Factors Influencing Human-Centric Innovation Hubs for Effective Digital Marketing of Eco-Friendly Products

Anandhu VIJAYAKUMAR
Department of Business Administration, Turiba University, Riga, Latvia
anandhuvijayakumarhere@gmail.com

Jelena DAVIDOVA
Department of Law, Management Science and Economics
Faculty of Humanities and Social Science, Daugavpils University, Daugavpils, Latvia

Abstract
The eco-friendly products are digitally marketed through prioritising sustainable practices, adopting technological solutions, and other innovative approaches. New marketing strategies emerge better through human-centric innovation hubs since these platforms support integrated decision-making that combines data evaluation and customer experiences. These digital platforms provide a favourable environment to collaborate with policymakers and consumers for building effective sustainable product digital marketing strategies. Various elements determine how successful this collaborative approach becomes in its output. The aim of the research is to find out the factors influencing human-centric innovation hubs to enhance digital marketing of eco-friendly products. The study initiates a review of literature and a factor analysis method to determine these influential factors. Digital marketing of eco-friendly products depends on four significant elements, with data-driven elements taking the leading role at 25.715%, followed by motivational aspects at 16.675% and policy and engagement dimensions at 10.678%, along with persuasive components at 8.758%. Data-driven elements capture the most critical position among these influential factors. Digital marketing effectiveness increases for businesses and policymakers through their use of human-centric innovation hubs because these hubs offer clear insights into factors that influence eco-friendly product adoption.

Keywords: Digital marketing; eco-friendly products; factor analysis; innovation hubs; marketing

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1. Introduction

The digital innovation hubs enable the firms to enhance their developed products, services, and other related operations. These kinds of hubs help to transmit information, encourage strategic alliances between stakeholders, and develop opportunities for innovations. The innovation hub facilitates the increase in digital marketing, which allows the enterprises to maximise the benefits of innovative technologies to improve competitiveness and productivity (Hervás Oliver & Artés Artés, 2021). Organisations within human-centric innovation hubs combine physical as well as virtual workplace environments seamlessly. They can act as a central hub that facilitates the exchange of information, indulges in effective learning, and gives advanced initiatives to increase productivity (Haukipuro et al., 2024). There are various functions for

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human-centric innovation hubs. Through strategic start-up alliances and advanced solutions, organisations can establish strategic partnerships. They enable small enterprises to attract large investments, which in turn increases the competitive edge. They support and provide skill enhancement training by advanced technological experts. They also develop awareness and testing facilities for assessing and evaluating human-centric innovation hubs before the pre-investment (Sotirofski & Kraja, 2024).

In other words, the human-centric innovation hubs are also known as innovation labs or incubators and co-working spaces. These hubs mainly promote the expansion of small start-ups through knowledge sharing (Vakirayi & Van Belle, 2020). The rapid development of digital evolution and modernisation introduced in the companies increases some obstructions. To withstand the competition in the market, enterprises require the development of strategic initiatives and utilisation of modern technologies to create additional revenues. Even though there are disruptions in order to secure the topmost place in the competition, the organisations need to incorporate advanced digital technologies as part of innovations (Calderon Monge & Ribeiro Soriano, 2024). As digital technologies advance, clients are able to search and purchase products easily. Due to sudden advancement, the innovative technologies have become an important part of the present customers due to the convenience and reduced cost when compared to offline stores (Anggraini et al., 2024). Utilising digital technologies in marketing products offers various benefits. The online marketing elevates interaction as well as personalisation between the clients and entrepreneurs. It helps organisations to overcome challenges arising due to location, maintain communication all over the world, and create partnerships. Digital marketing helps to monitor current marketing trends and behaviour of customers, which enhances efficiency (Veleva & Tsvetanova, 2020).

Eco-friendly products are mainly referred to as the goods or commodities that are made by the companies that give more importance to sustainability and issues focusing on the environment. These products tremendously reduce the carbon emissions and mainly use renewable resources as well as recycled materials. The sustainable products thus developed are biodegradable and are chemical-free (Chakrabarty & Das, 2019). The companies in European countries are offering ecologically sustainable products, integrating both advanced technology and sustainable practices, which reduces environmental damage and increases resource allocation. This leads to enhancing the well-being of the economy as well as the environment (Paparoidamis & Tran, 2019).

Human-centric innovation hubs operate as dual-world working platforms that join consumer participation with commercial enterprises, scientific teams, and regulatory entities to focus on solution creation that prioritises human requirements and perceptions. Numerous innovation centres focus on creating inclusive environments and use digital resources to increase engagement between users and enhance sustainable innovation through user-centred approaches. The vital function of sustainable products acts to combine customer perspectives with marketing strategies for demonstrating eco-friendly product knowledge to consumers.

The research demonstrates the fundamental role that digital human-centric innovation hubs serve in sustainable product marketing. The strategic marketing alliances between innovation hubs seek to achieve success through profit alongside delivering environmental conservation and welfare benefits for people. Digital technology applications help to boost customer engagement so they become more conscious about environmentally safe commodities. The research explores how human-centric innovation hubs affect the digital marketing of environmentally friendly products within developed countries, especially Latvia. The research uses simplified questionnaire design because it concentrates on European Union states while

selecting most participants from Latvia through snowball sampling. The sampling design includes Latvia because it is a developed nation to support effective information collection in this area.

In this research, the authors focus on understanding how human-centric innovation hubs can help in supporting the digital marketing of sustainable products. The primary research question focuses on:

In what manner can human-oriented innovation hubs foster collaboration and achieve efficiency in the use of digital marketing methods in promoting sustainable products? The specific tasks of this paper are:

i) to understand how the established innovation hubs facilitate stakeholders' co-engagement;
ii) to examine the factors influencing human-centric innovation hubs for effective digital marketing of eco-friendly products.

In this research, the human-oriented innovation hubs are used in combination with digital marketing and sustainability, which have limited exploration within Latvia. In doing so, the research helps to meet a crucial need to identify how innovation ecosystems may be leveraged for environmentally friendly consuming practices. Towards the end, the implications of the findings are presented here for academics, marketers, and policymakers interested in implementing sustainable and engaging marketing practices.

The first section (Introduction) gives a broad description of human-centric innovation hubs while explaining their function in promoting green products, along with their contribution to developing sustainable advances. The research contains clear statements about its aim, along with its important tasks, and presents its problem for investigation. The second section, titled 'Literature Review and Research Hypotheses Development', includes existing research about eco-friendly products, alongside the variables that shape the relationship of innovation hubs with digital marketing operations. This analysis develops hypothesis statements, which originate from the reviewed literature material. The third chapter, 'Methodology', describes the approach used for data collection and the methods for sampling and data analysis. The fourth chapter, 'Results and Analysis', contains the survey results that undergo factor analysis, which leads to a presentation of essential observations. The fifth chapter, 'Discussion', validates hypotheses through research findings while presenting practical approaches and the unique nature of this research, together with conceptual models and appropriate recommendations. Future research guidelines with highlights on study significance and summarisation of research findings are given in the sixth section, 'Conclusions'.

2. Literature review and research hypotheses development

2.1 Overview of eco-friendly products

Products and initiatives can be described as eco-friendly if they reduce environmental damage. The sustainable commodities are modified based on customer preferences and needs with low environmental impact (Bansal, 2019). The purchasing patterns of individuals in developed countries are different, and the level of awareness about the environment as well as the behaviour of consumers serve an essential function in the segmentation of the market. As individuals are more interested in utilising green products, the marketers manufacture their products according to sustainable principles. This helps to achieve financial success during a market downtrend (Lorek, 2015). The companies are introducing new production methods as a popular marketing strategy that decreases ecological impact and increases performance. Even

though integrating environmentally friendly initiatives into the development of products is complex, these strategies enable the brand to become more visible and increase its environmental image. This increases the competitiveness of the company (Katsikeas et al., 2016).

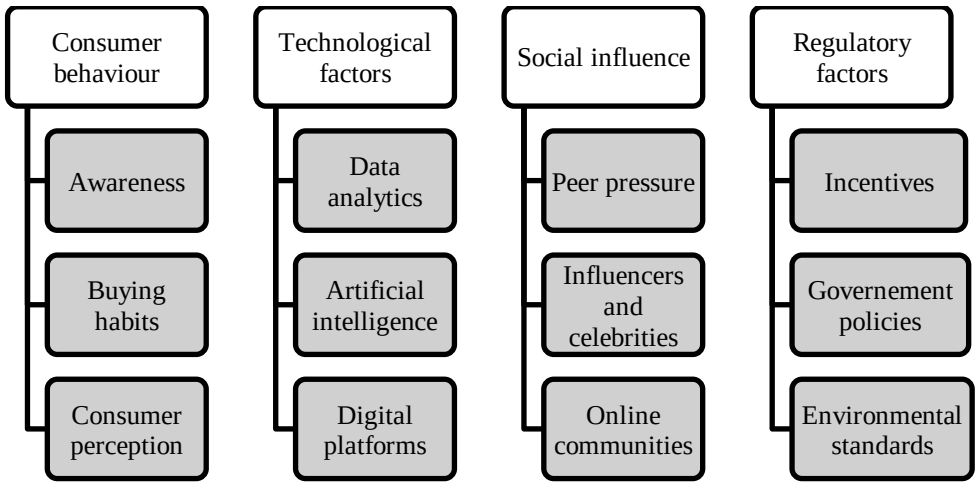
The green behaviour is referred to as choices of purchasers regarding eco-friendly products. This is influenced by the beliefs and ecological consciousness of the consumers related to issues of the environment. Environmental awareness growth among people leads to a consistent increase in the interest for green products. Sustainable product acquisition provides mutual advantages between consumers and environmental protection (Pratap, 2018). Increased environmental consciousness has led customers to spend money on naturally produced products, which are fresh with organic components. Green behavioural shift promotes eco-safe products in developed nations. Green behaviour aids in conserving the natural resources and decreases the harmful environmental impact (Gupta, 2021).

An extensive literature review was conducted by the authors to determine the main elements affecting digital marketing strategies for eco-friendly products as described in the upcoming section.

2.2 Collaboration between digital marketing of eco-friendly products and human-centric innovation hubs

Figure 1 depicts various attributes of human-centric innovation hub that influence the digital promotion of ecologically favourable products. The major variables are consumer behaviour, technological factors, social influence factors, as well as regulatory variables.

Figure 1. Attributes of human-centric innovation hubs that influence digital marketing



Source: Created by authors.

The lifecycle of the product starts from designing, acquiring raw materials, storing, transporting, using the product, and post-usage activities. It is very important to understand the fluctuations in the market and factors that affect digital marketing (Kumar & Ghodeswar, 2015). Finally, it is concluded that all the factors mentioned in Figure 1 are basically human-initiated and human-induced as a result of consumer behaviour, decisions, and innovations. These variables include consumer behaviour, technological factors, social factors, and regulatory factors, which are all relative within a human factor approach to encourage people to embrace green products.

Influence of consumer behaviour

The changing consumer behaviour transformed the marketing strategies by prioritising environmental protection. The consumers, irrespective of age groups, prefer the eco-friendly products, and this introduced a sustainable trend (Kalaiselvi & Dhinakaran, 2021). Digital marketing of eco-friendly products experiences changes due to the increasing awareness of ecological concerns by consumers. As this demand increases, marketers adopt sustainable strategies by giving emphasis to eco-friendly products. The companies regularly publish their sustainability reports to make consumers aware and attract them (Maciaszczyk et al., 2022). The increasing awareness about the environmentally friendly products boosts their respective sales. Consumer behaviour develops a positive trend among the consumers that prioritise ecologically friendly and ethical consumption (Baviskar et al., 2024).

Customers develop their purchasing behaviours under the influence of social influence combined with personal interests and environmental concerns. Consumers make purchases from recommendations from their peers and acquaintances. After the emergence of online shopping and online reviews, buying habits of customers are changing (Barbarossa & De Pelsmacker, 2016; Chen et al., 2021). Consumers with high awareness have a higher chance to buy green products compared to consumers with low awareness, as they possess an encouraging attitude towards paying a higher price for organic products. Packaging, labelling, and product quality influence people's purchasing habits (Naz & Magda, 2019).

The perspective of customers contributes greatly to advertising environmentally safe products. As people are more cautious regarding ecological issues, people are ready to buy green products and force the companies to opt for environmentally friendly procedures to make the product. Open communication practices have become essential for companies to build customer trust, which assures sustainable operations. Such behaviour builds trust and increases the demand for eco-friendly goods of the respective brand (Bhatia & Jain, 2013). The developed hypothesis is as follows:

H1. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by consumer behaviour*.

Influence of technological factors

Eco-sustainable goods promotion through digital marketing operates significantly under the influence of technological elements. The marketers heavily depend on the innovative technologies to develop their brand and need huge investments. By utilising the advanced technologies, the visual appeal and effectiveness of the sustainable products are increased, which boosts the sale (Manjunath & Manjunath, 2013). Marketing campaigns become more effective by using data analytics to generate necessary information about current market patterns and their development. Moreover, data analytics also enhances the effectiveness of marketing campaigns by acquiring information related to the present and changing market trends. This approach also enhances the customer engagement (Yao, 2024).

AI technology uses effective management of resources to advance green product promotion. The reduction of waste production achieved through artificial intelligence technologies produces less ecological damage (Tran & Nguyen, 2023). Artificial intelligence chatbots enable customers to receive prompt answers for their queries while simultaneously creating new customer relationships. This process has an impact on shaping the purchasing choices of environmentally conscious customers (Ganesh et al., 2024). Digital marketing strategies particularly rely on several different digital platforms to function successfully. The online platforms, like social media and e-commerce platforms, provide immense information related

to the environmentally safe products, social media engages with the customers and shares brand updates regarding sustainability practices. The use of digital platforms by companies makes it easy to reach environmentally conscious customers and meet their expectations (Saseanu et al., 2020). The developed hypothesis statement is as follows:

H2. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by technological factors.*

Influence of social factors

Ecological product promotions benefit from revolutionary digital marketing methods as a result of social influences, including peer pressure and online community effects, alongside celebrity publicity. Customers, especially those from the younger demographic, accept new views through information exchange, which results in alterations to their purchase decisions and belief patterns. The social learning theory states that people imitate the behaviours of their peers or acquaintances, which plays an essential part in the marketing of eco-friendly commodities (Nagarajan et al., 2022). The celebrity endorsements have a huge impact. When the celebrities and influencers promote the usage of vegan products or any other eco-friendly products, more and more people follow them blindly and increase the usage of green products. The involvement of celebrities enhances environmental awareness while exerting more impact on consumer beliefs as well as environmentally friendly purchasing choices than other promotional strategies (Zaelani & Chaldun, 2021). The creation of online communities helps to share experiences and provides emotional support to the buyers, which accelerates the eco-friendly merchandise sales. This process helps to increment the level of social interactions among sellers and buyers (Gao et al., 2022). The main platforms behind online community creation are Facebook and Instagram, together with WhatsApp. The digital platforms help to develop strong relationships with environmentally conscious clients. Through the virtual communities, customer loyalty increases and motivates them to utilise eco-friendly commodities (Gupta & Syed, 2022). The authors developed a research hypothesis as follows:

H3. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by social influence factors.*

Influence of regulatory factors

The new regulations establish sustainable economic practices for decreasing carbon emission rates. The regulations attract investment in infrastructure and business practices, which leads to preserving biodiversity (Mustafa et al., 2022). Significant investment receives enthusiasm through administrative incentives and policies that encourage sustainable expansion. Since the United Nations Conference on Environment and Development (UNCED) in 1992, it has encouraged sustainable practices and increased the promotion of eco-friendly products that have a substantial influence on society around the world (Mustafa et al., 2022). Various environmental standards have been adopted to enhance energy efficiency, preserve energy, and decrease greenhouse gas emissions (Singh, 2017). The environmental standards provide significant guidance to the marketers about manufacturing methods that are environmentally friendly, which helps to reduce ecological impact (Chen et al., 2021). Based on findings, authors developed a research hypothesis statement, which is given below.

H4. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by regulatory factors.*

3. Methodology

Quantitative methodology has mainly been utilised in the present paper, enabling the analysis of large samples. This helps authors to analyse large objective data acquired through an online survey. The digital survey is conducted through an online platform, Google Forms. The respondents were selected by using snowball sampling. Authors chose participants who were closely connected to this sector, which facilitates understanding the digital marketing of environmentally safe products through innovation hubs. About 163 individuals participated in the online survey. The survey was performed during a period of 1 month, ranging from 19 April 2024 to 20 May 2024. A pilot study has been conducted before the main survey to find the suitability of survey questions. Suggestions obtained from the pilot study helped modify the questions. 20 samples were considered for this pilot study. Five-point Likert scale options were incorporated in the questionnaire for the ease of answering the questions by the survey subjects. The 163 participants were adequate to justify the study, as it met the minimum requirements for carrying out factor analysis that guarantees valid and reliable results. The sample size ensures that we have adequate power to test for significance whilst reducing possible errors. Also, it shows the heterogeneity within the target population, making the study adoptable in other consumer domains. The authors select this sample size based on best practices used in field research studies and provide insights into sustainable consumer behaviour and environmental products. In aggregate, the size of the sample adequately addresses both methodological and practical requirements of the study.

The authors adopt a systematic and detailed study to establish how human-centred innovation centres and digital marketing function together for sustainable products. The research examines digital marketing accessibility and information sharing attributes together with human-centred design adoption impacts, which researchers validate by implementing conceptual models and direct product discussions. The study uses factual observations to present findings in a practical domain and the conceptual model integrates findings, which demonstrate that digital marketing enhances accessibility and information sharing together with human-centred design, improving utility and adoption rates for products. The method generates explanations that clarify how different factors influence sustainable product adoption. Traditional approaches like offline marketing are useful to quantify consumers' behaviour and perspective in a researched market, while innovative approaches like digital marketing are helpful to assess teamwork and collaboration among members of an innovation ecosystem. Using real-life experiences places the study results in relevant practice settings, and a conceptual model integrates the study results to demonstrate that digital marketing benefits accessibility and information sharing, and human-centred design benefits product utility and adoption. This method creates explanations for the intricate relations that affect sustainable product adoption.

3.1 Data collection

The information acquired by the authors is through primary and secondary data collection techniques. The secondary data includes retrieving the articles and journals from the academic database Google Scholar. As part of this study, international sources (monographs and scientific articles) with keywords "factor", "digital", "marketing", "innovation hubs" as well as the exact phrases "eco-friendly" and "product" with at least one of the words "impact" or "affect" were analysed in Google Scholar. The articles dated from 2013 to 2024 are mainly considered and found in 640 matching documents.

The raw data is procured through an online survey. The poll questions are developed leveraging Google Forms, which is a user-friendly web platform. The authors created a total of 18 questions based on factors identified in the literature review. The geographical location taken is various parts of Latvia. Authors followed all ethical guidelines while conducting the online survey.

3.2 Sampling method and data analysis

The snowball sampling is utilized to choose the responders. In this type of sampling, the initial group of survey participants is selected by the authors themselves. For the next set of poll subjects, the initial participants choose the next group of people to participate in the survey (Dragan & Isaic Maniu, 2013). The authors utilised the mentioned sampling method, as it helps to acquire a large sample size and reach participants who are inaccessible to authors and have immense knowledge regarding the investigated topic. The number of respondents to the survey is 163, who are tech developers, retailers, entrepreneurs of eco-friendly companies, innovation hub members, and academic researchers from Latvia.

After acquiring the desired sample size, factor analysis was used to analyse the received poll responses. This statistical technique helps to analyse the interrelation existing between the factors identified by authors (Mokhtar et al., 2024). This facilitates identification of the multiple relationships within the factors, which lead to identifying the underlying patterns in the acquired responses. The factor analysis helps to understand the connections that exist between the digital marketing of eco-friendly products and the recognized factors. Consumer behaviour, technological factors, social influence, and regulatory factors are major factors based on literature review. Twelve subsidiary factors are allocated into these four main variables.

4. Results and analysis

To evaluate the consistency of survey questions, Cronbach's alpha is performed. A value of 0.857 is obtained, which is comprehended as good consistency. As the initial step called coding, the authors assign each value for the Likert scale options. For example, there are five options for each of the survey questions, namely, strongly agree, agree, neutral, disagree, and strongly disagree. The 1, 2, 3, 4, and 5 are the values given to the above-mentioned options, respectively.

To find the adequacy of sample data, KMO and Bartlett's test are conducted. The KMO values help to find out whether factor analysis can be executed or not. The Bartlett's test helps to check the hypothesis statements. Table 1 shows the test outcomes of KMO and Bartlett's test. From Table 1, the KMO value obtained is 0.812, which exceeds 0.5, therefore, the factor analysis can be conducted. The significance value of Bartlett's test is 0.000, which is smaller than 0.005. This indicates that the null hypothesis is rejected (Harefa & Sitanggang, 2024). Therefore, it is inferred that the integration of digital marketing as well as human-centric innovation hubs is affected by multiple variables.

Table 1. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.812
Bartlett's Test of Sphericity	**Approx. Chi-Square**	239.214
	df	107
	Sig.	.000

Source: SPSS 29 Software.

As per the eigenvalues, components are extracted using principal component analysis. To effectively separate the components, the eigenvalue must exceed 1. Table 2 represents the outcomes of principal component analysis performed by using SPSS 29 software. With reference to Table 2, it is evident that only the components having an Eigenvalue greater than 1 are extracted. Out of 12 components, only 4 components are derived. The primary component has 25.715% variance, which is followed by the second factor, constituting 16.675%, the subsequent (3rd) component is 10.678%, and the last (4th) component is 8.758%. The characteristics of the 12 variables are exhibited by 4 components. The subsequent step is the component matrix analysis.

Table 2. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.598	25.715	25.663	2.598	25.715	25.663	1.635	11.356	11.780
2	1.384	16.675	26.6354	1.384	16.675	26.6354	1.645	12.050	20.985
3	1.322	10.678	34.549	1.322	10.678	34.549	1.500	10.105	32.250
4	1.217	8.758	44.776	1.217	8.758	44.776	1.310	9.760	40.225
5	.979	8.104	49.086						
6	.967	7.56	56.142						
7	.953	4.25	65.955						
8	.918	4.15	72.076						
9	.857	3.95	73.698						
10	.749	3.52	82.645						
11	.743	3.35	87. 691						
12	.651	3.29	90.129						

Source: SPSS 29 software.

In this analysis, the Pearson correlation coefficient is utilised to extract and allocate the factors into components. This analysis is not accurate, as the number of iterations is minimal.

Table 3 shows the outcomes of component matrix analysis performed by utilising SPSS 29 software. From Table 3, it is clear that some factors are distributed into multiple components, which is referred to as cross loading.

Table 3. Component matrix analysis

Variables	Component			
	1	2	3	4
Awareness			.434	-.487
Buying habits		.516		
Consumer perception				.551
Data analytics	.663			
Artificial intelligence	.416			
Digital platforms				.521
Peer pressure			.493	.523
Influencers and celebrities		.524		
Online communities	-.557		.612	
Incentives	.413	.482		
Government policies			.523	
Environmental standards			.516	

Source: SPSS 29 software.

To eliminate the state of cross-loading, the rotated component matrix is conducted, which has a higher number of iterations and thus has high accuracy. Table 4 represents the conclusions of the rotated component matrix created by using SPSS 29.

Table 4. Rotated component matrix

Variables	Component			
	1	2	3	4
Awareness			.434	
Buying habits		.516		
Consumer perception				.551
Data analytics	.663			
Artificial intelligence	.416			
Digital platforms				.613
Peer pressure				.523
Influencers and celebrities		.524		
Online communities			.612	
Incentives		.582		
Government policies			.523	
Environmental standards			.516	

Source: SPSS 29 software.

Iterations are repeated eighteen times to eliminate cross-loadings, and each factor is allocated into components that have similar characteristics. Based on the Pearson correlation coefficient, the subsidiary elements are allocated into 4 components, which are given suitable titles.

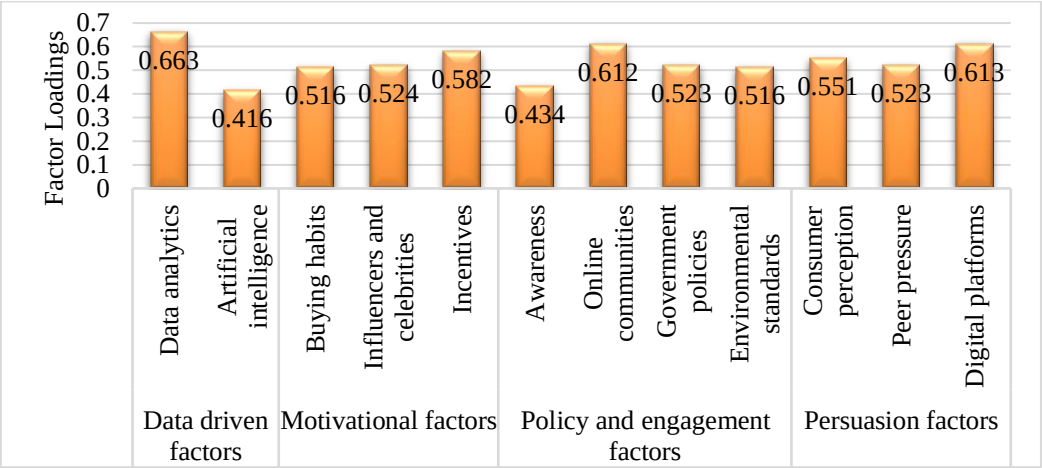
Component 1 is labelled as "data-driven factors", and the factors allocated under this component are data analytics (0.663) and artificial intelligence (0.416). The proportion of variance for component 1 is 25.715%, and this is the most prominent factor influencing the digital marketing of eco-friendly goods through innovation hubs. The human-centric innovation hubs utilise data-driven factors to increase the brand visibility of nature-friendly products. Business organisations employ data analytics tools to study consumer trends so they can transform their business choices as well as their marketing procedures. The artificial intelligence assists in sending personalised messages and content to the targeted customers. This increases the adoption rate of sustainable products.

Component 2 is given the heading "motivational factors", which has a percentage of variance of 16.675%. This variable is the second most significant factor. The sub-factors under this component are buying habits (0.516), influencers and celebrities (0.524), and incentives (0.582). These subsidiary factors encourage the eco-conscious clients to purchase the eco-friendly products. The different types of buying habits of people play a significant role, as people whose age is between 18 and 25 are more influenced to buy eco products rather than senior citizens and middle-aged groups. The influencers and celebrities endorse certain brands, which increases the reach as well as credibility. Customers tend to purchase sustainable merchandise more by using discounts, government financial support, and special deals. The human-centric innovation hubs simplify this process by incorporating motivational factors into online marketing initiatives, which increases customer loyalty towards nature-friendly products.

"Policy and engagement factor" is component 3 with 10.678% of variance and has subsidiary factors as awareness (0.434), online communities (0.612), government policies (0.523), and environmental standards (0.516). The awareness campaigns help to educate people about the significance of using environmentally favourable products. The online communities allow the

eco-friendly brands to communicate effectively about their vision and goal to the customers, thereby developing a strong alliance, which in turn promotes the mentioned brand products. The government policies improve the customer trust and credibility as the government provides various certifications when the companies align with sustainable goals. Moreover, environmental standards also enhance the commitment of both organisations and individuals towards the environment. Figure 2 represents the factor loadings of sub-factors as a result of factor analysis.

Figure 2. Factor loadings according to Pearson coefficient values



Source: Created by authors.

The component 4 “persuasion factors” with 8.758% variance has subsidiary factors consumer perception (0.551), peer pressure (0.523), and digital platforms (0.613). The digital marketing helps companies to improve the perception of eco-conscious clients to take purchasing decisions. The peer pressure or recommendations from acquaintances persuade people to buy natural or organic products. The digital platforms, like social media, virtual try-ons, and e-commerce sites, help individuals to choose better options that reduce the detrimental impact on the environment.

The percentage of variance for each component, as indicated in Table 2, indicates the priority of these components. The Pearson correlation value for each factor is identified after conducting the rotated component matrix, which is given in Table 4. The components from 5 to 12 in Table 2 are neglected as their collective percentage of variance is only 38.174%, which is much smaller as compared to the 4 components (61.826%) mentioned above and indicates that they had an insignificant impact on the digital marketing of eco-friendly products through innovation hubs. The following section includes a detailed analysis of hypothesis statements.

5. Discussion

The research conducted by authors reveals that the label “eco-friendly” is given to any products or activities that help to decrease the environmental footprint, mainly by utilising sustainable materials and reducing waste and consumption of energy. These practices are important to increase brand visibility and promotion as individuals are more conscious of the environmental consequences. As digital marketing became popular, by collaborating with social media influencers, e-mail marketing, and sending personalised messages to the target audience, the

awareness about eco-friendly products increased. This led to an increase in sales and revenue growth. The eco-conscious shoppers are eager to pay a premium price for the products and gradually increase their brand loyalty. The developed nations employ innovative advanced technologies primarily for manufacturing their green products. The companies release yearly sustainability reports to provide buyers with information regarding their sustainability performance levels that enhance brand reputation. The various research studies conducted by Chakrabarty & Das, (2019), Paparoidamis & Tran, (2019), and Pratap, (2018) found that digital marketing enhancements increased the visibility of eco-friendly products, leading to greater consumer popularity as well as volume of eco-conscious product sales.

Companies need digital marketing innovation hubs to successfully deploy environmentally friendly products. These types of hubs provide space to collaborate with business entrepreneurs and other participants to advance scientific development. The companies use artificial intelligence together with data analytics systems to develop personalised marketing strategies that aim at reaching their eco-conscious consumer base. Businesses utilize their intellectual resources with operational funding along with their expertise to advertise eco-friendly items to differentiate sustainable products from conventional products, which drives consumers toward sustainable behaviours. The other studies conducted by Vakirayi & Van Belle (2020), and Veleva & Tsvetanova (2020) validated that the introduction of innovation hubs caused the eco-friendly consumption rate to rise, as per the older research studies. The combination of advanced technologies in both marketing and eco-friendly product production makes this achievement possible.

The research aims to understand factors that affect the collaboration between human-centric innovation hubs and the digital marketing of eco-friendly products. According to the main aim, authors recognised four major factors and twelve subsidiary factors. Therefore, the further discussions are progressed through analysing the validation of hypothesis statements.

H1. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by consumer behaviour.*

This research's factor analysis showcases that consumer behaviour positively influences the collaboration of digital marketing and innovation hubs of eco-friendly products. The factor loading values of awareness, buying habits, and consumer perception are 0.434, 0.516, and 0.551, indicating that these subsidiary factors of consumer behaviour positively influence the integration. Better digital literacy enabled customers to develop enhanced knowledge about the benefits offered by environmentally sustainable products. After understanding the long-lasting benefits, consumers slowly changed to purchasing eco-friendly products as their priorities also changed. This is reflected in their buying habits. The marketers introduce user-friendly platforms, transparency, and displaying important information regarding products, which further escalated the sales of eco-friendly products. Buying eco-friendly products is also influenced by customer perception, as the viewpoints of consumers are changed due to digital marketing. Therefore, through innovation hubs, it helps marketers to understand the buying patterns of customers and effectively promote eco-friendly products online. These findings of the authors are in agreement with the studies undertaken by various other researchers. According to Kalaiselvi & Dhinakaran (2021), consumer behaviour revolutionises the marketing strategies opted for by companies as they indulge more in promoting eco-friendly products. Even though the manufacturing workflow of eco-friendly products is expensive and complex, due to increasing demand from customers, marketers adopt sustainable production methods (Maciaszczyk et al., 2022). The positive trend towards eco-friendly products increases when the level of environmental awareness of customers increases. The awareness develops a

positive attitude toward sustainable products, leading to an increment in the number of sales. The digital marketing through innovation hubs played a huge role in growing awareness among purchasers (Baviskar et al., 2024). Individuals are influenced by social media marketing, peer pressure, and other recommendations from close acquaintances that shape buying habits. Due to the popularity of digital marketing, the buying habits are fluctuating and inclining them towards eco-friendly products (Barbarossa & De Pelsmacker, 2016). The company makes purchasers aware of the benefits of utilising eco-friendly items, which influences the perception of consumers about the products and increases the purchasing of the same products (Bhatia & Jain, 2013). Therefore, the research conducted by authors and other studies equally proved that customer behaviour positively influences the integration process. Thus, the hypothesis statement H1 is validated.

H2. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by technological factors.*

Factor analysis in this research reveals technology plays an important role in making digital marketing platforms integrate better with facilities that manage human-centred innovation of environmentally sustainable products. All subsidiary elements within the analysis display signs of positive correlation with the core assessment based on data analytic findings (0.663) and artificial intelligence (0.416) and digital platform use (0.613). Eco-friendly product marketing depends on three technological forces, which include data analytics along with artificial intelligence that operates through digital platforms. The main marketing usage of data analytics enables market trend assessment along with delivering customised campaigns to reach customers who care about the environment. AI application in marketing provides needs prediction abilities for customers while simultaneously enabling automated system optimisation and price management processes. The digital technologies help consumers to interact effectively with marketers and indulge in sustainability initiatives. This increases eco-friendly purchases. Innovation hubs increase the effectiveness of online marketing initiatives by collaborating with eco-friendly products. These findings from the authors' research were further validated by other researchers. The marketers are depending on innovative technologies to increase the aesthetic elegance of sustainable products, which is a major factor in influencing the purchasing tendencies of consumers. Therefore, technological factors have an important role in marketing eco-friendly products (Manjunath & Manjunath, 2013). Through data analysis, marketers gain capabilities to anticipate consumer purchasing patterns alongside the ability to grasp their patterns of consumption. Market trends become available through such analysis (Yao, 2024). Through the implementation of artificial intelligence technology, organisations can handle their resources with maximum efficiency for waste reduction. Through AI chatbots, the marketers can maintain non-stop communication with customers, leading to changes in customer attitudes toward green products (Ganesh et al., 2024; Tran & Nguyen, 2023). Users receive information about sustainable products and their extended advantages through social networking sites and e-commerce platforms run by digital technology platforms. This approach enables the consumer to choose sustainable products and depends on the brands (Saseanu et al., 2020). Studies demonstrate a positive link occurs between digital marketing collaborations and green products through innovation hubs. The research results lead to acceptance of the second hypothesis statement, H2.

H3. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by social influence factors.*

The studies of Nagarajan et al. (2022), Zaelani & Chaldun (2021), and Gao et al. (2022) indicate that social factors have a productive impact on the integration of digital marketing and innovation hubs of sustainable products. From the factor analysis executed in this research, it also emphasised that subfactors of social influence factors positively affected the collaboration of digital marketing and human-centric innovation hubs of sustainable products, as the factor loading values of subfactors such as peer pressure, influencers and celebrities, and online communities are 0.523, 0.524, and 0.612, respectively. The social influence factors through peer pressure, influencers and celebrities, and online communities significantly impact the digital marketing of eco-friendly products through innovation hubs. The pressure from peers encourages positively to adopt eco-friendly products. Apart from that, celebrities and social media influencers improve the credibility and appeal of eco-friendly products. As a large number of celebrities promote eco-friendly products, the trust in that particular product increases, and a higher number of people are attracted towards the product. This approach grows a culture of eco-friendly product utilization. Online communities improve brand loyalty by sharing the information and personal reviews regarding the products. Such interaction develops a strategic relation between consumers and marketers. By understanding real-life experiences about the utilisation of eco-friendly items, a significant number of people became consumers of sustainably sourced products. Such success is possible through digital marketing. The peer pressure, social media influencers, and celebrity endorsements influence attitudes and behaviours exhibited by individuals, mainly youths. Therefore, the third hypothesis statement, H3, is proved.

H4. *The integration of digital marketing and human-centric innovation hubs of eco-friendly products is positively affected by regulatory factors.*

The analysis through factor analysis shows that regulatory elements enhance both digital joint marketing efforts and eco-friendly product initiatives on modern human-centric platforms. The subfactors manifest positive effects because their factor loading values measure at 0.582 for incentives along with 0.523 for government policies and 0.516 for environmental standards. The regulations imposed by the respective governments of Latvia help to form an eco-friendly culture among their citizens. As the rules and regulations favour a sustainable culture, more companies are attracted to the manufacturing of green products. The incentives provided by the government and companies attract consumers to purchase ecologically friendly products and reduce the environmental impact. Various environmental standards also provide necessary guidance to manufacturers and suppliers in adopting technologies that help to reduce negative effects on nature. These findings of authors are validated by the studies of Mustafa et al. (2022) and Chen et al. (2021), as they also agreed that regulatory factors have an encouraging impact on the integration process. This evidence proves the fourth hypothesis statement.

Therefore, the four hypothesis statements (H1, H2, H3, and H4) created by authors are validated. Validation of hypothesis statements concludes that the collaboration of digital marketing and human-centric innovation hubs of eco-friendly products is benefited by data-driven factors, motivational factors, policy and engagement factors, and persuasion factors (these are the identified four components, with twelve sub-factors allocated after factor analysis). Table 5 represents the summary of the status of the hypothesis statements formulated by authors.

Table 5. Status of hypothesis statements

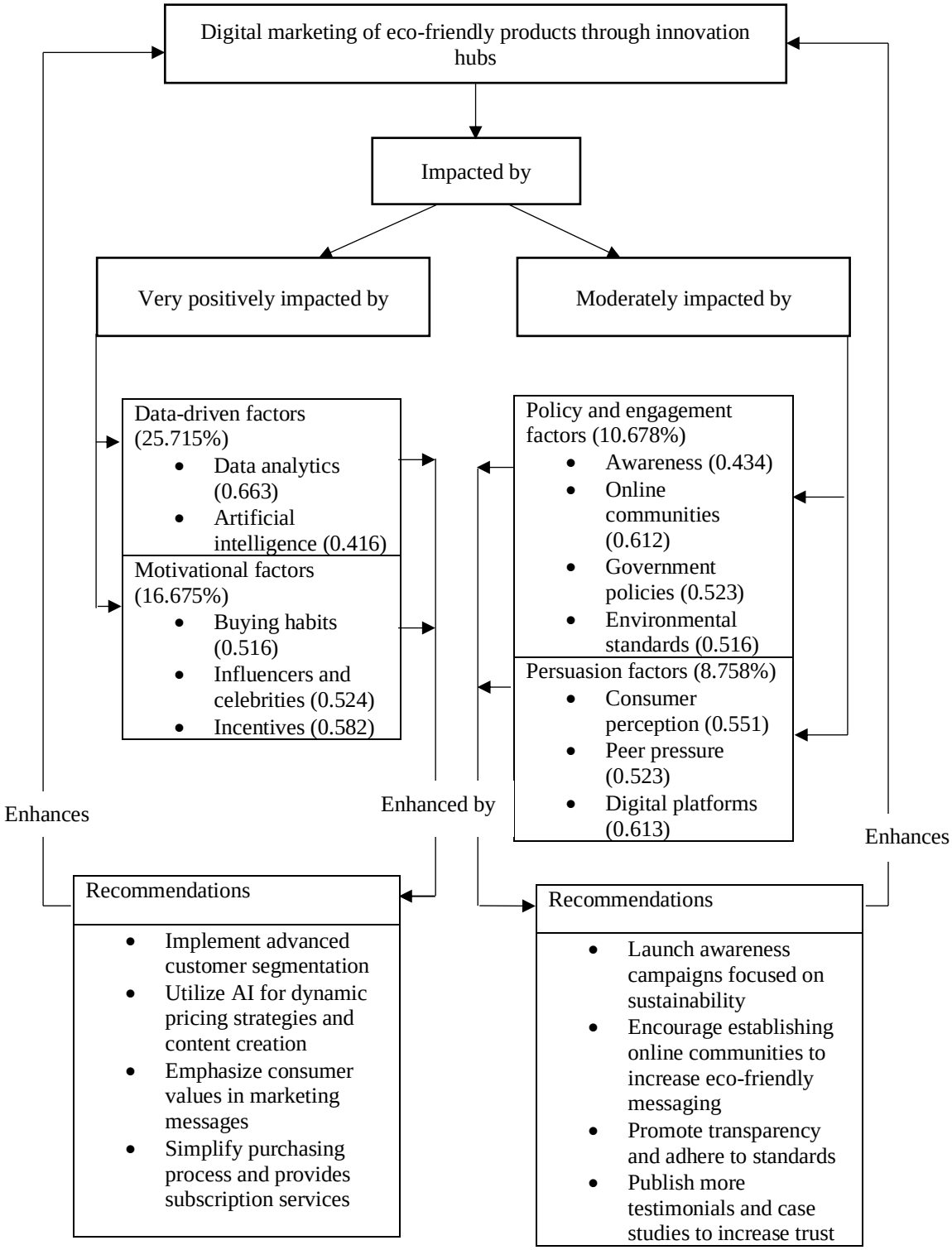
Hypothesis statement	Status
The integration of digital marketing and human-centric innovation hubs of eco-friendly products is affected by consumer behaviour (H1)	Accepted
The integration of digital marketing and human-centric innovation hubs of eco-friendly products is affected by technological factors (H2)	Accepted
The integration of digital marketing and human-centric innovation hubs of eco-friendly products is affected by social influence factors (H3)	Accepted
The integration of digital marketing and human-centric innovation hubs of eco-friendly products is affected by regulatory factors (H4)	Accepted

Source: Created by authors.

This present research is distinct from previous literature on various aspects. This research is able to identify multiple influential factors in the digital marketing of eco-friendly products and the priority of each factor. This research also details the interrelationship existing among technological, social, regulatory, consumer behaviour, and digital marketing of eco-friendly products. The majority of previous literature only focuses on the digital marketing of eco-friendly products, but this research gives more importance to the role of innovation hubs in the digital marketing of eco-friendly products. The emphasis of the research lies with human-centred innovation environments as co-working spaces supported by technology that drives sustainability. Thus, the research evaluating participants' activities related to eco-friendly product digital marketing estimate how familiar they are with these hubs, primarily addressing digital marketing and environment-friendly technologies.

Figure 3 represents the model proposed by the authors to enhance digital marketing of eco-friendly products by collaborating human-centric innovation hubs.

Figure 3. Model to enhance digital marketing of eco-friendly products collaborated with innovation hubs



Source: Created by authors.

There are different practical implications for this research. As this research provides stakeholders with useful insights and strategies, it helps to improve the digital marketing of sustainable products. Since the significance of innovation hubs is identified, the marketers understand the role and help to promote eco-friendly innovative hubs. The obtained findings are also useful for small businesses and start-ups to utilise their resources effectively and develop innovative solutions in marketing strategies. In addition, it also helps to improve the customer preferences and increase the brand visibility of eco-friendly products. This study also includes strategies that can be applied in the eco-friendly products business to remain competitive and stay unique from other similar products. The authors found it very challenging to keep the study up-to-date due to fast technological changes.

The generalisability of the findings is also affected as the behaviour of customers changes or varies from different cultures, regions, and countries. This may bring bias in the results. Even though there are various constraints, this research delivers a precise comprehension of the interplay between technological innovation hubs and the digital marketing of eco-friendly goods and commodities. Based on these findings, authors developed a model to enhance digital marketing of eco-friendly products through innovation hubs, which is another novelty of this research.

The recommendations, like segmenting customers by identifying buying patterns, interesting trends, and demographic and behavioural attributes using innovative technologies, developing AI algorithms that make necessary adjustments in product prices based on demand and price given by competitors, creating interesting content, showcasing the values that align with eco-conscious customers, simplifying the purchasing procedure, and giving subscription services based on preferences of customers help to enhance online marketing of eco-friendly products integrated with innovation hubs through data-driven and motivational factors. In addition, recommendations such as launching a large number of awareness campaigns using videos, webinars, and blogs, creating certified online community forums by collaborating with eco-conscious influencers, communicating clearly about environmental standards that the company follows, and featuring testimonials from satisfied customers help to improve the digital marketing of eco-friendly products through policy and engagement factors as well as persuasion factors.

The significance of this developed model is that it creates a win-win scenario for stakeholders associated with eco-friendly brands and consumers. This approach helps to increase competitiveness, differ from other brands, improve brand credibility, and enhance market opportunities. The formulated model helps increase the profitability of the brand and implement sustainable practices to reduce the adverse effect caused to the environment.

6. Conclusion

Human-centric innovation hubs are defined as centres in which both innovation and technology are guided by the needs of individuals, their behaviours, and priorities. The innovation hubs generate human-oriented innovations using modernised digital technologies. Through these hubs, the marketing of eco-friendly products is done, which increases the sales and profitability. The authors identified various factors affecting the integration process. The driving factors recognised are data-driven factors, motivational factors, policy and engagement factors, and persuasion factors. Data-driven factors are more important as they have the highest variance (25.715%). This is followed by motivational factors (16.675%), policy and engagement factors

(10.678%), and persuasion factors (8.758%). It is advisable that the stakeholders of eco-friendly brands focus more on data-driven factors, which include data analytics and artificial intelligence. Using natural products should be the focus to reduce environmental destruction and natural resource exhaustion.

The authors showcase the significance of innovation hubs in adopting eco-friendly practices in the daily life of consumers. The future researchers should widen the research by considering other countries to study the human-centric innovation hubs and marketing of eco-friendly products. The survey should be conducted all over the country to avoid the chances of bias in responses. Apart from factor analysis, other statistical techniques like multiple linear regression should also be employed to broaden the investigation. The stakeholders of eco-friendly brands should create more information-providing blogs, campaigns, and live sessions to enlighten people about the level of sustainability in products. They should also provide loyalty cards, discount coupons, attractive offers, and newsletters to their target customers. Moreover, they should also hire an excellent technical team to resolve the issues immediately, which helps in improving customer engagement and customer trust. The stakeholders must implement the model developed through the research conducted by the authors.

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