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Review Paper

Sustainable Landscape of Cultured Meat in Developing Countries: Opportunities, Challenges, and Sustainable Prospects

Wenxuan Guo[1] and Dawan Wiwattanadate[2]*

[1] Chulalongkorn University, Interdisciplinary Program Graduate School Environment Development and Sustainability, Bangkok, 10330, Thailand
[2] Chulalongkorn University, Faculty of Engineering, Bangkok, 10330, Thailand

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ABSTRACT

This study aimed to comprehensively examine the research on cultured meat in developing countries over the past decade, focusing on its opportunities and challenges for sustainable meat systems. The research method included a combination of literature review and text mining. The study found that research on cultured meat in developing countries has focused on consumer attitudes and acceptance, cultural factors, and policy and regulation. Consumer purchase intentions, attitudes, and knowledge levels significantly impact the promotion and adoption of cultured meat. At the same time, cultural factors, religious regulations, and sustainability challenges are also important factors affecting the development of cultured meat in developing countries. Furthermore, developing and implementing policy and regulatory frameworks are critical to fostering the development of sustainable meat systems. Through the combination of literature review and text analysis, this study provides an in-depth look at research on cultured meat in developing countries over the past decade. The findings suggest that consumer attitudes, cultural factors, and sustainability challenges are central topics in cultured meat research in developing countries. However, relatively little research has been done on social acceptance, economic feasibility, and technology adoption. These findings provide important insights for policymakers, researchers, and relevant stakeholders in formulating policies and strategies to advance sustainable food systems.

1. Introduction

Cultured or cellular meat has attracted extensive attention and research as an innovative food production technology (*Ye et al.,* 2022). Cultured meat is an emerging food technology that produces meat products in the laboratory through cell culture. It involves harvesting and multiplying muscle tissue from animal cells (*Treich*, 2021). This approach helps reduce reliance on traditional farming and slaughter, reduces environmental impact, and provides sustainable meat options to meet growing food demand. Cultured meat can also reduce animal harm and eliminate animal welfare issues associated with farming (*Gerhardt et al*., 2020).

With a growing global population and increasing demand for animal protein, conventional farming faces challenges, including resource consumption, environmental impact, and animal welfare issues. In this context, cultured meat as a sustainable way of food production is considered to have great potential to provide new solutions for global food safety and sustainable development challenges (*Guan et al.,* 2021).

Research on cultured meat has made remarkable progress over the past decade. Extensive research has been conducted on cell meat tech-

***Corresponding author:** Wenxuan Guo. guowenxuan199602@gmail.com*

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nology (*Kashim et al.,* 2022), consumer acceptance (*Mancini & Antonioli,* 2020), market potential (*Hopkins*, 2015), and environmental impact relative to meat products (*Hadi & Brightwell,* 2021). These studies provide valuable insights into the potential and challenges of growing meat.

Previous studies have found that consumer acceptance of cultured meat is one of the critical factors driving its marketing (*Guerrero et al.,* 2013). Studies have shown that consumers' acceptance of cultured meat varies across countries and regions, influenced by culture, religion, traditional eating habits, and food safety. For example, cultural and religious beliefs, particularly concerning vegetarianism and reverence for animals, influenced consumers' acceptance of cultured meat (*Chriki & Hocquette*, 2020). Similarly, research conducted in Muslim-majority countries, such as Malaysia, has highlighted the importance of halal certification and religious considerations in determining consumer acceptance of cultured meat products (*Hamdan et al.,* 2021).

Furthermore, traditional eating habits and culinary preferences significantly shape consumers' attitudes toward cultured meat. A study conducted in Brazil, a country known for its rich meat-eating tradition, found that consumers' familiarity with and preference for traditional meat-based dishes influenced their acceptance of cultured meat (*Heidemann et al.*, 2020). Similarly, research conducted in South Africa revealed that cultural norms and preferences for specific types of meat, such as game meat, influenced consumers' willingness to adopt cultured meat (*Domingo & Nadal,* 2017; *Tsvakirar et al.,* 2023).

Food safety is another important factor influencing consumer acceptance of cultured meat. Research conducted in various countries has shown that concerns about the safety and quality of cultured meat products impact consumers' willingness to consume them (*Kamalapuram et al.,* 2021). For instance, a study conducted in China found that consumers expressed concerns about the potential presence of harmful substances and the overall safety of cultured meat (*Zhang et al.,* 2020). Addressing these food safety concerns through transparent communication and regulatory measures is crucial for gaining consumer trust and acceptance.

However, despite the enormous interest in cultured meat in the scientific and industrial communities, research on cultured meat in some developing countries has been relatively sparse. In the research literature of the past decade, limited research on cultured meat comes from these countries. This limits our ability to recognize and assess engagement and research priorities in cultured meat research in developing countries.

Therefore, this study aims to fill this research gap by exploring the level of engagement and focus of research on cultured meat in developing countries. This study will review and comprehensively analyze the scientific research literature on cultured meat in the past ten years to obtain relevant information, i.e., the research status and trends in the area of cultured meat in developing countries.

Through the conduct of this study, the summarized research on projected cultured meat and consumer preferences provides a comprehensive perspective on a global scale, providing relevant stakeholders, policymakers, and anxious manufacturers with information about the sustainability, consumer acceptance, and market of projected growth for cultured meat. There is a need for this important information on the potential of cultured meat to drive its further development and the technologies required to achieve the goal of a sustainable food system.

2. Materials and Methods

This study aimed to gather relevant scientific literature on cultured meat-related research. A comprehensive search was conducted using the Web of Science and Scopus databases to achieve the objectives. These databases were chosen for their extensive coverage of scientific, technical, medical, and social sciences literature.

The selection of keywords for this study was based on previous research conducted in the field (Table 1). An extensive literature review was conducted to identify relevant topics and themes related to meat consumption, safety, processing, sustainability, and alternative meat production. The keywords used for the search included "meat safety", "meat consumption", "meat processing", "sustainable meat production", "cell-based meat", "plant-based meat", "meat alternatives", "meat nutrition", "meat history", and "environmental impact of meat production". (*Gómez-Luciano, Vriesekoop & Urbano,* 2019; *Mancini & Antonioli,* 2020; *Kashim et al.,* 2022). These keywords were selected to encompass a wide range of relevant topics.

The inclusion criteria for article selection were as follows: articles published within the past ten years (from 2013 to now), articles written in English, and peer-reviewed research articles, reviews, and meta-analyses. Articles that did not meet these criteria were excluded from the study.

Table 1. Literature collection strategy

	Document Collection Strategy
1	Choose Scopus and Web of Science databases.
2	Search for keywords, such as “meat alternatives”, “plant-based protein” and related terms (see in the text above), to further narrow the search.
3	Read the title, abstract and keywords of each article to screen articles related to meat substitutes.
4	For the selected articles, check the impact factor and journal information for the publishing journals to determine whether the articles meet the inclusion criteria.
5	Record information such as title, author, journal name, and DOI of eligible articles, and create a literature collection list.
6	Further expand or narrow the search and add or adjust keywords as needed to get more comprehensive or specific meat substitute related articles.
7	Organize the collected articles into text.

The initial search results were evaluated based on their titles and abstracts during the screening process. Full-text articles were obtained for potentially relevant studies that met the inclusion criteria. Two independent reviewers conducted the study selection process, and any disagreements were resolved through discussion and consensus.

Data extraction involved analyzing the selected articles to gather relevant information on meat-related topics such as safety, consumption patterns, processing techniques, sustainable production methods, nutritional aspects, historical perspectives, and environmental impacts.

In summary, this study utilized a systematic approach to search and select relevant articles from central databases, ensuring a comprehensive literature review on meat-related research. The inclusion and exclusion criteria were applied to ensure

Table 2. Thematic analysis steps

	Description
1	Collect literature text.
2	Data preprocessing: Clean and preprocess text data, including removing stop words, punctuation marks, and numbers, performing stemming or lemmatization, etc.
3	Build a bag-of-words model or term frequency-inverse document frequency (TF-IDF) matrix: Transform text data into a bag-of-words model or TF-IDF matrix to represent the frequency or importance of each word in a document.
4	Run the topic modeling algorithm: Use the topic modeling algorithm, Latent Dirichlet Allocation.
5	Determine the number of topics: Determine the appropriate number of topics by model evaluation metrics (such as perplexity or consistency), domain knowledge, or actual needs.
6	Interpreting and identifying topics: Based on the topic modeling results, extract the keywords for each topic, and manually analyze and explain the meaning and relevance of the topics. Identify the topics.
7	Topic Validation and Tuning: Validate and tune topic models for accuracy and consistency based on domain expert feedback or further analysis.
8	Result Presentation: Present the results of topic analysis in the form of charts, tables or descriptions, showing the keywords, weights, and related documents of each topic, as well as the relationship and trend between topics.
9	Discussion and Interpretation: An in-depth discussion and interpretation of thematic analysis results, exploring the insights, trends, and connections found, as well as their significance and application to the field of study.

the selection of high-quality studies aligned with the research objectives. The gathered data was then further analyzed and synthesized to provide valuable insights into the selected topics.

To comprehensively understand the research topic, the researchers employed three complementary analytical techniques: thematic analysis, word cloud analysis, and topic network graph analysis. The choice between these techniques is based on their ability to provide multidimensional subject understanding and capture different aspects of the data complementary to each other.

The thematic analysis identified and categorized critical themes in the scientific research literature related to cultured meat. The study included a systematic review of the finally selected articles, a diverse body of published research conducted between 2013 and now. Articles were carefully reviewed using text mining software to form common themes, and sub-themes were identified and recorded in a topic coding matrix. These themes were extracted from the articles' contents and represent the main areas of concern and discussion within the research field.

Word cloud analysis visualizes the frequency and importance of specific keywords using software tools to highlight the most frequently occurring keywords in the selected articles (*Philip*, 2020). Word clouds determine the size and prominence of each word in the cloud based on its frequency of occur-

Table 3. Word cloud analysis steps

	Description
1	Collect literature text.
2	Data preprocessing.
3	Construct word frequency matrix: Calculate the occurrence frequency of each word.
4	Calculate word frequency/TF-IDF: Perform word frequency statistics or calculate TF-IDF value for each word, which is used for the size and weight of word cloud.
5	Build a word cloud: According to the word frequency or TF-IDF value, generate a word cloud image, wherein words that occur with higher frequency are displayed larger in the image.

Table 4. Thematic Network Analysis Steps

	Description
1	Collect literature.
2	Data preprocessing.
3	Build a bag-of-words model: Convert text data into a bag-of-words model, which represents the frequency of occurrence of each word in the document.
4	Run the Latent Dirichlet Allocation algorithm (LDA): Use the LDA algorithm to perform topic modeling on the bag-of-words model, and infer the hidden topic distribution in each document.
5	Extract topic keywords: According to the LDA model, extract the keywords of each topic.
6	Construct a topic network: According to the co-occurrence relationship of topic keywords, construct a topic network, where each topic represents a node, and the co-occurrence relationship represents an edge.
7	Analyzing the topic network: Analyze the topic network, such as calculating the degree of nodes, betweenness centrality and other indicators, and exploring the relationship between topics.
8	Visual topic network: Use visualization tools to visualize the topic network to help understand the structure and relationship between topics.
9	Interpret and evaluate results: Interpret the structure and relationships of topic networks and evaluate the validity and feasibility of topic network analysis.

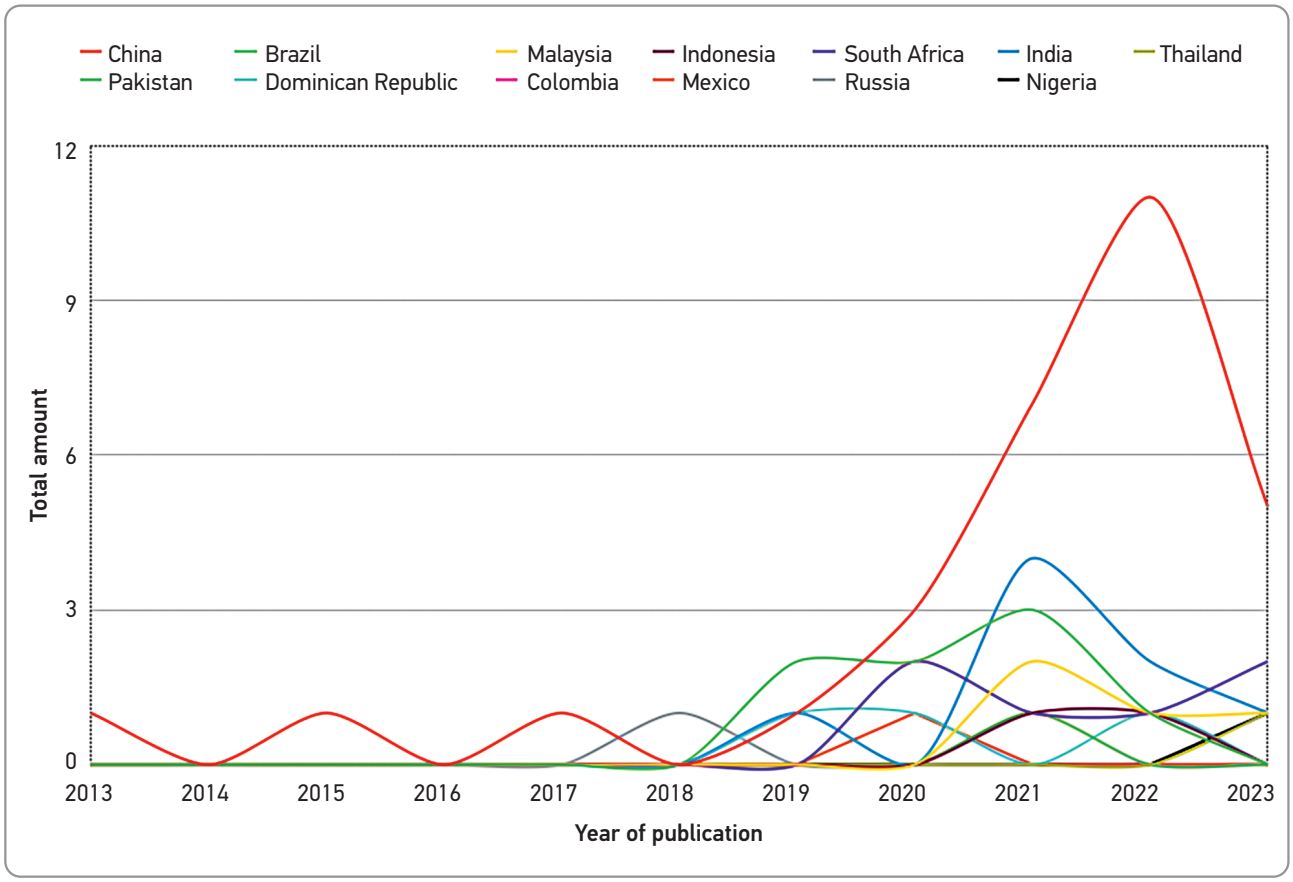

Figure 1. Number of scientific literature publications on cultured meat from different developing countries between 2013 and 2023

rence in the text. This analysis helped to identify central concepts, themes, and terms related to cultured meat, providing an overview of the research field. Table 3 shows the word cloud analysis steps.

The thematic network graph analysis explored the relationships and connections between research topics in selected articles (*Attride-Stirling,* 2001). This technique builds a thematic network map by using network analysis software. Each node in the graph represents a specific research topic, and edges represent relationships between issues based on co-occurrence patterns. Such analysis helps to reveal the interdependencies and linkages between different research areas within a research field, providing further insight into the complex relationships and dynamics within a domain. Table 4 shows the topic network analysis steps.

The integrated use of topic analysis, word cloud analysis, and topic network graph analysis allowed us to analyze and interpret the research literature on cultured meat comprehensively. By applying these three techniques, we were able to identify major themes, key concepts, and their interrelationships, providing a holistic view of the field of study. This integrated approach enhances the understanding of the research domain, generates valuable insights, and informs subsequent discussions and conclusions.

3. Results and Discussion

As shown in Table 5, the literature covers consumer perceptions of sustainable food technologies, neophobia of cultured meat, acceptance of cultured meat among consumers in different countries, the environmental impact of meat products, Muslim perceptions of cultured meat and its halal status, perspectives for cultured meat, etc.

Regarding developing country distribution, China was the most frequent country from which research originated in this literature review, and Chinese researchers covered multiple research topics. Other developing countries that have conducted studies include Brazil, South Africa, Indonesia, Malaysia, Pakistan, Thailand, and others (Figure 1).

Regarding the time distribution, the publication years of these studies were mainly concentrated between 2021 and 2023 (Figure 1). Among them, 2022 was the year with the highest number of publi-

Table 5. Scientific literature analyzed in the present study

Article Topics	Country	Reference
Perception and acceptance	Nigeria	*Owokoniran et al*. (2024)
Consumer acceptance of sustainable food technologies	India	*Giacalone & Jaeger* (2023)
Cell culture media optimization and cost reduction	China	*Gomez Romero & Boyle* (2023)
Challenges of bringing cultured meat to the market	China	*Xiang & Zhang* (2023)
Neophobia scale	South Africa	*Tsvakirai et al*. (2023)
Consumer segmentation and motives	China	*Wang & Scrimgeour* (2023)
Role of environmental messages on food technology acceptance	China	*Zheng et al*. (2023)
Consumer perceptions	Africa	*Ngah et al*. (2023)
Consumer attitudes and intentions	China	*Li et al*. (2023)
Appraisal from Muslim scholars' perspectives	Malaysia	*Burhanuddin et al*. (2023)
Consumer acceptance	Thailand	*Siripat & Srivardhana* (2023)
Consumer acceptance and production of in vitro meat	India China	*Kantono et al*. (2022)
Perspectives of meat eaters on cultured beef	South Africa	*Falowo et al*. (2022)
Commercialization of cultured meat products	Asia-Pacific region	*Ye et al*. (2022)
Consumer willingness to pay	China, Brazil and Dominican Republic	*Rombach et al*. (2022)
Porcine muscle stem cells for cultured meat production	China	*Li et al*. (2022)
Proliferation of porcine muscle stem cells for cultured meat production	China	*Fang et al*. (2022)
Regulating the commercialization of cell-cultured meat	China	*Li, Fu & Li* (2022)
Cost of large-scale production of cell-cultured meat	China India	*Garrison, Biermacher & Brorsen* (2022)
Indonesian Muslim communities' prospects	Indonesia	*Qotadah et al*. (2022)
Quality evaluation of cultured meat with plant protein scaffold	China	*Zheng et al*. (2022)
Identity labels	China	*Ortega et al*. (2022)
Halal status	Malaysia	*Kashim et al*. (2022)
Trends and public acceptance	India	*Kamalapuram et al*. (2021)
Trends and ideas in technology, regulation and public acceptance of cultured meat	China	*Guan et al*. (2021)
Food attributes	Brazil	*de Oliveir et al*. (2021)
Consumer adoption	South Africa	*Szejda et al*. (2021)
Consumers' valuation of cultured meat	China	*Rao et al*. (2021)
Cultural concepts of meat and future predictions	China, India and Colombia	*Hansen et al*. (2021)

Article Topics	Country	Reference
Attitudes and perceptions	Pakistan	*Ahsan, Khan & Ahmad* (2021)
Attitudes and perceptions	Brazil	*Munz Fernandes et al*. (2021)
Effect of smooth muscle cells on cultured meat quality	China	*Zheng et al*. (2021)
Muslim consumers' attitudes	Malaysia	*Hamdan et al*. (2021a)
Muslim consumers and the replacement of livestock slaughter with cultured meat	Malaysia	*Hamdan et al*. (2021b)
Preferences and willingness to pay for meat alternatives	India	*Arora, Brent & Jaenicke* (2020)
Technology landscaping in the Indian meat sector	India	*Sen et al*. (2021)
Undergraduate students' perceptions	Indonesia	*Virginia et al*. (2021)
Consumers' attitudes	Brazil	*Chriki et al*. (2021)
Chinese consumers and their appetite	China	*Dempsey & Bryant* (2020)
Consumer acceptance of cultured meat	Brazil Dominican Republic	*Bryant & Barnett* (2020)
Naturalness, disgust, trust, and food neophobia	China, Mexico, South Africa	*Siegrist & Hartmann* (2020)
Consumer acceptance	China	*Zhang et al*. (2020)
Animal production	Brazil	*Heidenmann et al*. (2020)
Consumer perceptions	India, China	*Bryant et al*. (2020)
Food security of alternative dietary proteins	Dominican Republic	*Gómez-Luciano, Vriesekoop & Urban* (2019)
Consumer willingness to pay	Brazil	*Gómez-Luciano et al*. (2019)
Highly educated consumers' attitudes	Brazil	*Valente et al*. (2019)
Clean cultured meat for today's future	Russia	*Hoogenkamp* (2018)
The cross-cultural perspective	China	*Bekker et al*. (2017)
The environmental prospects	China	*Sun et al*. (2015)

cations, indicating that research in this field is continuing to develop.

The literature provides findings on consumer acceptance of new sustainable food technologies and cultured meat, research perspectives from different countries, and the influences of religion and culture on food choices (Table 5).

3.1 Thematic Analysis Results

According to the themes, research on consumer purchase intentions, attitudes, beliefs, and cognition occupied a large proportion of the collected literature (Table 5). This suggests that consumer acceptance and attitudes toward cultured meat are essential concerns in the study. Studies in multiple countries and regions, including India, South Africa, China, and Africa, have investigated and analyzed consumers' acceptance of cultured meat. These studies explored consumers' knowledge level, willingness to purchase, attitudes, and perceptions toward plant-based meat products.

Second, research on culture and religion has been deserving of attention. Consumer purchase intentions, attitudes, beliefs, and perceptions proved to be essential concerns in cultured meat research. Research shows differences in consumer acceptance of new sustainable food technologies. These differences could be related to consumers' desire for naturalness, disgust, trust in food, awareness, and understanding of alternative meat products. Individual

Table 4. Thematic analysis results from the analyzed scientific literature

Theme	Sub-themes
Consumer Acceptance	Consumer acceptance of sustainable food technologies Consumer attitudes and intentions Perception and acceptability Consumer perceptions Highly educated consumers' attitudes Consumer willingness to purchase
Market Promotion and Commercialization	Commercialization of cultured meat products Regulating the commercialization of cell-cultured meat
Environmental, Ethical, and Health Factors	Ethical, ecological, and health factors influencing the acceptance of cultured meat Environmental prospects of cultured meat Food security of alternative dietary proteins
Cultural and Religious Factors	Neophobia Scale Muslim communities' perspectives Perspectives of meat eaters
Technology and Production Factors	Cell culture cost Porcine muscle stem cells Quality evaluation Smooth muscle cells
Public Acceptance and Trends	Trends and public acceptance Trends and ideas in technology, regulation, and public acceptance Cultural concepts Future predictions

values, cultural background, and social factors also impacted consumer attitudes toward cultured meat products.

Second, cultural and religious factors played different roles in cultured meat research in different countries and regions. In some countries, especially those with strict religious regulations on food preparation, religious factors play a significant role in the acceptance of cultured meat. For example, Shariah and Sufi scholars' assessment of halal cultured meat was given attention in the Malaysian study. This suggests that the influence of religious factors on the acceptance of sophisticated meat products by local consumers is significant in this country. However, studies in other developing countries did not specifically emphasize religious factors, possibly because religion would have little influence on the local acceptance of cultured meat.

These findings provide important insights into research into cultured meat in developing countries. Understanding consumer purchase intentions and attitudes and the influence of culture and religion on the acceptance of cultured meat will help us better understand the promotion and adoption of cultured meat in these countries and regions. These findings have significant reference value for developing the cultured meat industry and formulating promotional strategies.

3.2 Word cloud analysis results

In the cultured meat studies, words that appeared more frequently included "Cultured", "Meat", "Consumer", "Research", "Product", and "Animal cell." These words highlight the core themes of the studies, namely consumer acceptance of cultured meat products, the development of research, and the characteristics of related products (Figure 2).

"China" occurred frequently, reflecting the importance of China in cultured meat research and development. China's investment and innovation in cultured meat have significantly impacted the development of the global cultured meat industry. Relat-

Figure 2. Word cloud analysis results concerning scientific literature originating from developing countries and focusing on cultured meat

ed words included "Technology", "Alternative", and "Plant-based", reflecting China's aggressive efforts to promote cultured meat technology, find alternatives, and develop plant-based meat products.

"South Africa" was another country that stood out in the research on cultured meat, demonstrating the importance of South Africa in this area and consumer acceptance. The South African studies covered consumer acceptance of cultured meat products, purchase intentions, and marketing strategies. Associated words were "Neophobia" (fear of new things), "Quality", and "Welfare" (animal welfare), highlighting South Africa's focus on the quality of cultivated meat products and animal welfare (Figure 2).

Other terms such as "India", "Brazil", "Halal", "Education", and "Safety" also reflected the importance of these countries and fields in cultured meat research (Figure 2). These countries play an important role in consumer acceptance of cultured meat, related regulations and standards, religious factors, and education and safety.

3.3 Word Network Analysis Results

Based on the text analysis and thematic lexical network map analysis of research on cultured meat in developing countries, we found strong links between these themes. The following professional explanations can illustrate this result (Figure 3).

The strong connection between consumers and meat reflects the importance of consumers in the meat product sector. Consumer attitudes significantly impact the acceptance and market performance of cultured meat. Consumer attitudes and preferences towards meat products influence their willingness and purchase decisions for cultured meat.

The declassified connection between China and meat can be attributed to China's important position in the meat industry and consumer market. As one of the world's largest meat consumers, China is vital in researching and developing cultured meat. The deciphering of this link may indicate that China's investment and innovation in cultured meat technology have achieved remarkable results.

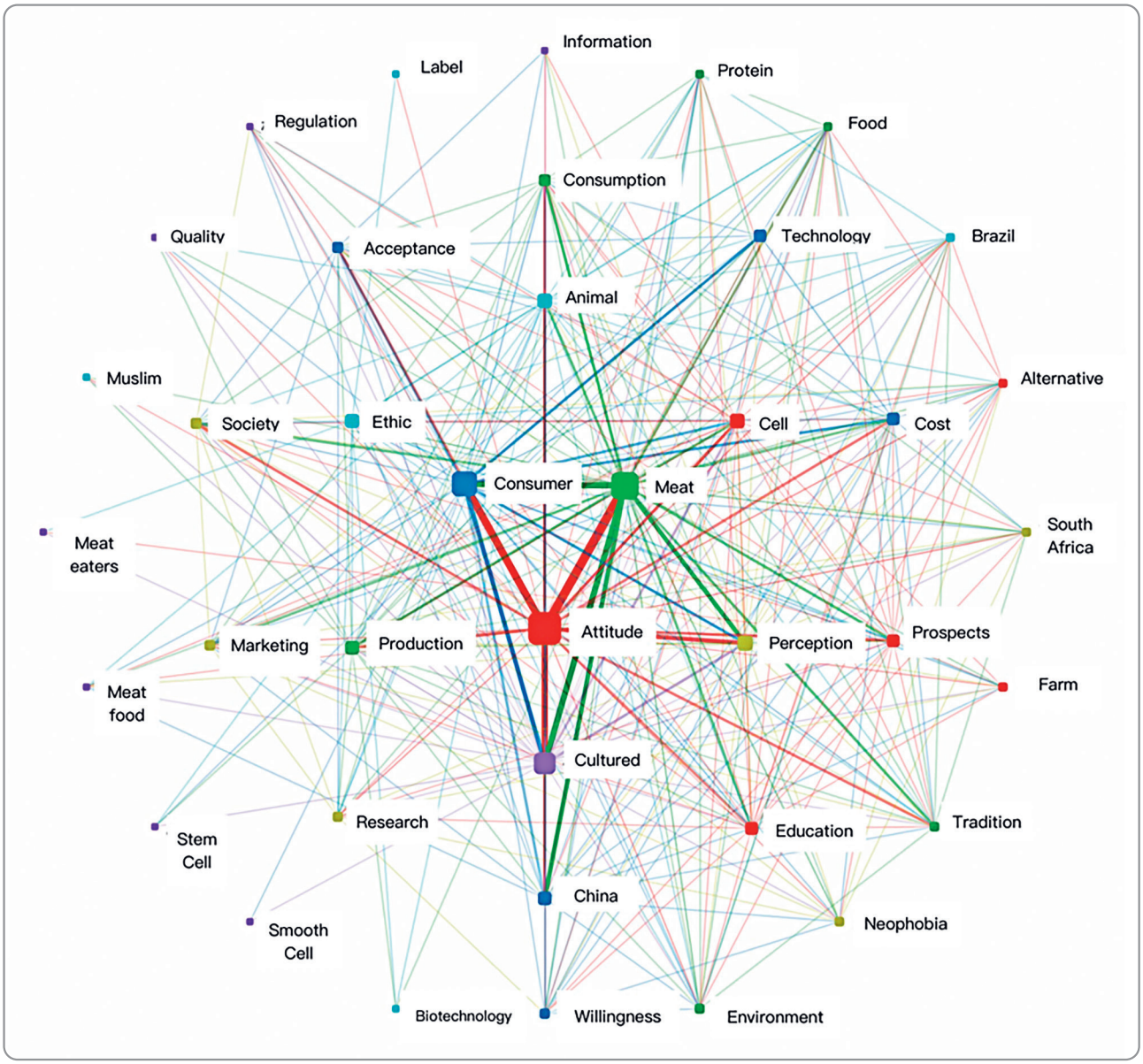

Figure 3. Word Network Analysis Results concerning the scientific literature originating from developing countries and focusing on cultured meat

The substantial tie between attitudes and perceptions, and perspectives suggests that consumers' attitudes toward cultured meat are closely related to their awareness and understanding of the technology (Figure 3). Consumer attitudes are influenced by their awareness and knowledge horizons about cultured meat, which could be affected by education, information access, and scientific research dissemination.

The strong link between attitude and society reflects the critical role of social factors in shaping consumer attitudes toward cultured meat (Figure 3). Social values, cultural traditions, and social identity can affect consumers' acceptance and attitude toward cultured meat.

The intense relationship between attitude and acceptance suggests that consumers' attitudes significantly impact their acceptance of cultured meat products (Figure 3). Positive consumer attitudes toward cultured meat tend to drive them to be more willing to try and purchase the product, while negative attitudes can hinder acceptance.

Finally, the vital link between attitude and tradition suggests that traditional culture influences consumers' attitudes and acceptance of new meat products (Figure 3). Traditional factors, such as cultural background, religious beliefs, and food habits, likely can shape consumer attitudes towards cultured meat, and so these factors need to be considered in strategies for promoting and adopting cultured meat.

It should be noted that different developing countries have differing research priorities. Taking China, Brazil, and South Africa as examples, their frequent support of or involvement in cultured meat research is closely related to the importance of these countries in meat production and consumption (*Bryant & Barnett*, 2020; *Heidemann* et al., 2020). These countries have large populations and significant meat markets, so research on meat production, consumption, and alternatives is of great economic and social importance.

2.4 Challenges and Opportunities for Cultured Meat in Developing Countries

The deployment of cultured meat technologies in developing countries presents several challenges and opportunities. First, one of the challenges is the cost and feasibility of cultured meat technology. The cultured meat production process requires a lot of capital, technical facilities, and expertise, which could be a considerable challenge for some developing countries (*Bhat, Kumar & Fayaz*, 2015). Finding innovative methods and technologies to reduce production costs and introducing locally adapted cultured meat production models will be vital in addressing this issue (*Chriki & Hocquette*, 2020).

Second, cultural and religious factors are also a significant challenge. Consumers' cultural and religious background influences the acceptance of cultured meat technology. Cultural and religious factors present a potential challenge to the acceptance of cultured meat technology in developing countries. Consumers' cultural and religious backgrounds deeply influence their attitudes and beliefs toward food choices, including their acceptance of new technologies. Research conducted in Malaysia highlighted the importance of cultural and religious beliefs, particularly among Muslim populations, in determining the acceptance of cultured meat (*Burhanuddin et al.*, 2023). Halal certification, aligning with Muslims' religious dietary requirements, played a crucial role in cultured meat gaining acceptance in Malaysia. Similarly, in Indonesia, a study emphasized the influence of religious perspectives on the perception of cultured meat. The research focused on the opinions of Muslim communities and revealed that the views of Islamic scholars on the permissibility of cultured meat affected consumer acceptance (*Hamdan et al.*, 2021b). Moreover, traditional food practices and cultural attachments to specific meat products also pose challenges. Research conducted in India demonstrated that consumers' deep-rooted connection to traditional meat-based dishes limited their willingness to adopt alternative options like cultured meat (*Kamalapuram et al*., 2021).

Additionally, food safety and regulatory oversight is a significant challenge. Developing countries could have weak links in food safety and legal supervision, and there are difficulties in supervising and controlling new food technologies.

In developing countries, cultured meat technology has multiple opportunities and strong links with the Sustainable Development Goals. First, cultured meat can create opportunities for gender equality. While traditional livestock farming is often dominated by men, cultured meat technology offers a gender-independent means of producing meat, promoting gender equality and opportunities for women to participate in the agricultural sector. The new food pathway contributes to achieving gender equality in the Sustainable Development Goals.

Second, cultured meat technology can help address the environmental and sustainability challenges faced by traditional livestock farming (*Kumar et al.,* 2021). Developing countries face problems such as limited land resources, water shortages, and climate change. Compared with livestock farming, cultured meat technology can provide a more environmentally friendly and sustainable method of meat production, reducing dependence on natural resources.

Third, cultured meat technology can contribute to food safety and the stability of the food supply (*Bryant & Barnett,* 2020). Developing countries often face challenges such as unstable food supply chains, food safety issues, and the spread of infectious diseases. Compared with livestock production, cultured meat technology can provide a more controllable and predictable production process, reduce the risk of food contamination and animal diseases, and improve food supply security, reliability, and safety.

In addition, cultured meat technology can also create decent jobs and economic growth (*Dupont-Inglis & Borg,* 2018). Developing the cultivated meat industry requires various professional and technical personnel, bringing new employment opportunities and investment to the local economy. The promotion of cultured meat technology can also promote the development of related industrial chains, including cell culture technology, food processing, and supply chain management, and is likely to bring opportunities for economic growth and technology transfer to developing countries.

The combination of tradition and modernity may be a promising direction when exploring sustainable meat-eating patterns in developing countries. Developing countries have rich traditional meat diet cultures as part of their unique cultural heritage. Preserving and passing on the value of traditional meat-based diets helps maintain cultural diversity and fosters community cohesion. At the same time, modern technology has played an important role in meat production and is now poised to provide more sustainable solutions in this area. Combining tradition and modernity, developing countries can explore the application of modern technology in the production and supply chain of traditional meat diets to improve efficiency and to reduce resource consumption and environmental impacts. Such a combination can meet the needs of local consumers for a traditional meat diet while keeping in mind the goal of sustainable development. In this process, attention to community participation, policy support, and scientific and technological innovation is vital to ensuring the successful implementation of sustainable meat diets and providing healthy, diverse, and sustainable meat choices for people in developing countries.

4. Conclusion

Through comprehensive analysis, including thematic analysis, word cloud visualization, and word network matrix, essential insights into cultured meat and its impact on developing countries were derived.

Thematic analysis reveals in the overall picture of cultured meat the importance of farming, consumer attitudes and acceptance, technological advancements, and environmental impacts. These themes highlight the multidimensional nature of the cultivated meat industry and its importance in addressing pressing challenges in the food sector. The word cloud further emphasizes the prominence of topics such as consumer behavior, research and development, and the production and consumption of meat substitutes.

The word network matrix visualizes the interconnections and frequencies between different keywords. It demonstrates the close relationship between words such as “farmed”, “meat”, “consumer,” “research” and “product”, indicating the interconnectedness and focus of our research. Furthermore, the word network highlights the importance of technology, market analysis, environmental concerns, and cultural factors in shaping the discussion about cultured meat.

The analysis also reveals the specific focus of research in different developing countries. Research in China, Brazil, and South Africa focuses on particular areas specific to each country, which reflects the research priorities and development directions of each country in the field of cultured meat.

Overall, this study provides important insights into and understanding of cultured meat and its development in developing countries. The findings of this study provide valuable information for relevant stakeholders, policymakers, and academia to advance the sustainable development and application of the cultured meat industry. This study provides a basis for further exploring the potential and development path of the cultivated meat industry and will help guide future research and policy formulation.

Održivo okruženje za veštačko/kultivisano meso u zemljama u razvoju: mogućnosti, izazovi i održivi izgledi

Wenxuan Guo i Dawan Wiwattanadate

INFORMACIJE O RADU

Ključne reči:
Veštačko/kultivisano meso
Zemlje u razvoju
Alternative mesu
Održivo meso

APSTRAKT

Ova studija je imala za cilj da sveobuhvatno ispita istraživanja koja su bila usmerena na dobijanje veštačkog/kultivisanog mesa u zemljama u razvoju tokom protekle decenije, fokusirajući se na njegove mogućnosti i izazove za održive sisteme proizvodnje mesa. Metod istraživanja uključivao je kombinaciju pregleda literature i analize tekstova. Studija je otkrila da se istraživanje kultivisanog mesa u zemljama u razvoju fokusiralo na stavove i prihvatanje potrošača, kulturne faktore, kao i politiku i regulativu. Kupovne namere, stavovi i nivo znanja potrošača značajno utiču na promociju i usvajanje kultivisanog mesa. Istovremeno, kulturni faktori, verski propisi i izazovi održivosti su takođe važni faktori koji utiču na razvoj kultivisanog mesa u zemljama u razvoju. Štaviše, razvoj i implementacija politike i regulatornih okvira su kritični za podsticanje razvoja održivih sistema mesa. Kombinacijom pregleda literature i analize tekstova, ova studija pruža dubinski pogled na istraživanje kultivisanog mesa u zemljama u razvoju tokom protekle decenije. Nalazi sugerišu da su stavovi potrošača, kulturni faktori i izazovi održivosti centralne teme u istraživanju kultivisanog mesa u zemljama u razvoju. Međutim, urađeno je relativno malo istraživanja o društvenoj prihvatljivosti, ekonomskoj izvodljivosti i usvajanju tehnologije. Ovi nalazi pružaju važan uvid kreatorima politike, istraživačima i relevantnim zainteresovanim stranama u formulisanju politika i strategija za unapređenje održivih sistema ishrane.

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