

Circular Economy Analysis as a Tool to Enhance Sustainability of Supply Chains in Kingdom Saudi Arabia and a Means to Achieve Saudi Vision 2030

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Abstract

This study aims to analyse the circular economy as a tool to enhance the sustainability of supply chains in Kingdom of Saudi Arabia in order to achieve the Saudi Vision 2030, applied on a sample of experts and stakeholders in the field of circular economy and food supply chains in a group of different Saudi factories. The descriptive approach was used in this study and relied on a questionnaire to collect data that serves the purpose of the study, as it included 60 food factory owners (30 fresh factory owners, 30 dry factory owners) representing factory owners from various sectors of the food supply chain. This objective of this study is to know the current state of knowledge about the circular economy and the challenges it faces. The study reveals the possibility of practicing the circular economy to enhance sustainability within supply chains.

Keywords

Sustainability, Circular Economy, Supply Chain, Food Industry, Saudi Vision 2030

1. Introduction

At present, companies operate in a complex environment characterized by a multiplicity and diversity of variables that make up them. This environmental complexity represents a challenge to those in charge of managing these organi-

zations and increases the difficulty of the decision-making process (Winans et al., 2017). The matter does not stop at this point of dealing with a complex environment with multiple and diverse variables. However, the matter becomes more complicated because these variables do not remain constant and change permanently and quickly, and may come sharply and suddenly (Shahin, 2014a). In view of this complex and changing environment; companies have realized the importance of supply chains in adapting to environmental changes, and are keen to build their own competitive advantages, especially in light of globalization and the resulting increase in intensity and often even ferocity in competition (Velenturf & Purnell, 2021). However, the increase in the number of parties making up the supply chain makes it longer and more complex, which in turn causes the chain to become slower in responding to surrounding changes. In particular, developed countries realized the importance of following the principles of the circular economy, which contribute to making use of natural resources, reducing their depletion, and converting waste into huge production projects, and confronting environmental, economic, and social challenges, that is, a more sustainable economy in which there is no waste (Shahin, 2014b; Al-shuwaikhat & Mohammed, 2017). However, the challenge is how to provide financial resources to finance it, so it has become important to search for new mechanisms that guarantee the provision of sources of funds and achieve economic, social, and environmental progress for societies, while preserving the rights of future generations in natural resources, as it is a tool for socially responsible investment and focuses on achieving sustainable development.

Circular economy is emerging as a promising innovative solution to successfully and effectively achieve sustainability across various economic domains, with a notable focus on supply chains (Hofstetter et al., 2021; Saadi, 2020). A supply chain includes a continuum of operations, which includes planning, coordinating, and controlling materials, parts, and finished goods all the way from supplier to customer. Companies that successfully manage the supply chain as a single cohesive entity and effectively use the appropriate tools and techniques in order to align with market demands will remain competitive and resilient in the current battle for survival (Stevens, 1989; Saadi & Rashid, 2017).

Therefore, this research deals with the analysis of the circular economy as a tool to enhance the sustainability of supply chains in the Kingdom of Saudi Arabia and a means to achieve the Saudi Vision 2030. To achieve this, the research will be divided into several parts, starting with defining the research problem, and the importance of the research, reviewing the theoretical literature that dealt with the subject of the study, arriving at the results, and proposing recommendations. This research will address the critical aspects of the circular economy within the context of the Kingdom of Saudi Arabia, exploring its potential as a transformative framework for sustainable development. The research objectives encompass a comprehensive investigation, beginning with an elucidation of the circular economy concept. Subsequently, we delve into an examination of the goals and principles underlying the circular economy, emphasizing its pivotal

role in advancing sustainable development goals. Moreover, we undertake a subtle circular economy analysis, positioning it as a strategic tool to fortify the sustainability of supply chains within the Kingdom of Saudi Arabia. Notably, our focus extends to the alignment of circular economy practices with the ambitious Saudi Vision 2030. The significance of this research lies in drawing attention to the circular economy as an instrumental mechanism for achieving sustainable development, particularly in the unique socio-economic landscape of Saudi Arabia. Additionally, we underscore the importance of implementing circular economy principles within supply chains, offering insights into the specific requirements and implications for realizing sustainability objectives in the pursuit of Saudi Vision 2030.

2. Methodology

In this study, we employed a descriptive approach to gain insights into the understanding of the circular economy concept among employees of food factories in the Kingdom of Saudi Arabia. To accomplish this, a carefully made questionnaire was designed and distributed among a diverse sample of employees, encompassing 30 from dry food factories and 30 from fresh food factories.

The sample size of 30 from both dry food factories and fresh food factories can be considered reasonable depending on various factors such as the population size, the level of variability within the population, the desired level of confidence, and the margin of error. Here's a rationale for this sample size:

1) **Representativeness:** The sample size of 30 from each type of factory allows for a reasonable representation of the population of interest, which includes dry food factories and fresh food factories in Saudi Arabia. While larger sample sizes are generally preferable for increased accuracy and reliability, a sample size of 30 can still provide valuable insights into the practices and perspectives within each type of factory (Jaafar, 2020).

2) **Resource Constraints:** Conducting research, particularly surveys or interviews, can be resource-intensive in terms of time, cost, and effort. A sample size of 30 from each category strikes a balance between obtaining sufficient data for analysis and managing resource constraints (Jorgensen & Remmen, 2018).

3) **Statistical Considerations:** With a sample size of 30 from each group, you can still perform basic statistical analyses to identify trends, patterns, and significant differences between dry food and fresh food factories. However, it's important to acknowledge that smaller sample sizes may limit the ability to detect smaller effects or differences with high precision (Suleiman & Lulia, 2022).

4) **Practicality:** Obtaining access to and cooperation from factories for data collection can sometimes be challenging. A sample size of 30 from each type of factory may be more feasible and practical within the constraints of the research timeline and available resources (Ziadeh, 2021).

5) **Qualitative Insights:** In addition to quantitative data, smaller sample sizes can also facilitate in-depth qualitative insights through interviews or case studies. Researchers can delve deeper into the experiences, challenges, and strate-

gies employed by individual factories within each category (Almulhim & Abubakar, 2021).

Overall, while a sample size of 30 from each type of factory may not provide the same level of precision as larger sample sizes, it can still yield valuable insights and contribute to the understanding of Circular Economy Analysis in enhancing sustainability within the Saudi Arabian food industry, particularly in alignment with the goals of Saudi Vision 2030.

The objective was to recognize not only the level of familiarity with the circular economy but also to reveal the challenges faced by these employees in sustaining supply chains within the unique socio-economic context of the Kingdom. This investigation holds particular relevance in the broader context of aligning industrial practices with the ambitious Saudi Vision 2030, where comprehending and addressing challenges in achieving a circular economy becomes paramount for sustainable development. When designing a questionnaire for your study on Circular Economy Analysis as a tool to enhance sustainability of supply chains in Saudi Arabia, and as a means to achieve Saudi Vision 2030, it's essential to adhere to several key principles:

Clarity and Simplicity: Ensure that questions are clear, concise, and easy to understand. Use simple language that is accessible to all participants, regardless of their level of education or expertise in the subject matter (Hassan, 2020).

Relevance: Each question should directly contribute to your research objectives and provide valuable insights into the topic at hand. Avoid including irrelevant or tangential questions that may confuse respondents or dilute the focus of the study (Al Aouniya, 2021).

Avoid Leading Questions: Questions should be neutral and unbiased, avoiding any language that could influence respondents' answers. This ensures that the data collected accurately reflects respondents' true opinions and experiences (Shahin, 2017).

Use of Closed and Open-Ended Questions: Mix closed-ended questions (e.g., multiple choice, Likert scale) with open-ended questions to gather both quantitative and qualitative data. Closed-ended questions provide structured responses for easy analysis, while open-ended questions allow respondents to provide more detailed insights and perspectives.

Logical Flow: Arrange questions in a logical sequence that follows a natural progression of ideas. Start with simple and general questions before moving on to more specific or complex ones. This helps to keep respondents engaged and makes it easier for them to follow the questionnaire (Mohamed, 2005).

Avoid Double-Barrelled Questions: Each question should focus on one specific issue or concept. Avoid combining multiple questions into one, as this can confuse respondents and lead to unclear or unreliable responses (Jabayli, 2022).

Pilot Testing: Before distributing the questionnaire to your target sample, conduct a pilot test with a small group of participants to identify any potential issues with clarity, wording, or formatting. Use feedback from the pilot test to refine and improve the questionnaire before launching it on a larger scale (Al-

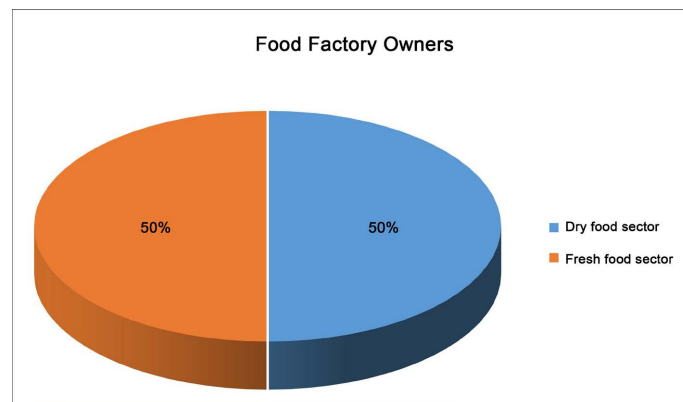
mulhim & Abubakar, 2021).

This research adopted a dual approach, relying initially on a descriptive method to authentically depict the problem, inspect its root causes, and identify the factors contributing to its emergence. Subsequently, an analytical approach was employed to delve deeper into the gathered information. The researcher carefully analysed the data at its source, drawing meaningful insights. Utilizing a case study framework, the questionnaire tool was strategically employed to engage with food factory owners.

Research Population:

The study is applied to food companies in Kingdom of Saudi Arabia. The data collection process resulted in obtaining 60 lists of results from food factory owners, to whom the study will be applied as follows:

Food factory owners	Number
Dry food sector	30
Fresh food sector	30
Total sample	60



- **Testing the Reliability of the Questionnaire List:**

The questionnaire list was tested before it was comprehensively distributed to a small sample of 21 items, to ensure its reliability in collecting the required data. The researcher relied on Cronbach's Alpha scale, the results of which are clear for each of the main axes of the survey list in **Table 1**.

It is clear from **Table 1** that all Cronbach's Alpha values exceed the acceptable level in the social sciences, which is Tabachnick 70% (Liu et al., 2013), which indicates that the survey list has a high degree of reliability in collecting the required data.

3. Results and Discussion

In the questionnaire, the researcher used a five-point Likert scale to measure the respondents' responses to the questionnaire items (**Table 2**). The scale scores are: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The Likert scale scores were distributed as follows:

Table 1. Cronbach's Alpha values for the main axes of the questionnaire list before comprehensive distribution.

Main topics of the survey list	Number of phrases	Cronbach's Alpha value %
Circular economy to enhance the sustainability of supply chains to environmental changes	16	86

Table 2. Likert scale scores.

Answers	Weight	Weighted average
Strongly disagree	1	1 to < 1.80
Disagree	2	1.80 to < 2.60
Neutral	3	2.60 to < 3.40
Agree	4	3.40 to < 4.20
Strongly agree	5	4.20 to 5

- Strongly disagree: 1 (Weighted average range: 1 to < 1.80)
- Disagree: 2 (Weighted average range: 1.80 to < 2.60)
- Neutral: 3 (Weighted average range: 2.60 to < 3.40)
- Agree: 4 (Weighted average range: 3.40 to < 4.20)
- Strongly agree: 5 (Weighted average range: 4.20 to 5)

Weighted arithmetic averages were calculated for each phrase of the study tool and compared with the range in the table above, and the answer corresponding to the range within which the average phrase falls is given.

1) Frequency distribution and percentages of descriptive data for the study sample

It is clear from the previous **Table 3** that the largest percentage of the study sample was male, as their percentage reached (82%) of the sample size, while the smallest percentage was female, as their percentage reached (18%). The following **Figure 1, Figure 2** show these ratios.

It is clear from the previous **Table 4** that the largest proportion of the study sample was for those holding a bachelor's degree, as their percentage reached (70%) of the sample size, followed by those holding a master's degree (25%), followed by those holding a doctorate degree (5%), which indicates a high level of education for the study sample, as shown in **Figure 3, Figure 4**.

We note from **Table 5** that the majority of the sample had years of experience of (10 years - and less than 15 years), at a rate of (19%) of the total respondents with a similar percentage for those who are (15 years and less than 20 years), followed by (23%) for less than 5 years, then followed by (20%) (from 25 years and above), then it was followed by (16%) of (less than 5 years), and finally (14%) of (20 years and less than 25 years), which indicates the diversity of practical experiences, as shown in **Figure 4**.

Table 3. Distribution of sample members according to gender variable.

S	Gender	Frequency	%
1	Male	50	82%
2	Female	10	18%
	Total	60	100%

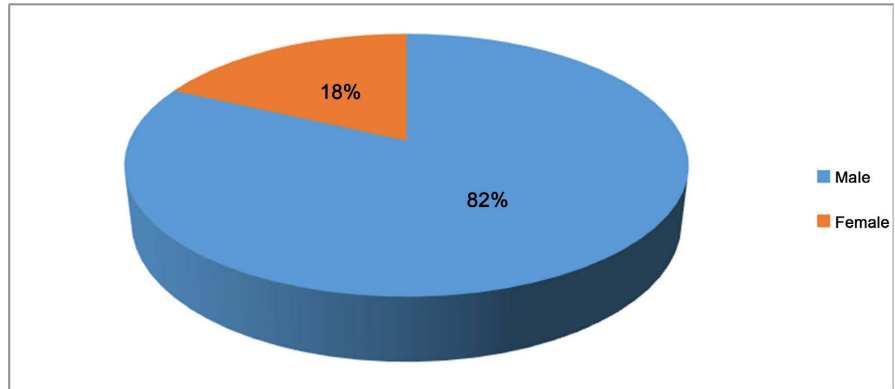


Figure 1. Distribution of sample members according to the gender variable.

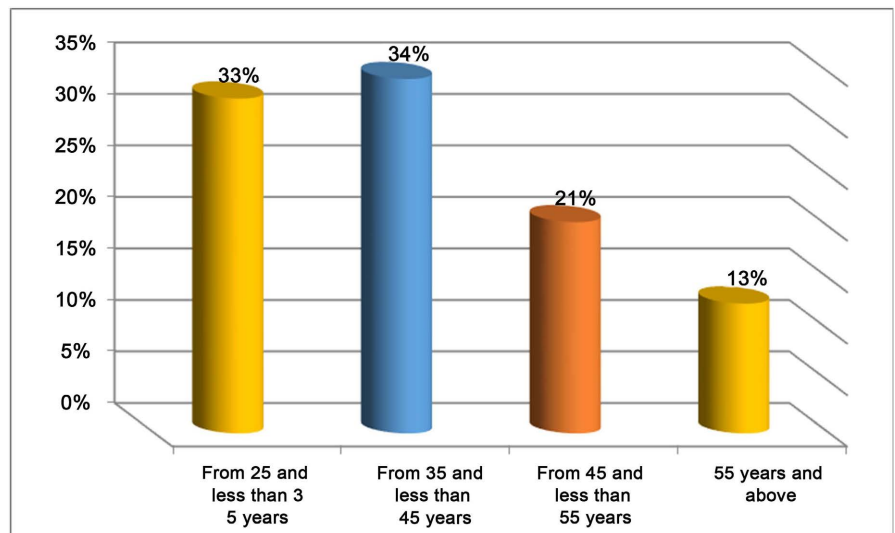


Figure 2. Distribution of sample members according to the age variable.

Table 4. Distribution of sample members according to the academic qualification variable.

S	Qualification	Frequency	%
1	B.Sc	42	70%
2	MA	15	25%
3	PhD	3	5%
	Total	60	100%

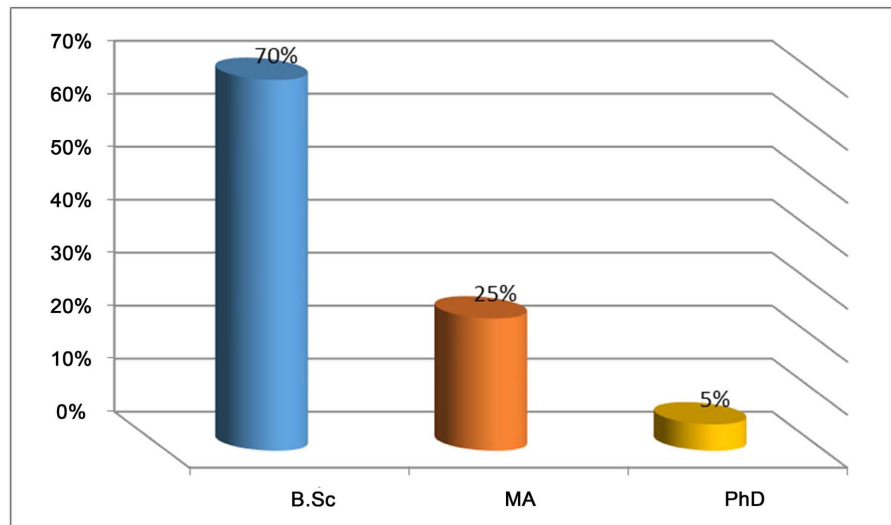


Figure 3. Distribution of sample members according to the educational level variable.

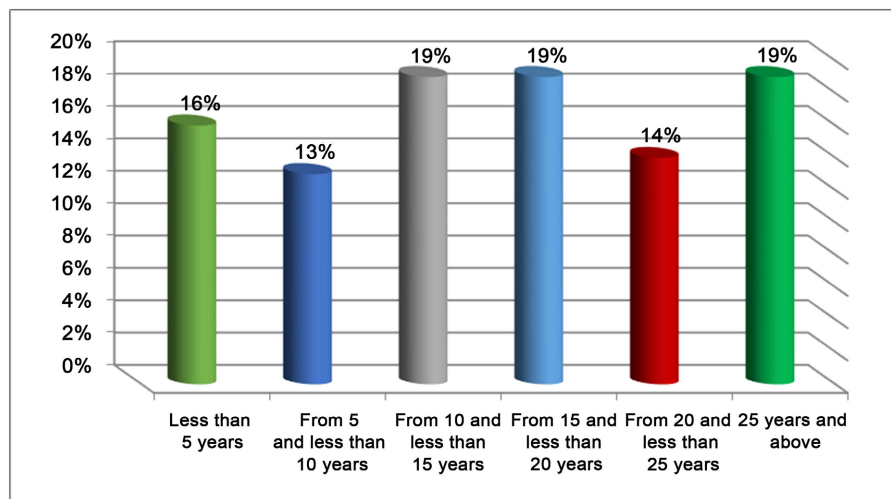


Figure 4. Distribution of sample members according to the years of experience variable.

Table 5. Distribution of sample members according to the years of experience variable.

S	Experience years	Frequency	%
1	Less than 5 years	10	16%
2	5 years - and less than 10 years	8	13%
3	10 years - and less than 15 years	11	19%
4	From 15 years and less than 20 years	11	19%
5	From 20 years and less than 25 years	8	14%
6	From 25 years and above	11	19%
	Total	60	100%

• Descriptive statistics and analysis of results

It is clear from **Table 6** that all the phrases of the focus of the study are statistically significant, and the relative importance ranged between 58.82% - 78.82%.

Table 6. Relative importance of the phrases of the focus of the study (fresh industries) in the research sample.

	Phrase		Fresh Factories					Average	Relative importance	Ranking	General trend
			Strongly Disagree	Disagree	Neutral	Agree	Strongly agree				
1	There are current sustainability practices in your company in the food industry	K	0	9	9	9	3	3.2355	64.71%	13	Neutral
		%	%0.0	30%	30%	30%	10%				
2	There are challenges facing your company regarding sustainability in the food industry	K	1	3	7	14	6	3.706	%74.12	4	Agree
		%	%2.0	%9.8	%23.5	%45.1	%19.6				
3	Your company applied circular economy principles to its food supply chains	K	1	2	8	9	11	3.941	%78.82	1	Agree
		%	%2.0	%5.9	%25.5	%29.4	%37.3				
4	There are obstacles to implementing circular economy principles in your company's food supply chains	K	1	7	9	11	2	3.255	%65.10	12	Neutral
		%	%2.0	%23.5	%29.4	%37.3	%7.8				
5	There are positive impacts or benefits from applying circular economy principles in food supply chains	K	2	6	8	9	5	3.3135	%66.27	10	Neutral
		%	%5.9	%19.6	%27.5	%31.4	%15.7				
6	There are potential positive impacts of applying circular economy principles on the environmental, social, economic and strategic aspects of food supply chains	K	2	2	6	16	4	3.5685	%71.37	5	Agree
		%	%7.8	%5.9	%19.6	%54.9	%11.8				
7	Conduct any assessments or studies to evaluate the environmental, social and economic performance of food supply chains after applying circular economy principles	K	1	4	14	9	3	3.294	%65.88	11	Neutral
		%	%3.9	%11.8	%45.1	%29.4	%9.8				
8	You believe that applying circular economy principles to the food industry in the Kingdom could be a globally applicable model	K	2	6	9	10	2	3.1375	%62.75	15	Neutral
		%	%7.8	%19.6	%31.4	%33.3	%7.8				
9	You believe that aspects of applying circular economy principles in the food industry in the Kingdom can be replicated globally	K	2	2	11	11	4	3.353	%67.06	8	Neutral
		%	%7.8	%7.8	%37.3	%35.3	%11.8				
10	There are challenges or obstacles to expect in applying circular economy principles on a global scale	K	2	5	9	11	3	3.2155	%64.31	14	Neutral
		%	%7.8	%17.6	%29.4	%35.3	%9.8				
11	Your company faces challenges in applying circular economy principles in food supply chains	K	4	8	7	8	3	2.941	%58.82	16	Neutral
		%	%13.7	%25.5	%23.5	%27.5	%9.8				
12	Your company is experiencing difficulties in collaborating with suppliers and partners in food supply chains to achieve a circular economy	K	1	3	5	14	7	3.745	%74.90	3	Agree
		%	%3.9	%9.8	%17.6	%45.1	%23.5				
13	There are increasing issues related to marketing and awareness around the concept of circular economy in the food industry	K	2	2	4	16	6	3.7645	%75.29	2	Agree
		%	%5.9	%7.8	%11.8	%52.9	%21.6				
14	You believe that the application of circular economy principles in the food industry in the Kingdom can be enhanced	K	2	5	5	13	5	3.51	%70.20	7	Agree
		%	%5.9	%15.7	%17.6	%43.1	%17.6				
15	Cooperation and coordination between companies, stakeholders and government can be strengthened to achieve a circular economy in the food industry	K	2	4	6	12	6	3.5685	%71.37	6	Agree
		%	%5.9	%11.8	%21.6	%41.2	%19.6				
16	You have expectations about the development of the circular economy concept in the food industry in the future	K	1	4	11	12	2	3.3335	%66.67	9	Neutral
		%	%3.9	%11.8	%37.3	%41.2	%5.9				

The overall average is 3.45; The overall trend of the questionnaire is I agree; Cronbach's alpha value for reliability is 0.844.

The following describes the arrangement of the aspect phrases according to relative importance.

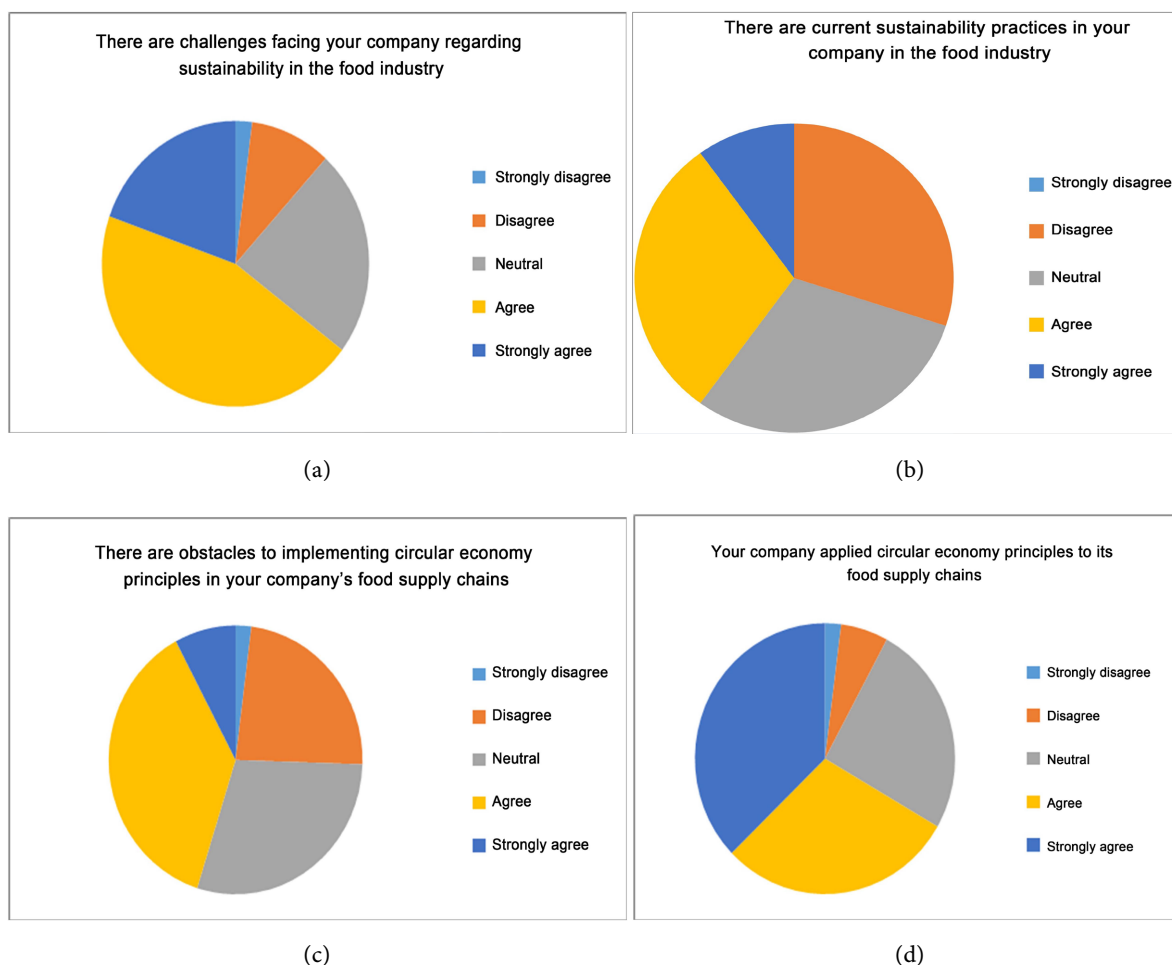
First rank: Phrase No. (3), which is (Your company applied the principles of the circular economy in food supply chains), comes in first place with a relative importance of 78.82%.

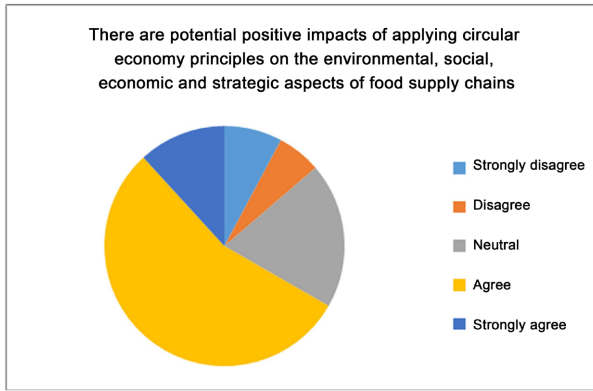
Second rank: Phrase No. (13), which is (Problems related to marketing and awareness of the concept of the circular economy in the food industry, are increasing) comes in second place with a relative importance of 75.29%.

Third rank: Phrase No. (12), which is (Your company faces difficulties in cooperating with suppliers and partners in food supply chains to achieve a circular economy) comes in third place with a relative importance of 74.90%.

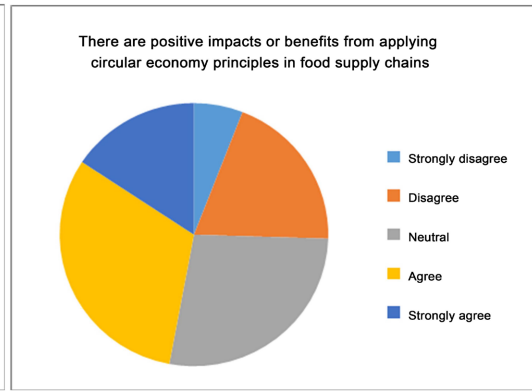
Penultimate rank: Phrase No. (8), which is (You believe that applying the principles of the circular economy in the food industry in the Kingdom can be a globally applicable model) comes in penultimate place with a relative importance of 62.75%.

Last rank: Phrase No. (11), which is (Your company faces challenges in applying circular economy principles in food supply chains), comes in last place with a relative importance of 58.82%.

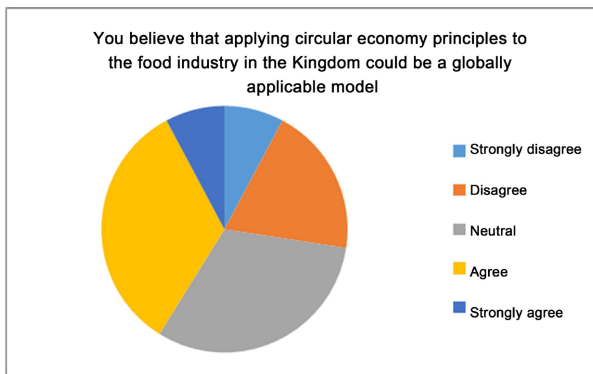




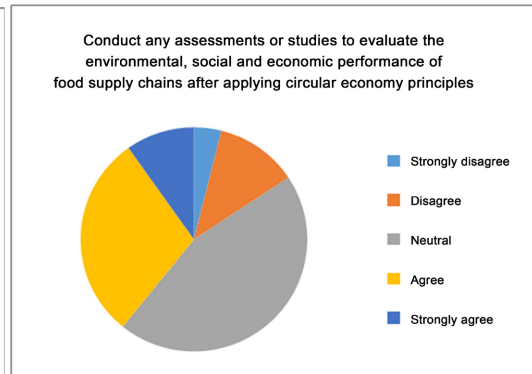
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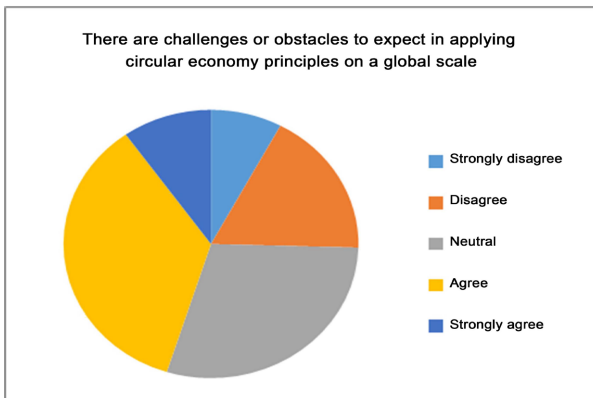
(f)



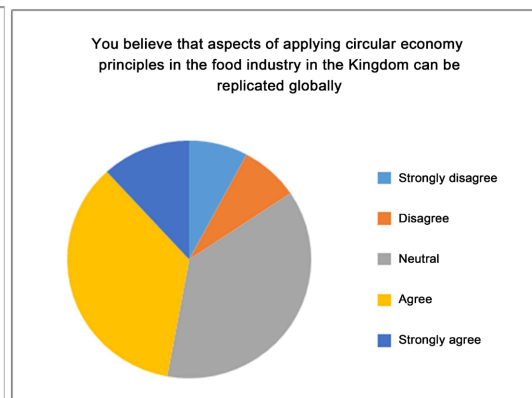
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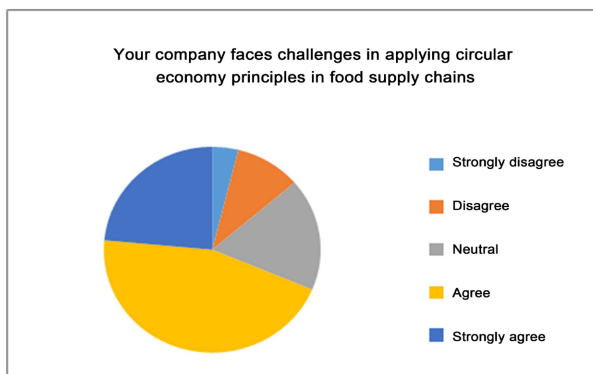
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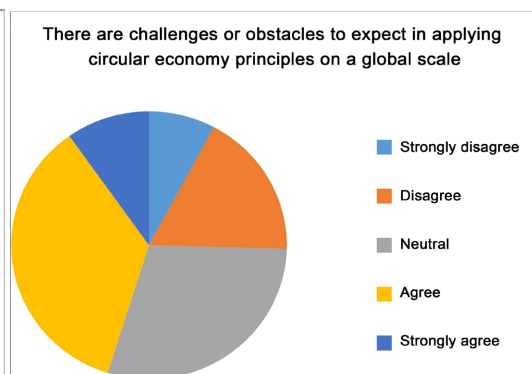
(i)



(j)



(k)



(l)

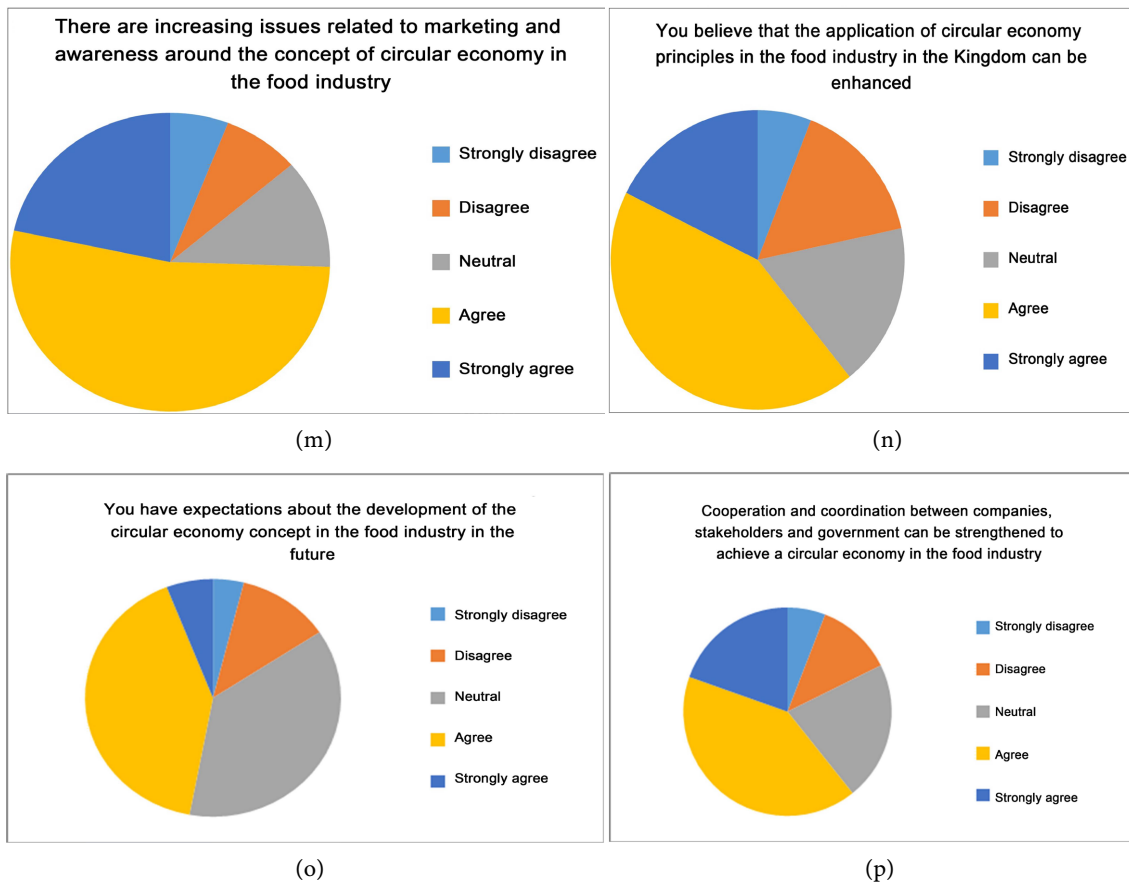


Table 7 The relative importance of the phrases of the focus of the study (dry industries) in the research sample

It is clear from **Table 7** that all the phrases of the focus of the study are statistically significant, and the relative importance ranged between 84% - 60%. The following describes the arrangement of the aspect phrases according to relative importance.

First rank: Phrase No. (4), which is (There are obstacles facing the application of circular economy principles in your company's food supply chains) comes in first place with a relative importance of 84%.

Second rank: Phrase No. (14), which is (you believe that the application of circular economy principles can be enhanced in the food industry in the Kingdom) comes in second place with a relative importance of 83%.

Third rank: Phrase No. (13), which is (Problems related to marketing and awareness of the concept of the circular economy in the food industry, are increasing) comes in third place, with a relative importance of 82%.

Penultimate rank: Phrase No. (11), which is (Your company faces challenges in applying circular economy principles in food supply chains), is ranked penultimate with a relative importance of 65%.

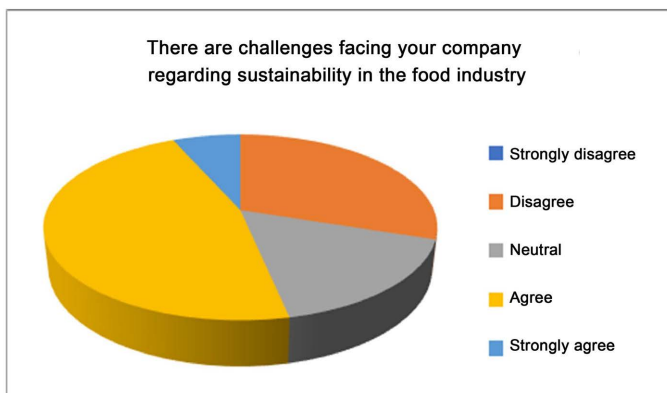
Last rank: Phrase No. (7), which is (conduct any assessments or studies to evaluate the environmental, social, and economic performance of food supply

Table 7. Relative importance of the phrases of the focus of the study from the point of view of dry factory owners.

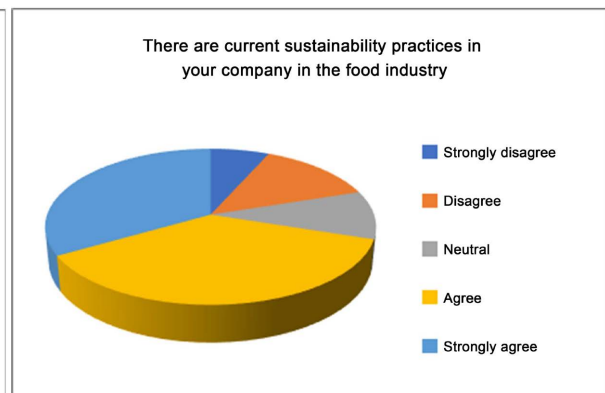
	Phrase		Dry Factories					Average	Relative importance	Ranking	General trend
			Strongly Disagree	Disagree	Neutral	Agree	Strongly agree				
1	There are current sustainability practices in your company in the food industry	K	2	4	3	11	10	3.88	%78	7	Agree
		%	%7	%13	%10	%37	%33				
2	There are challenges facing your company regarding sustainability in the food industry	K	0	9	5	14	2	3.45	%69	13	Agree
		%	%0.0	%30.0	%16.7	%46.7	%6.7				
3	Your company applied circular economy principles to its food supply chains	K	2	1	6	9	12	3.58	%72	12	Agree
		%	%7	%3	%20	%30	%40				
4	There are obstacles to implementing circular economy principles in your company's food supply chains	K	1	7	0	10	12	4.2	%84	1	Strongly agree
		%	%3	%23	%0	%33	%40				
5	There are positive impacts or benefits from applying circular economy principles in food supply chains	K	3	5	3	8	11	3.99	%80	5	Agree
		%	%10	%17	%10	%27	%37				
6	There are potential positive impacts of applying circular economy principles on the environmental, social, economic and strategic aspects of food supply chains	K	1	2	2	16	9	3.95	%79	6	Agree
		%	%7.80	%5.90	%19.60	%54.90	%11.80				
7	Conduct any assessments or studies to evaluate the environmental, social and economic performance of food supply chains after applying circular economy principles	K	1	4	14	9	3	2.98	%60	16	Neutral
		%	%3	%13	%47	%30	%10				
8	You believe that applying circular economy principles to the food industry in the Kingdom could be a globally applicable model	K	1	5	8	13	3	3.44	%69	14	Agree
		%	%3	%17	%27	%43	%10				
9	You believe that aspects of applying circular economy principles in the food industry in the Kingdom can be replicated globally	K	2	1	3	11	13	3.75	%75	10	Agree
		%	%7	%3	%10	%37	%43				
10	There are challenges or obstacles to expect in applying circular economy principles on a global scale	K	2	3	2	17	6	3.8	%76	9	Agree
		%	%7	%10	%7	%57	%20				
11	Your company faces challenges in applying circular economy principles in food supply chains	K	5	5	9	8	3	3.25	%65	15	Neutral
		%	%17	%17	%30	%27	%10				
12	Your company is experiencing difficulties in collaborating with suppliers and partners in food supply chains to achieve a circular economy	K	2	4	5	12	7	3.72	%74	11	Agree
		%	%7	%13	%17	%40	%23				
13	There are increasing issues related to marketing and awareness around the concept of circular economy in the food industry	K	2	2	6	12	8	4.1	%82	3	Agree
		%	%7	%7	%20	%40	%27				
14	You believe that the application of circular economy principles in the food industry in the Kingdom can be enhanced	K	1	2	4	10	13	4.15	%83	2	Agree
		%	%3	%7	%13	%33	%43				
15	Cooperation and coordination between companies, stakeholders and government can be strengthened to achieve a circular economy in the food industry	K	2	4	6	12	6	3.91	%78	8	Agree
		%	%7	%13	%20	%40	%20				
16	You have expectations about the development of the circular economy concept in the food industry in the future	K	2	3	5	16	4	4.05	%81	4	Agree
		%	%7	%10	%17	%53	%13				

Overall average: 3.98; The overall trend of the questionnaire is I agree; Cronbach's alpha reliability value: 0.795.

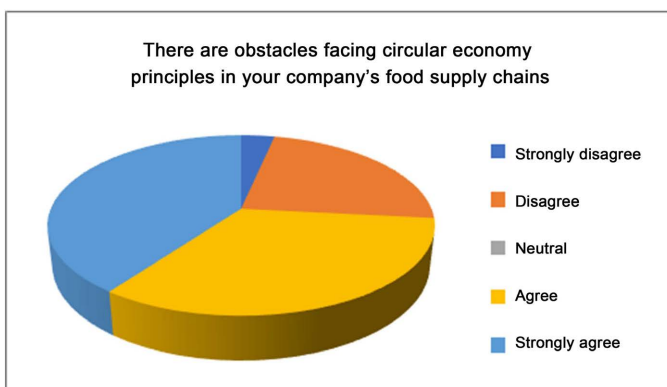
chains after applying the principles of the circular economy) comes in last place with a relative importance of 60%. This can be explained by the fact that supply chain sustainability aims to reduce spending, rationalize consumption, reduce emissions, reduce waste, improve the environment, and maximize the use of all raw materials, minerals, and resources in their various cases, shapes, and patterns, as well as launching recycling, manufacturing, development and reuse operations, which supports and enhances competitive priorities, creates greater value for customers, increases customer satisfaction, and improves the organization's targeted performance.



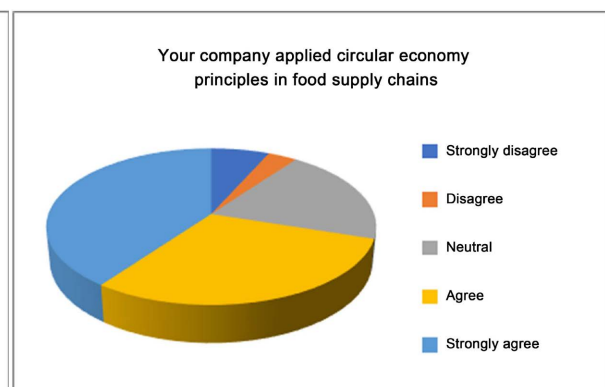
(a)



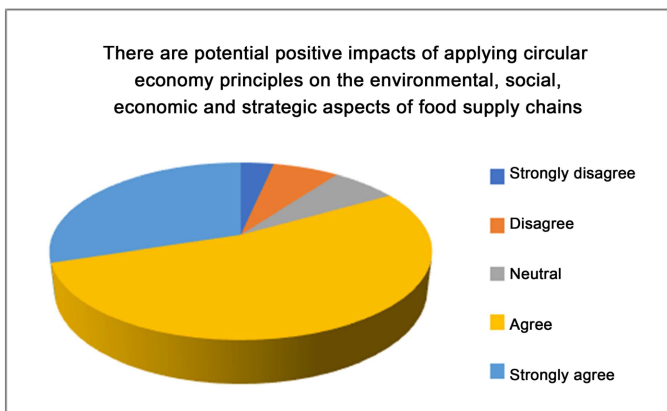
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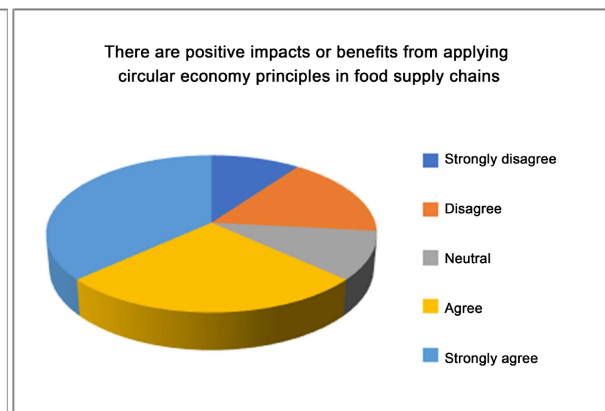
(c)



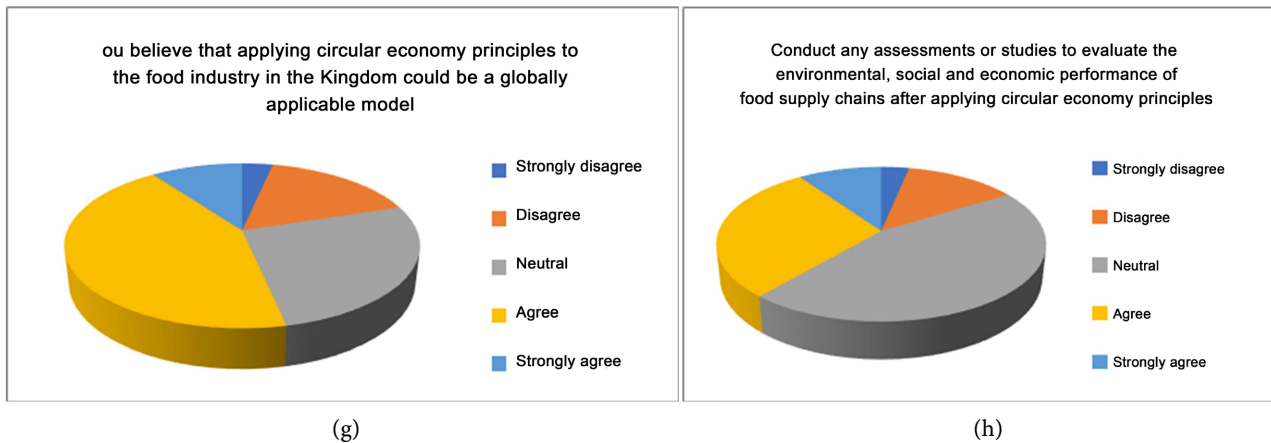
(d)



(e)



(f)



Comparison with previous studies with studies of fresh and dry food factories:

- The study agreed with the study (Almulhim & Abubakar, 2021) by following a circular approach to fresh factories. The organic portion of waste from the markets will be treated through a biological process (anaerobic digestion) and the digested product used as fertilizer on farms that supply fresh produce to local markets.
- The study agreed with the study of Al Tabini (2018): Climate change and global warming reduce the opportunities for factories to obtain fresh produce due to water scarcity, increasing drought, and the decline in the levels of lakes and other bodies of fresh water.
- The study agreed with Madani's study (2019) by paying attention to the impact of recent developments on dry food supply chains and the impact of rising global dry bulk shipping rates and grain prices to increase global consumer food prices by 1.2 percent. Impacts will be greater in middle-income economies that import more primary food products and low-income economies that import more processed foods. The world can also expect regular disruption to supply chains that will need to be more agile and flexible.
- It did not agree with Rashwan's study (2022), which dealt with the petrochemical sector to measure the capabilities of improving the sustainability and flexibility of the supply chain under the circular economy model, unlike the current study, which dealt with the fresh and dry food industries.
- It did not agree with Al Khaddam's study (2022), which dealt with clothing companies to measure green supply chain practices in sustainable performance, unlike the current study, which dealt with fresh food industries. However, it agreed with dry factories on the importance of green manufacturing, green marketing, and green information technology to improve the use of supply chains directed towards environmental practices, not to use hazardous materials or that waste energy in manufacturing processes, and to work on recycling.
- The study agreed with the study of Ismail and Hassan (2021) on waste man-

agement in dry industries to achieve sustainable development, at a time when the linear (traditional) economy depletes reserves of raw materials, creates pressure on limited natural resources, and leads to the production of a huge amount of waste and refuse.

- The study agreed with [Kannan et al., \(2020\)](#) study on waste management in the sustainability of the circular economy to achieve green sustainable development in fresh food industries and their supply from farms by adopting a set of short and long-term strategies to reduce the negative effects of waste on the environment and society, which has begun to show positive results by transforming black areas into green areas that take into consideration all the requirements of sustainable development.
- The study agreed with the study of [Naqah and Btayeb \(2018\)](#) in dry factories with the importance of using an economic model that aims to use resources in more effective ways through recycling, reusing material resources, and using waste.
- The study agreed with [Al Tabini's \(2018\)](#) study on fresh factories that factories whose management depends on supply chains need to pay attention to the supply chain due to its impact on the efficiency of operations and ensuring the supply of fresh agricultural crops faster and with high quality.

It is noted in [Table 8](#) that the sample members, fresh and dry factory owners, agree, according to the overall average, 3.45 and 3.98, respectively, on the role of the circular economy as a tool to enhance the sustainability of supply chains in Kingdom of Saudi Arabia.

Fresh and dry factories differed as follows:

- The phrase (there are current sustainability practices in your company in the food industry) the degree of agreement was in favor of dry factories while the opposite was neutral for fresh factories.
- The phrase (there are obstacles facing the application of circular economy principles in your company's food supply chains), the degree of approval was in favor of dry factories, while on the contrary, it was neutral for fresh factories.
- The phrase (there are positive impacts or benefits from applying circular economy principles in food supply chains) was in favor of dry factories, while the degree of agreement was neutral for fresh factories.
- The phrase (believes that applying circular economy principles in the food industry in the Kingdom can be a globally applicable model) was in favor of dry factories, while the degree of approval was neutral for fresh factories.
- The phrase (you believe that aspects of applying circular economy principles in the food industry in the Kingdom can be replicated globally) the degree of approval was in favor of dry factories, on the contrary it was neutral for fresh factories.
- The phrase (there are challenges or obstacles to be expected in applying circular economy principles on a global scale) was in favor of dry factories, while the degree of agreement was neutral for fresh factories.

Table 8. Comparison of analysis results between fresh and dry factories for the focus of the study.

S	Phrase	Fresh food factories	Dry food factories
1	There are current sustainability practices in your company in the food industry	Neutral	Agree
2	There are challenges facing your company in the area of sustainability in the food industry	Agree	Agree
3	Your company applied circular economy principles in its food supply chains	Agree	Agree
4	There are obstacles to implementing circular economy principles in your company's food supply chains	Neutral	Strongly agree
5	There are positive impacts or benefits from applying circular economy principles in food supply chains	Neutral	Agree
6	There are potential positive impacts of applying circular economy principles on the environmental, social, economic and strategic aspects of food supply chains	Agree	Agree
7	Conduct any assessments or studies to evaluate the environmental, social and economic performance of food supply chains after applying circular economy principles.	Neutral	Neutral
8	You believe that applying circular economy principles in the food industry in the Kingdom could be a globally applicable model	Neutral	Agree
9	You believe that aspects of applying circular economy principles in the food industry in the Kingdom can be replicated globally	Neutral	Agree
10	There are challenges or obstacles to expect in applying circular economy principles on a global scale	Neutral	Agree
11	Your company faces challenges in applying circular economy principles in food supply chains	Neutral	Neutral
12	Your company is experiencing difficulties in collaborating with suppliers and partners in food supply chains to achieve a circular economy	Agree	Agree
13	Problems related to marketing and awareness around the concept of the circular economy are increasing in the food industry	Agree	Agree
14	You believe that the application of circular economy principles can be enhanced in the food industry in the Kingdom	Agree	Agree
15	Cooperation and coordination can be strengthened between companies, stakeholders and the government to achieve a circular economy in the food industry	Agree	Agree
16	You have expectations about the development of the circular economy concept in the food industry in the future	Neutral	Agree
	Overall average	3.45	3.98

- The phrase (you have expectations about the development of the concept of the circular economy in the food industry in the future), the degree of agreement was in favor of dry factories, while on the contrary, it was neutral for fresh factories.

4. Conclusion

This study asserts the critical role of the circular economy as a potent instrument for supporting the sustainability of supply chains within the Kingdom of Saudi Arabia, aligning seamlessly with the overarching objectives of Saudi Vision 2030. The outcomes of the research underscore several pivotal findings. First, the transition to a circular approach is deemed an unavoidable imperative, given the escalating environmental challenges. Second, there is an unprecedented surge of interest in the circular economy within the Kingdom, indicative of a heightened understanding of its importance and anticipated benefits. Third, the success of circular economy implementation is contingent upon effective management of supply chain relationships, necessitating compatibility that fosters ongoing educational capacities of organizations for the circular flow of materials. Active participation and collaboration among stakeholders are paramount for curbing environmental impacts and achieving strategic objectives. Additionally, the study suggests that food industry companies can enhance the sustainability of their supply chains by achieving and supporting flexibility in supply sources, particularly in response to environmental changes. The interpretation of changes by these companies, geared towards sustainability, is closely tied to the degree of achievement and support for the flexibility of supply sources. Collectively, these insights emphasize the transformative potential of the circular economy in shaping resilient, environmentally conscious supply chains and lay the groundwork for a sustainable and strategically aligned future, in line with the aspirations of Saudi Vision 2030.

Recommendations:

Based on the researcher's interpretation and discussion of the study results, some recommendations can be made that we hope will improve the sustainability of food industry companies' supply chains to environmental changes, which are:

- The necessity of integrating the principles of the circular economy into the strategies of the Kingdom of Saudi Arabia and its National Vision 2030.
- Work to mobilize international efforts to accelerate the pace of transition towards a circular economy; adopting modern industrial technologies with high production quality, establishing decent infrastructure, and stimulating industrialization in its circular model.
- The necessity of shifting to applying the circular economy model because of its significant effects on the organization's performance.
- Developing legislation, laws, and plans related to embodying the circular economy to achieve sustainability, since the legislation in effect related to waste management in all countries is only a reflection of the strict directives issued by the United Nations to protect the environment from pollution.
- Food industry companies must help their suppliers and support their capabilities to formulate and implement pricing strategies capable of adapting to environmental changes. This will enhance the degree of flexibility of supply

sources, and improve the speed of these suppliers' response to the need to change their pricing policy.

Food industry companies must maintain their encouragement and support for their suppliers' keenness to constantly develop their products, considering that developing the inputs of these companies is considered one of the basic factors for developing their final products, while giving more attention to other factors that indicate their achievement and support for the flexibility of supply sources.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Al Aouniya, B. Z. (2021). The Circular Economy and Its Role in Achieving the 2030 Sustainable Development Agenda: An Analytical Study. *Journal of Economics and Environment*, 4, 230-250.
- Al Khaddam, N. M. (2022). *The Impact of Green Supply Chain Practices on Sustainable Performance in Clothing Companies within Qualified Industrial Zones: The Mediating Role of Governance*. Master's Thesis, Amman Arab University.
- Al Tabini, H. J. (2018). *The Impact of Supply Chain Management Practices on the Efficiency of Operations in Agricultural Materials Companies in Jordan*. Master's Thesis, Al Al Bayt University.
- Almulhim, A. I., & Abubakar, I. R. (2021). Understanding Public Environmental Awareness and Attitudes toward Circular Economy Transition in Kingdom of Saudi Arabia. *Sustainability*, 13, Article No. 10157. <https://doi.org/10.3390/su131810157>
- Alshuwaikhat, H. M., & Mohammed, I. (2017). Sustainability Matters in National Development Visions—Evidence from Saudi Arabia's Vision for 2030. *Sustainability*, 9, Article No. 408. <https://doi.org/10.3390/su9030408>
- Hassan, S. M. A.-G. (2020). A Proposed Framework for the Role of Knowledge Management in Improving the Performance of Green Supply Chains: A Field Study on Pharmaceutical Companies in the Private Sector in Greater Cairo. *Scientific Journal of Economics and Trade*, No. 2, 305-326.
- Hofstetter, J. S., De Marchi, V., Sarkis, J., Govindan, K., Klassen, R., Ometto, A. R. et al. (2021). From Sustainable Global Value Chains to Circular Economy—Different Silos, Different Perspectives, but Many Opportunities to Build Bridges. *Circular Economy and Sustainability*, 1, 21-47. <https://doi.org/10.1007/s43615-021-00015-2>
- Ismail, A. S., & Hassan, D. M. (2021). Circular Economy as a Mechanism for Waste Management and Achieving Sustainable Development Goals in the United Arab Emirates: Theoretical and Applied Frameworks. *Ajman Journal of Studies and Research*, No. 20, 315-340.
- Jaafar, L. F. (2020). Electronic Waste Recycling Mechanisms in Light of the Knowledge Economy (a Study within the Framework of the 2030 UN Goals). *Contemporary Egypt*, No. 111, 287-318.
- Jabayli, S. (2022). The Circular Economy as a Contemporary Global Trend to Achieve Sustainability: Highlighting Some International Experiences. *Al Aseel Journal of Economic and Administrative Research*, 6, 379-398.
- Jorgensen, M., & Remmen, A. (2018). A .Methodological Approach to Development of

- Circular Economy Options in Businesses. *Procedia CIRP*, 69, 816-821.
<https://doi.org/10.1016/j.procir.2017.12.002>
- Kannan, G., Rajeev, A., Sidhartha, S. P., & Rupesh, K. P. (2020). Supply Chain Sustainability and Performance of Firms: A Metaanalysis of the Literature. *Transportation Research Part E*, 137, Article ID: 101923. <https://doi.org/10.1016/j.tre.2020.101923>
- Liu, H., Ke, W., Wei, K., & Hua, Z. (2013). Effects of Supply Chain Integration and Market Orientation on Firm Performance: Evidence from China. *International Journal of Operations & Production Management*, 33, 322-346.
<https://doi.org/10.1108/01443571311300809>
- Madani, M. Y. (2019). Analysis of the Relationship between Supply Chain Management Practices and Improving the Level of Health Service Quality: An Applied Study on University Hospitals Operating in the South Upper Egypt Region. *Journal of Contemporary Business Research*, 33, 223-293.
- Mohamed, K. S. (2005). *Management of the Supply Network in the Immune Institution, a Case Study of the Textile Factory for "Heavy Materials" MANTAL* (p. 59). A Memorandum for Obtaining a Master's Degree in Economic Sciences, Specializing in Operations and Production Management, Abu Bakr Belkaid University, Tlemsa.
- Naqah, Z., & Btayeb, A.-W. (2018). *International Forum: The New Development Model and Quality of Life. The Focus of the Intervention: Quality of Life and the Environmental Dimension. The Circular Economy as a Basic Pillar for Achieving Quality of Life. A Case Study of the Dutch Company DSM.*
- Rashwan, A. M. (2022). The Role of the Capabilities of Improving the Sustainability of Supply Chain Flexibility on Target Performance under the Circular Economy Model: An Applied Study on the Petrochemical Industry Sector in the Governorates of Alexandria and Beheira. *Journal of Financial and Commercial Studies*, No. 3, 238-287.
- Saadi, J. (2020). Sustainable Supply Chain Management and Its Impact on Sustainable Performance. *Al Afaq Journal for Economic Studies*, 5, 232-245.
- Saadi, J., & Mansiriya, R. (2017). Green Supply Chain Management as an Input to Activating the Circular Economy: A Case Study of Dolphin Energy. *Journal of Financial and Accounting Studies*, 8, 863-880.
- Shahin, M. S. (2014a). The Impact of Supply Chain Integration on Their Level of Performance, an Applied Study on Ceramic Manufacturing Companies in the Arab Republic of Egypt. *Journal of Trade and Finance, Tanta University*, No. 2, 193-236.
- Shahin, M. S. (2014b). The Impact of the Flexibility of Supply Chains on the Speed of Their Response to Environmental Changes, an Applied Study on Ceramic Manufacturing Companies in the Arab Republic of Egypt. *Egyptian Journal of Business Studies, Mansoura University*, 38, 1-66.
- Shahin, M. S. (2017). The Impact of Green Supply Chain Practices on Their Sustainability: Analysis of the Mediating Role of Chain Information Sharing: An Applied Study on Automobile Manufacturing Companies in the Arab Republic of Egypt. *Journal of Trade and Finance*, No. 1, 54-100.
- Stevens, G. C. (1989). Integrating the Supply Chain. *International Journal of Physical Distribution & Materials Management*, 19, 3-8.
<https://doi.org/10.1108/EUM00000000000329>
- Suleiman, A., & Shaaban, L. (2022). The Trend towards a Circular Economy and Its Role in Achieving Economic Growth. *Economic and Tourism Sciences Series*, 44, 11-38.
- Velenturf, A. P. M., & Purnell, P. (2021). Principles for a Sustainable Circular Economy. *Sustainable Production and Consumption*, 27, 1437-1457.

<https://doi.org/10.1016/j.spc.2021.02.018>

Winans, K., Kendall, A., & Deng, H. (2017). The History and Current Applications of the Circular Economy Concept. *Renewable and Sustainable Energy Reviews*, 68, 825-833.

<https://doi.org/10.1016/j.rser.2016.09.123>

Ziadeh, R. M. M. (2021). Ethical Finance as a Creative Approach to Achieving Sustainable Development in Light of the Circular Economy: A Theoretical and Analytical Study. *International Journal of Educational and Psychological Sciences*, No. 50, 208-238.