eriksson et al., 2020; Dalenogare et al., 2018). Competitiveness intensified under market conditions due to the exponential progress of Industry 4.0, has caused radical changes in marketing and the way individuals live and work (Dash et al., 2021; Ghobakhloo, 2020). Building on Industry 4.0, Industry 5.0 supports agility and resilience through ICT (Huang et al., 2022); promotes human centralization, sustainability, and resilience (Carayannis & Morawska-Jancelewicz, 2022; Mourtzis et al., 2022); and aims to achieve the United Nations (UN) Sustainable Development Goals (SDGs) Kasinathan et al., 2022). Industry 5.0 can enable and improve ICT integration not only into production-related process management but also into sustainable management levels and strategies (Dalenogare, 2018). Digital transformation requires acceleration in keeping up with changes in the business world (Ghobakhloo, 2020). Businesses are striving to update and adapt their management strategies to current digitalization management tools to survive under the competitive digital market conditions (Verma et al., 2021). Technological implications (e.g., AI and the Internet of Things [IoT]) that are a part of the digital transformation (Verma et al., 2021) lead companies to seek differentiation in strategic and managerial terms to maintain their market share (Eriksson et al., 2020). The impacts of digitalization, Industry 5.0, and Society 5.0 have enabled a globally sustainable networked system and encouraged organizations in different sectors to invest in AI (Chintalapati & Pandey, 2022; Verma et al., 2021), which has become a critical business strategic tool operating as market intelligence (Chintalapati & Pandey, 2022). AI is transforming the marketing industry by enabling the widespread use of AI in marketing operations (Shaik, 2023; Huang & Rust, 2021). The creation of new-age digitalization-driven marketing, known as Marketing 5.0, is modernizing marketing transforming it into a more data-driven, automated, and intelligent one (Chintalapati & Pandey, 2022; Kumar et al., 2019). AI can have a significant impact on improving and developing marketing

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strategies, including updating business models, revising marketing channels, shifting to customer-centric marketing, and predicting customer behavior (Davenport, 2020).

Advancements in ICT have not only caused a shift in marketing and increase in its complexity (Srivastava & Bag, 2023) but also a cognitive transformation in customers' expectations and decision-making processes (Siddique et al., 2023). While competitiveness is being exponentially increased, companies have prompted to seek new methods to better understand consumer behavior (Alsharif et al., 2021). The architecture, engineering, and construction industry (AEC) cannot isolate itself from the changes in the marketing field and developments. AEC plays an important role in improving quality of life, ensuring economic prosperity, and supporting sustainable development (Ikudayisi et al., 2023). Being a service sector under the classification of professional, scientific, and technical activities according to the UN's International Standard Industrial Classification of All Economic Activities (ISIC, 2022) and the North American Industry Classification System (NAICS, 2022), AEC can provide a project design that contributes to the creation of the built environment and ensures that the performance of the project meet all needs of human beings in accordance with the project purpose (Elshafei et al., 2021). AEC accelerates developments for adapting to Industry 5.0, which emphasizes connection among people, processes, and ICT applications and is based on focal points such as human-centered, sustainability-oriented, and resilience-oriented core values (Ikudayisi et al., 2023).

AEC can provide designs that affect project performance in the built environment to meet human needs. As there is differentiation in segmentation, meeting customer expectations and increasing customer satisfaction are the focus of the design process, analysis of customer data is important in customer segmentations while managing project development in the AEC. Shaik (2023) emphasized that the integration of AI into marketing can increase efficiency. Benchmarking from Shaik (2023), integration of AI into marketing in AEC can provide benefits to AEC companies. Furthermore, Chintalapati and Pandey (2022) suggested that conducting sectoral analysis research on AI in marketing can contribute significantly to the literature. The algorithm-based and data-driven orientation of AI enables analysis of customer behavior through human-imitating technologies and offers customer-focused solutions (Verma et al., 2021). The integration of green marketing and AI into the neuromarketing design process can increase the implementation of digital sustainable marketing strategies in AEC (Alsharif et al., 2021). For example, traditional marketing strategies' inadequacies resulted in neuromarketing as contemporary marketing (Siddique et al., 2023). Additionally, marketing strategies' inability to meet customers' green expectations fostered integration of sustainability into marketing strategies (Tuz & Sertyeşilışık, 2020) resulting in research on green marketing (e.g., Tuz & Sertyeşilışık, 2022). AEC supports and is part of Construction 5.0, which is focused on SDGs and sustainability; and AEC also aims to enhance people-centricity through IT-based solutions (Marinelli, 2023; Yitmen et al., 2023; Ikudayisi et al., 2023). The acceleration of innovation enables changes in AEC's supply and demand, which is indicative of intensifying competition, thus emphasizing the need for collaborative, innovative, sustainable, and people-oriented strategic marketing strategies to gain competitive advantage (Ikudayisi et al., 2023). This study aims to suggest the preliminary conceptual model's step towards AI-neuro-green marketing in the AEC industry as a potential key for sustainable built environment.

2. Contemporary Marketing Constructs in AEC

Marketing is a strategic management tool that can enable help companies gain a competitive advantage and provides short- and long-term benefits (Tuz & Sertyeşilışık, 2021). AEC is a competitive industry where different stakeholders can be involved in different projects that contribute to the creation of a built environment (Tuz & Sertyeşilışık, 2022). Moreover, Industry 5.0, Society 5.0, and Marketing 5.0 foster AEC to become more ICT-oriented, sustainability focused, and human-centric (Kasinathan et al., 2022). From that perspective, this situation increases the importance of marketing, and thus marketing tends to become a more IT-focused strategic management tool that provides competitive advantage.

2.1. Industry 5.0, Society 5.0, and Marketing 5.0's Interactions within AEC

Humanity has experienced different transformations that have affected society, such as the Industrial Revolution (Figure 1). Industry 5.0, which has been accepted and has already taken its place in the global business world (Huang et al., 2022), is built on Industry 4.0 through the integration of human orientation, sustainability, and resiliency (Kasinathan et al., 2022, Huang et al., 2022; Carayannis & Morawska-Jancelewicz, 2022; Mourtzis et al., 2022). Industry 5.0 supports agility and resilience through the use of ICT (Huang et al., 2022) and alignment with SDGs (Kasinathan et al., 2022). AEC is compatible with and supports Construction 5.0, which is oriented towards SDGs to benefit society, and aims to create sustainable and innovative solutions in the construction industry and offers smart solutions (Yitmen et al., 2023). Furthermore, Construction 5.0, which has a human-oriented perspective, aims to increase human-oriented efficiency with IT-based integration of robotization (Marinelli, 2023).

Society 5.0, which can be called as a super smart society (Carayannis & Morawska-Jancelewicz, 2022), envisions the society of the future (Huang et al., 2022) with the assistance of its human-centered position (Kasinathan et al., 2022; Carayannis & Morawska-Jancelewicz, 2022; Mourtzis et al., 2022). As Society 5.0 is a human-centered systematic approach and provides guiding principles

for innovative ICT-based solutions, it creates a bridge between the techno-centric and human-centric (Carayannis & Morawska-Jancelewicz, 2022). Social capital is the key asset of Society 5.0 (Carayannis & Morawska-Jancelewicz, 2022), which aims to enhance the life quality based on the triple bottom line (TBL) of sustainability with the aim of creating a lean and super smart society (Huang et al., 2022) under the guidance of science, technology, and innovation ecosystem (Huang et al., 2022). Society 5.0 focuses mainly on social capital, revolutionizing society through sustainability and the integration of ICTs into the human lifestyle and aims to create a lean and super smart society (Carayannis & Morawska-Jancelewicz, 2022), therefore, AEC aims to adopt Society 5.0.

The marketing industry is experiencing a rapid transformation through the impact of Industry 5.0, Society 5.0, and digitalization (Ghobakhloo, 2020). The integration of IoT and AI into marketing has enabled increased connectivity and accessibility to information, forcing existing marketing strategies to become obsolete and exponentially change in Industry 4.0 (Dash et al., 2021). Human-oriented Industry 5.0 has increased the emphasis on sustainability using ICT technologies and enabled marketing to be developed to keep pace with sustainability-oriented digital marketing (Huang et al., 2022). The impact of the Industrial Revolutions (including Industry 5.0) on living and working conditions has required the marketing sector to evolve within itself and adapt to the radical changes that occur (Dash et al., 2021; Ghobakhloo, 2020). Industry 5.0 supports efforts to achieve and improve SDGs (Carayannis & Morawska-Jancelewicz, 2022), while Society 5.0 targets the creation of a future society where it balances economic development with social responsibility (Kasinathan et al., 2022). Industry 5.0 and Society 5.0 have increased the importance of sustainable marketing strategies, drawing attention to sustainability and its TBL (i.e., the social, economic, and environmental) (Kasinathan et al., 2022). Figure 1 highlights the transformation of marketing concept under the influence of industry and society. Accordingly, and in line with the improvements in Industry 4.0, marketing prior to the emergence of the digitalization-oriented Marketing 4.0, marketing had shifted from being product-oriented (Marketing 1.0) to customer-oriented (Marketing 2.0) and then evolved into a customer management-focused approach that creates value for customers (Marketing 3.0) (Sima, 2021; Alanazi, 2022).

Marketing 5.0, which is a result of the integration of marketing 3.0 and 4.0 (Alanazi, 2022), offers simultaneous solutions and aims to improve the customer experience by understanding customer expectations through human imitation technology-oriented methods (e.g., AI) (Sima, 2021). Industry 5.0 and Society 5.0 have supported the delivery of Marketing 5.0, which enhances the integration of ICT applications into marketing strategies (Figure 1). In addition, Marketing 5.0, which provides new-age digitalization-oriented marketing, supports the spread of AI applications in marketing operations (Shaik, 2023; Huang & Rust, 2021). Therefore, contemporary marketing is becoming more data-driven, automated, and intelligent (Chintalapati & Pandey, 2022). As AEC project specific customer preferences such as environmental concerns, sustainability orientation that depend on customer's concerns and expectations are among the key criteria influencing AEC projects (Tuz & Sertyeşilışık, 2022), the AEC project's marketing strategies and marketing mix tools need to meet the expectations of the target segmentation. Adapting AI to marketing strategies, the real-time monitoring of customer expectations and reactions with human-mimicking technology tools (Srivastava & Bag, 2023) can enable AEC to quickly implement changes in customer expectations into the project design and marketing strategies of projects. Marketing 5.0 focuses mainly on human-mimicking technology, creating, communicating, and delivering value to customers by understanding customer expectations, and aims to enhance customer experiences (Sima, 2021). Therefore, AEC aims to adopt Marketing 5.0. This emphasizes AEC as being located at the intersection of Industry 5.0, Society 5.0, and Marketing 5.0. This also shows that AEC arguments overlap with AI (Marinelli, 2023), sustainability (Yitmen et al., 2023), and human centralization (Ikudayisi et al., 2023), which are defined as the common arguments of Industry 5.0, Society 5.0, and Marketing 5.0.

2.2. The Green Marketing, Neuromarketing and AI Marketing Interaction as the Basis for the AI-neuro-green Marketing in the AEC

Progress in ICT has improved the application of tools (e.g., AI) in marketing strategies for Marketing 5.0. Additionally, while Industry 5.0 and Society 5.0 have enhanced sustainability orientation and human centralization, marketing has become customer solution focused (Kasinathan et al., 2022). In this regard, marketing has led to the development of different marketing strategies.

2.2.1. The Green Marketing

Customers' increasing environmental concerns have put pressure on marketing in recent years. The inability of marketing strategies to meet customers' green expectations has led to the integration of sustainability into marketing strategies (Tuz & Sertyeşilışık, 2020). Incorporating the TBL approach into marketing strategies known as green marketing can enhance not only companies' environmental performance but also their social and economic performances, which can create organization values (Tuz & Sertyeşilışık, 2020). Integrating sustainability into marketing strategies enables a green marketing that aims to meet customers'

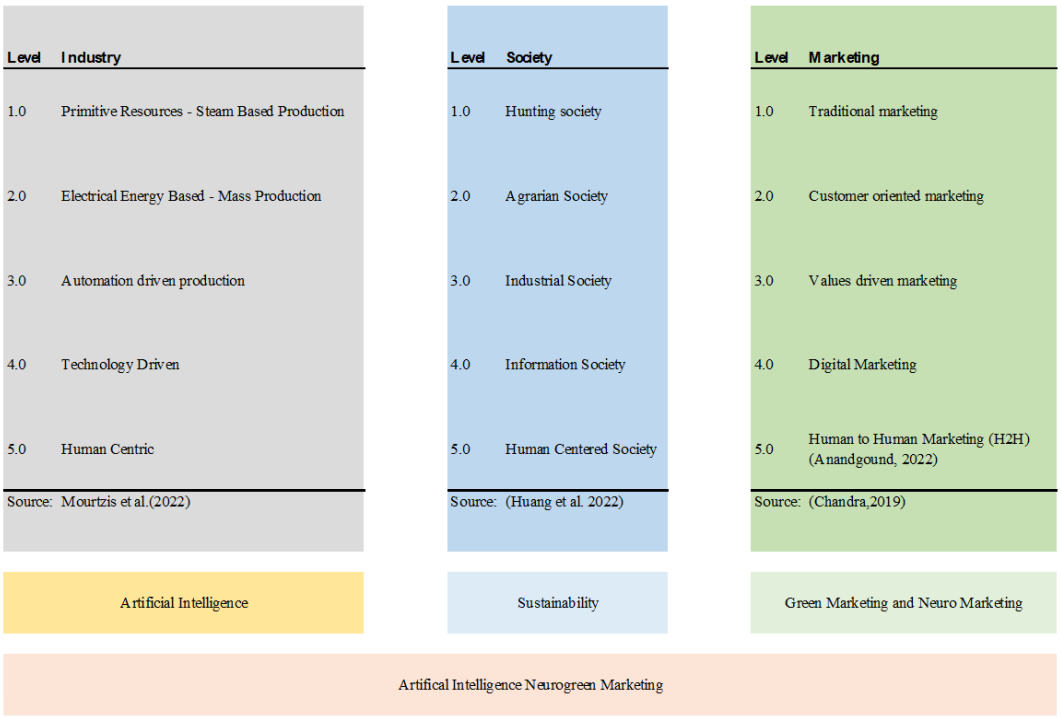

Figure 1. The industry, society, and marketing levels.

green expectations (Tuz & Sertyeşilışık, 2020). In line with the SDGs and the TBL approach, green marketing can provide customization in marketing with a value creation that increases customer satisfaction. Green marketing has a three-dimensional perspective at the intersection of social, economic, and environmental concerns. Green marketing is a strategic management tool (Tuz & Sertyeşilışık, 2022) that is compatible with SDGs and focuses on social expectations in the short run and on customer welfare in the long run (Tuz & Sertyeşilışık, 2021). With its customer satisfaction-oriented approach, green marketing is based on creating, communicating, and delivering value to the end customer (Tuz & Sertyeşilışık, 2020). Green marketing has attracted the attention of academic in recent years. Furthermore, green marketing as a strategic management tool attracts the attention of not only academics from different disciplines but also of professionals who are willing to implement green marketing strategies. Therefore, this attention emphasizes the importance of sustainability, which is the main pillar of Industry 5.0 and Society 5.0, in academic studies and different sectors (Kasinathan et al., 2022).

2.2.2. The Neuromarketing

The inadequacy of traditional marketing strategies has led to a shift towards the discovery of contemporary marketing (Alsharif et al., 2021) known as neuromarketing, which provides a multidisciplinary perspective (Siddique et al., 2023) and which is based on insights gathered from customer behavior (Srivastava & Bag, 2023). Neuromarketing refers to the application of ICT-advanced neuroscientific techniques to the field of marketing that enhance data-driven marketing to better understand consumer behavior (Robaina-Calderín & Martín-Santana, 2021). Neuromarketing has a multidisciplinary perspective at the intersection of marketing, neuroscience, and psychology (Alsharif et al., 2021). Neuromarketing enables the analysis and evaluation of the relationships among the emotion, attention, memory, and decision-making processes that can be classified as consumer behavior (Alsharif et al., 2021). Neuromarketing provides a better understanding of customer behavior to develop value creation strategies for target customers (Siddique et al., 2023). Neuromarketing is a tool-based practice that uses neuroimaging and physiological tools and techniques to record the neural correlates of consumer behaviors related to branding and advertising (Alsharif et al., 2021).

The multidisciplinary perspective of neuromarketing has attracted the attention of different disciplines in academia in the last decade (e.g., Siddique et al. 2023; Robaina-Calderín & Martín-Santana, 2021). In addition, increasing interest leads to an increase in multidisciplinary publications on marketing-oriented neuroscience (Robaina-Calderín & Martín-Santana, 2021). This reveals the impact of Marketing 5.0 on the importance of neuromarketing strategies in determining customer behavior in academic studies (e.g., Srivastava & Bag, 2023; Alsharif et al., 2021). Based on the literature review on the most examined neuromarketing tools and techniques, Alsharif et al. (2021) classified neuromarketing tools into four subgroups (e.g., neuroimaging tools, physiological techniques). Alsharif et al. (2021) indicated that physiological tools provide more sufficient insights regarding

customer behavior and underlined the importance of marketing-appropriate neuroimaging tools for advertising and branding to provide information about the neural correlates of emotion and cognitive processes. Alsharif et al. (2021) emphasized the important effects of neuromarketing design that should ensure: (1) the creation of neural correlations with its impact on customer behavior and emotional processing and (2) strengthening the aspects that lead the consumer to enjoy and make decisions. Regarding the changing focuses of neuromarketing research throughout the years, Siddique et al.'s (2023) research on studies between 2006-2021 revealed three following periods, when: in the first period, it was possible to measure customer appreciation (like or dislike); in the second period, the development of technology and developments in neuromarketing measurement tools enabled the understanding of the psychology of the customer and the use of these methods in marketing, mostly in branding and advertising activities;and in the third period, subgroups of consumer behavior (e.g. facial expressions, attitude) were discussed (Siddique et al. 2023). Furthermore, Srivastava and Bag (2023) focused on AI-based facial recognition marketing and neuromarketing that enable segmentation of customers. Srivastava and Bag (2023) classified in five groups (i.e., customer profiling, customer insights, safety and security, data collection through social media, cognitive learning about consumer behaviors). According to Srivastava and Bag (2023) research, customer profiling classification that provides how facial recognition marketing and neuromarketing can provide neuro-information where the customer profiling (directly related to gathering demographics data that provides segmentation) and insights into customer behavior (related to gathering neuro-information and getting an actual response in neuromarketing) are determined as the more significant ones. Srivastava and Bag (2023) recommended for the future research to focus on mimic recognition analysis for precisely segmentation.

2.2.3. AI in Marketing

AI-driven marketing, which provides strategies to increase customer satisfaction through the use of ICT, has attracted the attention of academics and professionals in the last decades (Hermann, 2022; Verma et al., 2021; Davenport et al., 2020). AI acts as: automated (Hermann, 2022; Kumar et al., 2019), algorithm-oriented (Chintalapati & Pandey, 2022; Verma et al., 2021; Eriksson et al., 2020), data-driven (Shaik, 2023; Davenport et al., 2020), continuous learning-focused (Kumar et al., 2019), predictor (Shaik, 2023; Huang & Rust, 2021), decision-making processor (Hermann, 2022; Huang & Rust, 2021; Verma et al., 2021), customizer (Hermann,2022; Davenport et al., 2020; Kumar et al., 2019), intellectual task performer (Verma et al., 2021), interpreter (Chintalapati & Pandey, 2022; Eriksson et al., 2020), cost and time reducer (Shaik, 2023), value creator (Shaik, 2023), and problem solver (Yau et al., 2021; Verma et al., 2021). Therefore, AI can become a strategic powerful management tool that provides multidimensionally consistent and reliable benefits to society and organizations to reshape business strategies in line with digitalization (Hermann, 2022). AI can create various opportunities in marketing as a management tool (Hermann, 2022; Huang & Rust, 2021). Huang and Rust (2021) classified the literature on AI in marketing into four groups as: technical/algorithm-based; psychological - customer-oriented; social impact-living conditions; and management-strategy-oriented. Furthermore, Chintalapati and Pandey (2022) examined the five-year period of the marketing literature (2015-2020) on AI-driven marketing and classified the existing research into five main groups (e.g., integrated digital marketing, contextual marketing). Focusing on the intersection of the effects of AI on marketing and the effects of personalization to support customer satisfaction in marketing management, Kumar et al. (2019) pointed out the difference between personalization and customization from the marketing perspective and emphasized the importance of personalizing marketing channels to provide the customer and organization connection, which has a positive relationship with emotional bonds (e.g., customer behavior, customer engagement, and customer loyalty). Therefore, Kumar et al. (2019) conceptually defined digital curation, which enables the automatic presentation of marketing mix tools aimed at customer expectations and stated that customers encountered with personalized marketing mix tools offered by AI-driven marketing channels can contribute to customer satisfaction, loyalty, and emotions in their behavior, defined as emotional bonds. Furthermore, Kumar et al. (2019) underlined that increasing success in personalization depends on accessing more customer-focused data, creating insights from the data, and strategically applying and evaluating these insights.

Regarding the impact of AI on marketing, Shaik (2023) stated that AI and marketing are an integral whole under today's market conditions and introduced the term artificial intelligence marketing (AIM) as a strategic management tool that increases the customer experience by using technology at the maximum level and by examining the data obtained from the market. Additionally, Shaik (2023) emphasized that the integration of AI into marketing can increase efficiency, improve marketing management, create value for satisfied customers, and enable marketers to create market strategy (e.g., segmentation) and improve marketing by sending messages through digital channels while analyzing customer behavior. Furthermore, Verma et al. (2021) defined AI as an algorithm that improves business processes (e.g., automation), analyzes customer and market behavior by evaluating historical data by providing insight (e.g., market analysis), enables the determination of customer needs with real-time data, and ensures continuity of service. It attracts the attention of old customers and new potential customers by predicting customer insight (customer behavior) (Verma et al., 2021). Additionally, Verma et al. (2021) stated the automation effect of AI as an approach focused on continuous learning and problem solving with any machine that can think like a human. Emphasizing that the process is based on the determination of customer expectations through data collection and analysis, Verma et al. (2021) stated that the data

collection phase is the most important element of AI. Shaik (2023) underlined that data is the most ethically important element in AIM management. Furthermore, Huang and Rust (2021) created a cyclical framework of marketing-focused research, strategy, and action. Additionally, regarding analysis of the effects of AI on marketing, Huang and Rust (2021) classified AI into three levels, namely: mechanical, thinking, and feeling. Mechanical AI is based on algorithms and refers to data collection in marketing research, analysis of customer preferences in strategy, and system standardization in action, whereas thinking AI is focused on the decision-making process and emphasizes market analysis in marketing research, how segmentation should be done in strategy, and personalization of the system in action (Huang & Rust, 2021). Furthermore, feeling AI focuses on the emotions of target customers and enables the determination of customer expectations in marketing research, how to communicate with the target audience at the strategic level, and the association of products and/or services with customer satisfaction by using communication methods to meet customer expectations in action (Huang & Rust, 2021).

2.3. The AI-Neuro-Green Marketing

AI, which can be classified as a tactical marketing tool (Erikkson, 2020), is an ICT tool and provides marketing strategies focused on customer satisfaction (Hermann, 2022). AI is an algorithm-based ICT and has a data driven orientation that enables to analyze customer behavior and provides standardized customer-oriented solutions. AI-driven marketing develops strategies on maximizing the use of technology, collection, and analysis of market data to increase customer satisfaction (Shaik, 2023). Adapting innovative, improvement- and solution-oriented AI applications to the marketing sector can enable companies to quickly adapt to changing market conditions and develop customer-oriented solutions (Chintalapati & Pandey, 2022). AI can automate business processes for today's conditions by providing customer and market insight through analysis of historical data (Verma et al., 2021). Furthermore, AI can analyze possible changes in customer expectations by evaluating real-time data and revising the system with a focus on customer satisfaction based on the obtained results (Verma et al., 2021). Therefore, AI can create customer insight on customer behavior that provides attraction of new customers while retaining old customers (Verma et al., 2021). AI can be classified as a tactical marketing tool, and it has significant strategic potential in marketing (Eriksson et al., 2020). AI can provide data to marketing strategies through translation of strategic information to guide managerial activities (Eriksson et al., 2020). Furthermore, neuromarketing can benefit from AI. For example, neuromarketing, which applies advanced neuroscientific techniques focused on AI to better understand customer behavior and develops data-driven and customized marketing into personalized marketing, enables analysis and evaluation of the relationship between customer behavior (e.g., emotions, decision-making processes) (Robaina-Calderín & Martín-Santana, 2021; Alsharif et al., 2021).

Even if there are separate definitions for the concepts of AI marketing, neuromarketing, neuro-green marketing, and green marketing in the literature, there is no definition for AI-neuro-green marketing as a single integrated concept in the literature. AI-neuro-green marketing is defined as an individualized marketing that is data-based, sustainable and technology-oriented, strategized on customer insights, and offers agile, customer-focused solutions that can increase customer satisfaction with its marketing mix tools.

The AEC industry, which can create a built environment with a focus on customer satisfaction, expectations, and design compatible with the TBL approach, can support Society 5.0 and Industry 5.0. Integrating Industry 5.0, Society 5.0, and ICT applications into marketing strategies has enabled the existence of Marketing 5.0 and the rapid spread of AI applications in marketing operations (Kasinathan et al., 2022). Moreover, the integration of Kumar et al.'s (2019) digital curation concept into marketing operations has sought to advance digitalization in marketing in the AEC industry in terms of green marketing, neuromarketing, and AI-neuro-green marketing practices at AEC.

The AI-neuro-green marketing concept in the AEC industry gets its roots from the integration of: (Figures 1, 2, and 3): the mechanical AI, thinking AI, and feeling AI categorization (Huang & Rust; 2021); the individualization, personalization, customization, and standardization from marketing perspectives (Kumar et al., 2019); neuromarketing (e.g., Robaina-Calderin & Martin-Santana, 2021); green marketing (e.g., Tuz & Sertyeşilışık, 2022); data-driven marketing (e.g., Shaik, 2023); neuro-green marketing (e.g., Topcu, 2022; Topcu & Sertyeşilışık, 2021); and AIM (Shaik, 2023). Benchmarking from Huang and Rust's (2021) categorization (i.e., the mechanical AI, thinking AI, and feeling AI), mechanical AI enables automatic data collection in marketing research (Huang & Rust, 2021). As mechanical AI is algorithm-based (Chintalapati & Pandey, 2022), it improves standardization (Kumar et al., 2019) that can be suitable for mass marketing strategies. Thinking AI focuses on customer decision-making (Huang & Rust, 2021). Furthermore, customer orientation can improve strategy in market segmentation and enable customization in marketing (Kumar et al., 2019) through green marketing that can suit niche marketing strategies. Feeling AI enables the determination of customer expectations (Huang & Rust, 2021), through human-imitating technology in market research (Sima, 2021), and personalizes marketing communications through neuromarketing in line with customers' preferences (Alsharif et al., 2021) with marketing mix tools suitable for individual marketing strategies (Kumar et al., 2019). In line with the Marketing 5.0, this study attempts to present the potential marketing strategies for AEC:

- *The mass marketing perspective:* The integration of mechanical AI (Huang & Rust, 2021), also known as automation (Verma et al., 2021), into marketing strategies can increase the data-driven approach through marketing channels, allowing the identification of customer expectations and the creation of databases for different types of projects (Huang & Rust, 2021). Additionally, the integration of mechanical AI can increase digitalization in the AEC industry, which focuses on Industry 5.0, Society 5.0, and Marketing 5.0. Therefore, the industry can become more data-driven, automated, and intelligent in its marketing strategies (Chintalapati & Pandey, 2022). Mechanical AI, which enables automatic data collection in marketing research (Huang & Rust, 2021), is algorithm-based (Chintalapati & Pandey, 2022), and improves standardization (Kumar et al., 2019) that can be suitable for mass marketing strategies.

- *The niche marketing perspective:* Adopting thinking AI in marketing strategies can enable the collection of information about the customer's preferences and orientation (Huang & Rust, 2021). Additionally, ensuring standardization by collecting information about the target market's expectations for different project types can increase sustainability in designs. Therefore, sustainable design criteria for different projects can be achieved through digital data-driven progress. Adopting green marketing strategies as a marketing strategy in the AEC industry can increase the industry's adaptation to Marketing 5.0. In addition, the implementation of green marketing mix tools (GMMT), one of the most important components of green marketing, can increase the sector's adaptation to Marketing 5.0. There has been a lack of green marketing mix and strategies studies focused on AEC. Tuz and Sertyeşilışık (2022) focused on the creation of green marketing strategies and mix tools and identified 16 GMMT for mass marketing in the construction industry. Adapting these GMMT can enable the application of thinking AI to marketing strategies. Therefore, it can increase sustainable marketing strategies on the AEC basis. Focusing on the customer decision-making process (Huang & Rust, 2021), the thinking AI improves market segmentation strategy through focusing on decision-making process. Therefore, customer focus can enable customization in marketing (Kumar et al., 2019) with green marketing suitable for niche marketing strategies (Huang & Rust, 2021).

- *The personalized marketing perspective:* Kumar et al. (2019) emphasized the importance of personalization in marketing. The feeling AI in marketing strategies can enable the creation of marketing strategies for the targeted customer segment (Huang & Rust, 2021). Greater personalization enables more data to be collected through human-mimicking AI applications to determine customer expectations (Srivastava & Bag, 2023). As marketing mix tools vary based on customer expectations, with the effect of personalization, customers can be provided with GMMT that can meet their expectations (Kumar et al., 2019). Customer expectations can be diversified by increasing the application of neuro design in marketing strategies in the light of the information collected from the customer through neuromarketing strategies (Topcu, 2022). There is a lack of studies providing AEC-focused different segments oriented GMMT. Tuz (2021) focused on the creation of green marketing strategies and mix tools and defined GMMT for different socioeconomic classifications for the construction industry. The integration of GMMT and AI into the neuromarketing design process can increase the implementation of digital sustainable marketing strategies in AEC (Alsharif et al., 2021). Integration of Al-neuro-green marketing strategies into marketing management can improve digital strategic decision-making at the strategic, operational, and tactical management levels, while enabling management to focus on sustainably focused digital agile strategies for different target markets (Tuz & Sertyeşilışık, 2021). Feeling AI enables the determination of customer expectations (Huang & Rust, 2021) with human-imitating technology in market research (Sima, 2021) and personalizes marketing communications through neuromarketing in line with customers' preferences with marketing mix tools suitable for personalized marketing strategies (Kumar et al., 2019).

- *The individualized marketing perspective:* AI enables the collection of large amounts of data and analysis of the collected data at the individual level (Kumar et al., 2019). AI-neuro-green marketing can support AEC to create green marketing strategies on real-time tracking data obtained and analyzed from customer expectations and customer reactions at the individual level through technologies (e.g., human-imitating technologies), enabling AEC to demonstrate rapid changes in marketing. Applying neuro-design strategies to AI-neuro-green marketing can enable AEC to get benefit from neuro-green marketing. The neuro-green marketing can support sustainable client-based design criteria for projects to be designed in the creation of a sustainable built environment (Topcu, 2022).

3. Discussion

Figure 3 represents the preliminary step towards the concept of AI-neuro-green marketing in AEC. This concept mainly emerges as a result of the digital integration of mechanical, thinking, and feeling AI types as indicated by Huang and Rust (2021) into marketing perspectives (i.e., standardization, personalization, personalization, and individualization), as highlighted by Kumar et al. (2019) together with: neuromarketing (e.g., Robaina-Caldering & Martin-Santana, 2021), green marketing (e.g. Tuz & Sertyeşilışık, 2022), data-driven marketing (Shaik, 2023), AIM (Shaik, 2023), and neuro-green marketing (Topcu, 2022; Topcu & Sertyeşilışık, 2021). The concept provides the AI-neuro-green marketing concept to the AEC industry digital marketing strategies from the mass- and niche-marketing perspectives: from the mass-marketing perspective, data-driven marketing, green

marketing, and neuro-green marketing, whereas from the niche-marketing perspective, neuromarketing in personalized marketing and neuro-green marketing strategies in individual marketing.

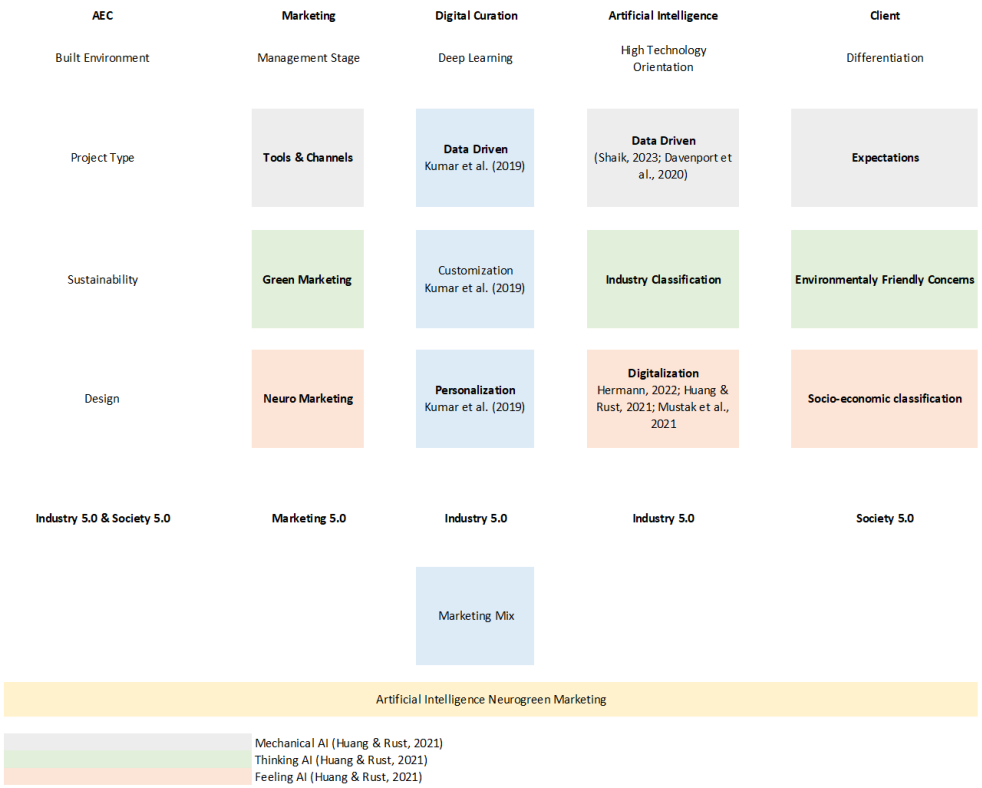

Figure 2. Main aspects of the preliminary conceptual model towards AI-neuro-green marketing.

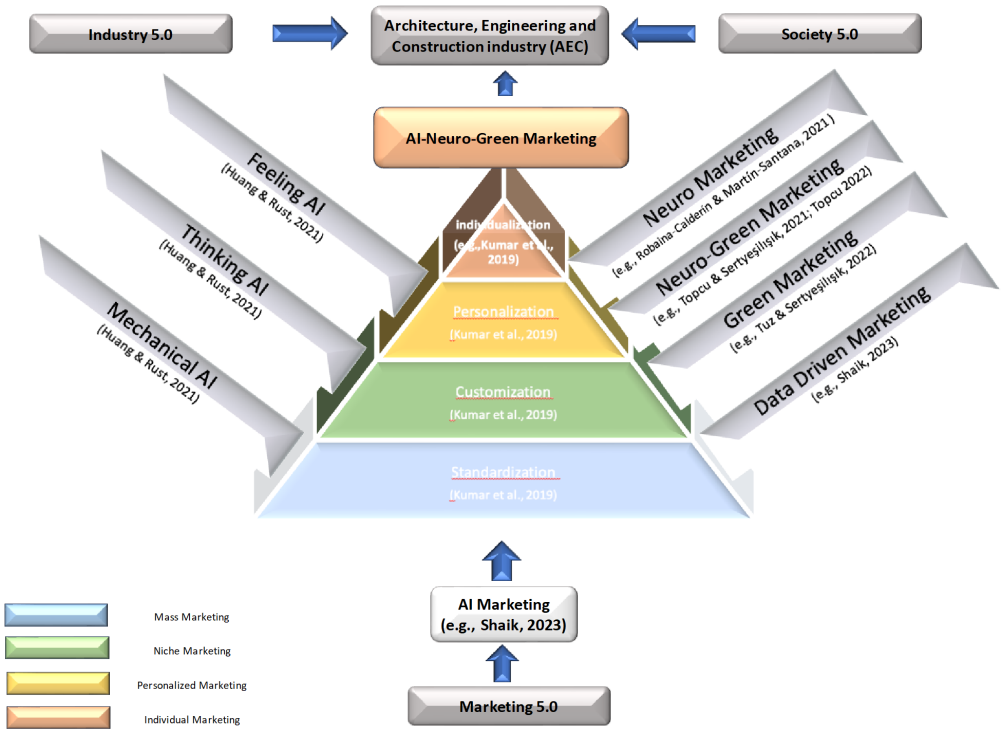

Figure 3. The preliminary concept of AI-neuro-green marketing in AEC.

AI-neuro-green marketing has the potential to enhance the effectiveness of neuro-green marketing in fostering sustainable built environment. Neuro-green marketing has a potential role in supporting the sustainability of the construction material industry (Topcu & Sertyeşilışık, 2021) and of built environment (Topcu, 2022). The potential of the AI-neuro-green marketing to enhance the effectiveness of neuro-green marketing is following the AI integrated marketing's potential advantages as regarding AI's contribution to marketing Shaik (2023) indicated that the integration of AI into marketing can provide many advantages including: increase in efficiency, improvement in marketing management, creation of value for customers. For this reason, benchmarking from Shaik (2023), AI-integrated neuro-green marketing can have potential to be more effective than neuro-green marketing at supporting sustainability in built environment. In this way, the effective use of AI-integrated neuro-green marketing by the AEC industry can have potential to influence its environmental footprint and contribute to reducing the embodied environmental footprint of the AEC industry's outputs and services, both directly and indirectly.

AEC companies effectively using AI-neuro-green marketing can have potential to enhance their competitiveness by value-driven and human-centric design (including architectural and interior design, material design) supported by the input of the better and deeper understanding of their customer segments' expectation and behavior. As companies seek new methods to better understand consumer behavior (Alsharif et al., 2021), AI-neuro-green marketing can have potential to support this process through synergy which can be created as a result of effective integration of the mechanical AI, thinking AI, and feeling AI (Huang & Rust; 2021); the individualization, personalization, customization, and standardization marketing perspectives (Kumar et al., 2019); neuromarketing (e.g., Robaina-Calderin & Martin-Santana, 2021); green marketing (e.g., Tuz & Sertyeşilışık, 2022); data-driven marketing (e.g., Shaik, 2023); neuro-green marketing (e.g., Topcu, 2022); and AIM (Shaik, 2023) aspects into the AI-neuro-green marketing process. As enhanced competitiveness of the companies can support their survival and success in the ever-intensifying competitive market and under the business fluctuation conditions, potential of the effective and successful management of the AI-neuro-green marketing in the AEC industry to directly and indirectly contribute to a company's competitiveness can act as a driver for AI-neuro-green marketing integrated into the strategic management of companies in the AEC industry.

Integrating sustainability and human centralization into marketing strategies can allow AEC to enhance the creation of built environment with the focus on understanding customer's expectation through human-mimicking technologies and designs compatible with the (TBL) approach. In addition, Shaik's (2023) study results may also have benefits for AEC: Improving marketing management, creating value for satisfied customers, enabling marketers to create a segmentation-oriented market strategy.

The AI-neuro-green marketing in the AEC industry has the potential to contribute to Construction 5.0 and Society 5.0 as they have common arguments as: AI (Marinelli, 2023), sustainability (Yitmen et al., 2023), and human centralization (Ikudayisi et al., 2023). Therefore, AI-neuro-green marketing can become an innovative, sustainability-oriented, and strategic marketing tool for companies operating in AEC. It is important for the AEC companies to respect the ethical aspects of the AI-neuro-green marketing mainly due to the ethical aspects related to data acquisition and use. This is in line with Shaik's (2023) emphasis on the data as the most ethically important element in AIM management.

4. Conclusion

This study has aimed to suggest the preliminary conceptual model's step towards the AI-neuro-green marketing as a potential strategic key to a sustainable built environment. AEC cannot isolate itself from the changes and developments resulting from Industry 5.0, Society 5.0, and Marketing 5.0, and it plays an important role in creating sustainable built environment with the contributions it provides. AEC offers design projects to built environment to ensure that project performance meets all human needs in accordance with the project purpose, minimizing environmental degradation and maximizing time and cost effectiveness. AEC is a competitive sector located at the intersection of Industry 5.0, Society 5.0, and Marketing 5.0, directly overlapping with the goals.

This study has provided a suggestion for the preliminary conceptual model's step towards the AI-neuro-green marketing. Figure 3 illustrates the preliminary AI-neuro-green marketing concept for AEC. As seen in Figures 2 and 3, this study highlights mechanical AI-oriented data collection to pave the way of marketing strategies, determination of customer preferences with thinking AI techniques to better customize the marketing mix tools, personalization with the support of feeling AI implementation to get the customers' attention (Huang & Rust, 2021). This study highlights the potential significant effects (e.g., improving digital sustainable orientation in marketing, increasing effectiveness of neuro-green marketing in supporting sustainable built environment, and providing direct or indirect effects in minimizing the environmental footprint of AEC and its outputs) of AI-neuro-green marketing strategies on AEC. Furthermore, this study emphasizes that the effective application of AI-neuro-green marketing as a marketing strategy to companies operating in AEC that can enable companies to enhance their marketing strategies under intensive competition, increase efficiency, improve marketing management, contribute to Industry 5.0, Society 5.0, and Marketing 5.0, and support AEC to keep up with the changes in Industry 5.0, Society 5.0, and Marketing 5.0.

This study highlights the potential of the effective application of AI-neuro-green marketing as a marketing strategy that can support companies to analyze customer expectations and behaviors so that customer satisfaction can be enhanced with the help of designs focused on human-centered value creation supporting their competitive advantage in the AEC through increased customer satisfaction and meeting the expectations of the different target segments. Furthermore, this study highlights the potential of the effective AI-neuro-green marketing to increase marketing effectiveness in creating sustainable built environment.

This study contributes to the marketing literature through putting emphasis on the interaction of AI, green marketing, neuromarketing and marketing in AEC. This study can contribute to the widespread and establishment of sustainable built environment. This study can provide information for professionals and academics to understand AI-neuro-green marketing and its importance in marketing practices. This study underlines the importance of AI-neuro-green marketing, and its marketing mix tools for AEC. Future studies could identify the AI-neuro-green marketing mix tools specific to AEC from the mass- and niche-marketing perspectives. Furthermore, future studies are recommended to focus on AI-neuro-green marketing strategies for different industries.

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