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Article

Assessing the impact of sustainability practices on organizational performance in dairy industry: An empirical case study from a developing country

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Abstract: The dairy industry is considered one of the most needed industries in almost every country; this is due to the continuous daily demand of its different products. Nevertheless, this industry consumes large amount of water, energy and material resources, and generates large quantities of liquid and solid wastes. In the sequel, under the pressure of fulfilling the 17 sustainable development goals (17 SDGs), it is important to address the sustainability of this sector in the world and particularly in developing countries. This study aims at assessing the impact of environmental, economic and social sustainability practices on the organizational performance of dairy industry in Palestine. To this end, a quantitative-research approach, based on a questionnaire for data collection, was adopted. Data has been collected from a convenient sample of 15 dairy factories working in West Bank in Palestine during a three-month period from March to May, 2023. Inferential statistical analyses were conducted as well. The results revealed that there is a difference between the median values of environmental and economic practices. In addition, the results showed that there is a medium relationship between sustainability practices and organizational performance. However, the economic practices proved to have the strongest impact then social practices; while, there is no impact of environmental practices on organizational performance. Furthermore, the results showed that this industry consumes larger amount of water as well as it generates large amounts of wastewater that mainly discharged to the drainage system without treatment for recycling or reuse. Several sound recommendations are given at the end of this paper. It worth mentioning that there are no previous studies conducted on the dairy industry sector in Palestine about sustainability assessment.

Keywords: sustainability; organizational performance; dairy industry; empirical case study; SDG

1. Introduction

Humans have made significant economic and technical advancements over the past few decades, yet these advancements caused negative impacts on human and ecosystems; its impact is manifested in pollution and global warming, in addition to several economic and social issues such as poverty, health, and inequality (Lior et al., 2008). Hence, new concepts have been developed to face such challenges; sustainability has been one of the key concepts globally adopted with its environmental, economic, and social objectives (Miller et al., 2013). Sustainability is a wide concept that aims to integrate social, environmental, and economic disciplines with the objective of satisfying the needs of the current population without

jeopardizing those of future generations (Deif, 2011). Industrial sustainability is known as the process of producing high-quality goods using procedures and methods that minimize adverse environmental effects and conserve energy and natural resources, resulting in the development of regulatory frameworks to achieve sustainability and enhance competitiveness. Worker health and workplace safety are also important components of industrial sustainability. In the industrial sector, sustainability often tries to boost production by cutting costs and getting rid of waste to achieve long term company reliability (Bilgin et al., 2012; Deif, 2011). Other researches (El-Khalil and Mezher, 2020) have shown a positive relationship between sustainability and organizational performance in industrial establishments.

Sustainability assessment in the industrial sector is an important tool for achieving sustainability improvements, it adopts a variety of different techniques including forms of projects and programs; it seeks to determine whether the process is sustainable or not. Sustainability assessment can be defined as any procedure that leads to a decision towards sustainability; it has the potential to significantly contributing to a more desirable and long-lasting future (Bond et al., 2012).

As a developing country, Palestine faces sustainability challenges along with weak awareness and lack of sustainable practices (Arman et al., 2013). For instance, 95.9% of firms do not treat the produced wastewater on their sites, and 67.9% of establishments use the wastewater network as their primary means of disposal. Over 92.6% of businesses do not separate their solid waste (Palestinian Central Bureau of Statistics [PCBS], 2020). Palestine straggles a serious shortage of water and electricity due to resections imposed by Israeli authorities on Palestinian diary factories (Tibi and Ramahi, 2005). Even though it is crucial to use renewable energy in Palestine, less than 13% of the estimated total is generated using solar energy (Abboushi and Alsamamra, 2021). Therefore, it is urgent and necessary to promote sustainability practices in the Palestinian industrial sectors.

One of the main industrial sectors worldwide is the dairy industry, its ecological footprint, arising from resource-intensive operations and waste generation like energy and water consumption, as well as packaging-related environmental toxicity and sewage discharge; all this necessitates a comprehensive appraisal of its commitment to sustainability. This entails assessing waste management, quality control of raw materials, packaging, and final products, as well as worker safety, health protocols, profitability strategies, cost coverage mechanisms, and the resultant impact on organizational performance (Al-Bitawi, 2019).

In Palestine, the dairy sector plays a pivotal role in national food security, commanding approximately 75% of the local market share. It contributes to global food security through the efficient conversion of milk into different products like cheese, yogurt, butter, low fat milk, high fat milk, strained yogurt, yogurt milk and other milk derivative products (Ramahi et al., 2023). Raw milk is supplied to the dairy factories in Palestine from their own farms of cattle and/or from local farms of cattle. Operating as a labor-intensive field, this sector significantly influences local agricultural income and overall employment. However, the Palestinian dairy industry sector confronts a multitude of challenges. Notably, production decline is attributed to Israeli occupation policies, while the presence of competitive Israeli dairy products impacts the market (Asaad and Barakat, 2016), in addition to environmental

predicaments including water and energy consumption, along with packaging-induced pollution (Ramahi et al., 2023). Socially, dairy manufacturing poses risks of accidents and health concerns (Grout et al., 2020). Economically, the sector grapples with stagnated export growth, a lack of diversity in local products, and obstacles related to certification and infrastructure (Al-Bitawi, 2019). Despite all these difficulties, yet numerous opportunities can be utilized to make this sector more sustainable and efficient, like raising awareness and implementing best practices; which leads collectively to a better organizational performance. The main goal of this study is to assess the sustainability practices in diary industry in Palestine and their impact on the organizational performance. Worth noting is the absence of prior investigations into the sustainability of Palestine's dairy sector; underscoring the significance of this research. To the best of the authors' knowledge and based on the literature review, this study is the first of its kind in the Palestinian context that aims at assessing the sustainability practices in one of the Palestinian vital sectors, the dairy industry and investigating their impact on the organizational performance.

The importance of this research topic as well as the vitality of the dairy industry in Palestine, a developing country with unique economic and political conditions motivated us to address this topic and conduct this study. More specifically, compared to other manufacturing sectors in Palestine, the dairy sector is a promising sector that contributes to the economic growth in the country, employs a relatively large number of employees in its plants and produces milk-derivative products that are essential for human beings and health. Nevertheless, this sector is known for its adverse environmental impacts due to the nature of its raw materials, products and processes that negatively contribute to environmental pollution and hence adversely affect its organizational sustainable performance. In the sequel, assessing the sustainability practices in this sector and their impact on the organizational performance of its factories represents a research gap that needs to be addressed. To this end, this study has been conducted.

This paper consists of five sections; the first section provides an introduction of the paper, including problem statement, goals and significance of the study. Literature review on sustainability and the dairy industry is included in the second section. Research methodology is discussed in the third section including data collection tool and process. As for the fourth section, it contains the analysis of the collected data, results and discussion. Finally, the fifth section includes the conclusions and recommendations.

2. Literature review

2.1. Sustainability overview

Sustainability has gained paramount importance, spanning economic, environmental, and social realms. While businesses acknowledge its significance, its seamless integration into strategies remains incomplete (Ramahi et al., 2023). This is driven by concerns over swift environmental degradation and its long-term implications for humanity's survival. Its pervasive impact extends beyond industrial domains, encompassing technology, commerce, the environment, and social sciences. Industry 4.0 also highlights its role in continuous improvement. The evolving concept

of sustainability assessment serves as a valuable tool for immediate and future sustainability enhancements. It encompasses diverse processes aimed at determining the sustainability of various endeavors. Its pluralistic nature comprises an array of plans, projects, or programs, with a focus on decision-making towards sustainability. Crucially, the assessment process necessitates a departure from traditional approaches for achieving meaningful sustainability outcomes (Bond et al., 2012).

Sustainability framework is a diagnostic tool reveals strengths, weaknesses, and the likelihood of sustainability in continuous improvement strategies. Its early-stage usage offers insights for sectorial enhancement and development. Effective implementation of sustainability framework can be facilitated through innovative tools for corporate sustainability management. Tools for embodiment and evaluation aid in scaling sustainability levels upward (Juuti et al., 2021). The sustainability indicators in the industrial sectors are aligned with the 'triple bottom line' of the economy, environment, and society; these indicators form a foundation for sustainability assessment in the industry sector. A systematic review of literature reveals a comprehensive set of indicators affecting each aspect of sustainability (Feil et al., 2020). Similarly, for the dairy industry, environmental indicators span ozone depletion, energy consumption, and eco-toxicity. Social indicators encompass product quality, employee well-being, and noise pollution. Economic indicators cover profit margin, production cost, and delivery expenses.

These indicators align with desirable qualities and underscore the evolving nature of sustainability assessment (Feil et al., 2020). To measure sustainability and the effect of its practices on organizational performance, especially concerning social issues, criteria are crucial, necessitating the development and implementation of performance measurement tools and management systems across supply chain partners (Jafari, 2017). Previous research reveals that successfully addressing environmental challenges establishes new competitive opportunities and innovative ways to enhance core business strategies. Corporate environmental management practices demonstrate a substantial correlation with economic performance, affirming the 'win-win' concept. Organizational performance is oriented towards wealth generation, safeguarding invested capital, facilitated by sustainable management methods that promote robust sales growth, return on assets, pre-tax profit, and operational cash flows (Ameer and Othman, 2012). Organizational performance assessment evaluates efficacy and efficiency through factors like market share, economic performance, organizational expansion, operational performance, environmental performance, and social performance. Therefore, the measuring approach should focus on the three dimensions of sustainability: economic, environmental, and social (El-Khalil and Mezher, 2020).

2.2. Challenges and risks in the Palestinian dairy sector

The dairy industry's remarkable growth is accompanied by challenges, including escalating production costs, imported material prices, and water scarcity. Market openness affects local products, and border inspections cause product damage. Taxation on dairy products and cheese, along with rising energy costs, adversely affect corporate profits. Urgent intervention is necessary to preserve the sector's stability and contribute to economic recovery (Organization for Economic Cooperation and

Development (OECD) and Food and Agriculture Organization of the United Nations, 2021). Milk production's seasonality, fluctuating prices, and inadequate agricultural infrastructure cause problems in dairy industry; particularly in developing countries. Sustainability initiatives and consumer preferences are shaping the sector, with considerations like greenhouse gas emissions and environmental impacts guiding legislations. Consumer trends are driving plant-based alternatives, pushing further innovation. Environmental regulations stimulate innovative solutions, enhancing competitiveness. International trade and production practices attempt to mitigate seasonality (Al-Bitawi, 2019; Knips, 2005; McDowell, 1981).

The dairy industry in Palestine has undergone a transformation from manual labor to modern machinery-based production (Al-Rai, 2004). This sector significantly contributes to Palestinian food security, accounting for 75% of the local market. There are about 101 dairy factories plants with around 1754 workers as of 2020 (PCBS, 2020). Among those 101, there are only 41 dairy factories in which milk-derivative products are produced on production lines, and each factory has an organization chart that defines the different functions (departments) in it. The rest (60 plants) are classified as micro, small, medium-sized plants that are run by small number of staff using some machines and have no organizational charts and are not registered as factories in the Ministry of National Economy in Palestine. Promising investment prospects exist due to substantial daily dairy consumption of approximately 600 tons in Palestine, reflecting its pivotal role in the economy (Raya Media Network, 2019). Furthermore, dairy product market share surged from 8.45% in 2007 to 57% in 2017, fostering the industry's significance (Al-Bitawi, 2019). However, the dairy sector in Palestine faces challenges spanning the environmental, social, and economic dimensions; which can be summarized as follows (Al-Bitawi, 2019; PFIF, 2021).

Environmental challenges: Including: (a) The dairy sector consumes 80% of drinking water for equipment, processing, and vehicles cleaning, posing a significant challenge in territories with limited natural resources. (b) The dairy sector generates 2830 tons of solid waste per year; 79% of packaging materials are mostly burnt in unregulated disposal sites. (c) Dairy processing plants consume large amounts of energy, with thermal uses accounting for 80%, and 20% for processing, refrigeration, and lighting. (d) Wastewater generated from milk processing facilities usually contains milk residues, detergents, whey, and disinfectants. Large percent of the facilities directly discharge their wastewater to the public sewage network.

Social challenges: Including: (a) Physical hazards and injuries involve falling to the ground due to slipping conditions, using machinery and tools, and collision with material handling vehicles. (b) Dust from ingredients used in dairy processing and high humidity levels can cause skin irritation or other types of allergic reactions. (c) Lack of health insurance, low wages, and high turnover rates are issues to be considered in this sector.

Economic challenges: Including: (a) The dairy sector's export growth has slowed, despite developments in the sector in recent years. This is due to the focus of dairy factories on serving the local market mainly. (b) Volume of export in the dairy sector is becoming less, annual exports do not exceed $5 million; manufacturers' primary concentration is on serving local markets. (c) Local dairy product diversity is limited in comparison to imported items. (d) The high cost of fuel in Palestine makes it

difficult for firms to distribute their products across larger geographical area. (e) Limited number of laboratories required to execute dairy product safety and quality assurance tests. (f) Inadequate electricity networks to serve industrial facilities. (g) The dairy sector is the least qualified in terms of international quality certifications and exportability.

2.3. Previous studies on sustainability assessment of dairy industry

Several global studies have examined sustainability assessment in the dairy industry; von Keyserlingk et al. (2013) have highlighted different factors that affect the sustainability of the United States dairy sector, such as climate change, advancements in technological innovation, globalization, difficulties in integrating societal values, and weak initiatives of multidisciplinary research. They explained that sustainability is connected to social and environmental practices, and to economic growth. Furthermore, they concluded that having more sustainable practices requires solid coordination between producers, customers and the community.

Buys et al. (2014) developed a sustainability scorecard as tool to measure the economic, social and environmental effects of the Australian dairy industry, the developed tool is a Bayesian network model that can be used to formulate and test improvement methods. It may be adopted for comparison purposes with similar industries in different countries.

Munyaneza (2018) developed a tool to evaluate the sustainability of the smallholder dairy and traditional cattle milk production in Tanzania. Six sub-domains make up the tool: financial, health, relationship with output purchasers, efficient and transparent leadership, accessibility to inputs and services for dairy production, cooperation with the outside environment, and member loyalty. Each sub-domain consists of a set of quantifiable indicators. Ndambi et al. (2020) have reviewed forty-two sustainability assessment tools to adopt the most appropriate one to assess the sustainability of dairy initiatives in East Africa. The researchers found that the RISE (Response-Inducing Sustainability Evaluation) and SAFA (Sustainability Assessment of Food and Agriculture systems) are the most appropriate tools to evaluate sustainability of dairy farming in East Africa; of course, the tools needed to be customized to meet the East African context.

Attia et al. (2022) evaluated the sustainability of small dairy farms in the Northern region of Tunisia. To this end, a semi-structured interviews with 107 dairy farms was adopted to get sustainability scores based on agro ecological, socio-territorial and economic dimensions. Statistical analyses, including Principal Component Analysis (PCA) and Ascending Hierarchical Classification (AHC), were employed to classify farms into groups based on their final score. The results revealed that the highest performance was found in the agro-ecological and economic scales, while the socio-territorial dimension negatively impacts the overall sustainability of farms. The findings indicate an interconnectedness between agro-ecological, socio-territorial, and economic sustainability, highlighting the need for simultaneous improvements across all three dimensions.

Satolo et al. (2020) undertook a study to quantify the effects of acquisition, transportation, storage, and packaging on sustainability. The study examined the

economic, social, and environmental impacts of the logistic activities of a dairy business in Brazil. The findings indicated that the triple bottom line's environmental, economic, and social elements are all influenced in this dairy business differently.

Galliano and Siqueira (2020) analyzed the relationship between organizational design and environmental performance in French dairy farms, emphasizing the role of internal and external factors, spatial environment, and providing policy recommendations for improvement. They also indicated that the spatial environment and the environmental performance of neighboring dairy farms are strongly correlated. Wattiaux (2023) addressed sustainability of dairy farming from a broader context of agricultural sustainability from a macro national perspective of the country's commitment to the 17 SDGs. More specifically, SDG number 13 (climate action) was considered to underscore that while there is current emphasis on reducing the carbon footprint, the dairy sector's contribution to climate action depends on its annual emissions. Also, SDG number 2 (zero hunger) was considered to demonstrate the potential tradeoffs between input and output ratios of humans-edible proteins in milk and prioritize the use of human-inedible feed in dairy rations to enhance efficiency and circularity at the food system level. In Kumar and Choubey (2023), the methodology used in this study helps food supply chain companies manage sustainable development. It offers a sustainable assessment system that makes use of fuzzy TOPSIS, fuzzy VIKOR, and fuzzy analytic hierarchy process. This study's research framework assessed the sustainability of three dairy companies in India that are owned and operated by cooperative societies. Economic, environmental, business operations and social dimensions are listed in decreasing order. In addition, the average cost of the supply chain and the percentage of renewable energy that falls under the categories of economic and environmental impact are the two performance indicators that are used to gauge how sustainably the dairy business performs. Other works that combine the sustainability of supply chain activities include Kichili (2020), Sumuni (2019), Ferreira et al. (2020), Zanin (2020) and Feil et al. (2020).

Braik et al. (2023) investigate how Green Marketing (GM) implementation affects the performance of Palestinian food industry in a sustainable manner. To this end, relevant quantitative data on GM practices and performance were obtained and examined using partial least squares structural equation modeling (PLS-SEM) method. The results provide a simple, unstructured quasi-GM strategy. More specifically, while green promotion improves the firm's economic performance, green product and green placement and distribution both contribute to improving the firm's environmental performance. The green placement and distribution also have an impact on social performance.

A recent study by Singh et al. (2024) was conducted to compare the carbon emissions associated with packaged milk production in two large states in India, namely, Punjab and Rajasthan. A life cycle assessment (LCA) approach was adopted to conduct the environmental impact assessment. Relevant primary data was collected via interviews with farmers, plant observations and insights from processing facility personnel. The LCA analysis revealed that milk production in Punjab exhibits larger environmental efficiency than that in Rajasthan, with observable environmental impacts stemming from cattle feed cultivation and packaging material selection for processed milk. The study offers insights to stakeholders on sustainable practices and

mitigates the ecological footprint of dairy industry.

2.4. Hypotheses and framework development

The main goal of this study is to evaluate the sector's alignment with the three dimensions of sustainability—environmental, economic, and social. This, in turn, offers insights into their collective influence on organizational performance, thus ensuring enduring profitability and industry diversity and providing pertinent recommendations. Subordinate aims involve the formulation of an encompassing framework for evaluating sustainability practices and their impact on organizational performance within the Palestinian dairy sector, alongside the development of a fitting data collection tool. Through these endeavors, this research aims to shed light on the intricate relationship between sustainability initiatives and performance outcomes within the sector. To investigate the impact of sustainability practices on the organizational performance the following hypotheses were stated and tested:

- H1: There are no significant differences between the mean environmental, economic and social sustainability practices in Palestinian dairy sector.
- H2: There is a positive impact of the sustainability practices (SP) on general organizational performance (OP) in Palestinian dairy sector.
- H2en: There is a positive impact of the environmental practices (EnP) on general organizational performance (OP) in Palestinian dairy sector.
- H2ec: There is a positive impact of the economic practices (EcP) on general organizational performance (OP) in Palestinian dairy sector.
- H2so: There is a positive impact of the social practices (SoP) on general organizational performance (OP) in Palestinian dairy sector.

In accordance with the previous studies and based on the particularity of the Palestinian dairy sector, EnP encompass practices on the following seven indicators: Materials usage, water, energy consumption, emissions, waste management, transportation and site management. While, EcP include practices on the following two indicators: quality assessment, financial performance and risk management. The SoP includes practices on four indicators, which are employment and labor, human rights, health and safety and social responsibility. On the other hand, the OP is indicated by six indicators; namely, market share, economic performance, organization expansion, operational performance, environmental performance and social performance. **Figure 1** depicts the proposed conceptual framework of the study including dimensions along with their indicators.

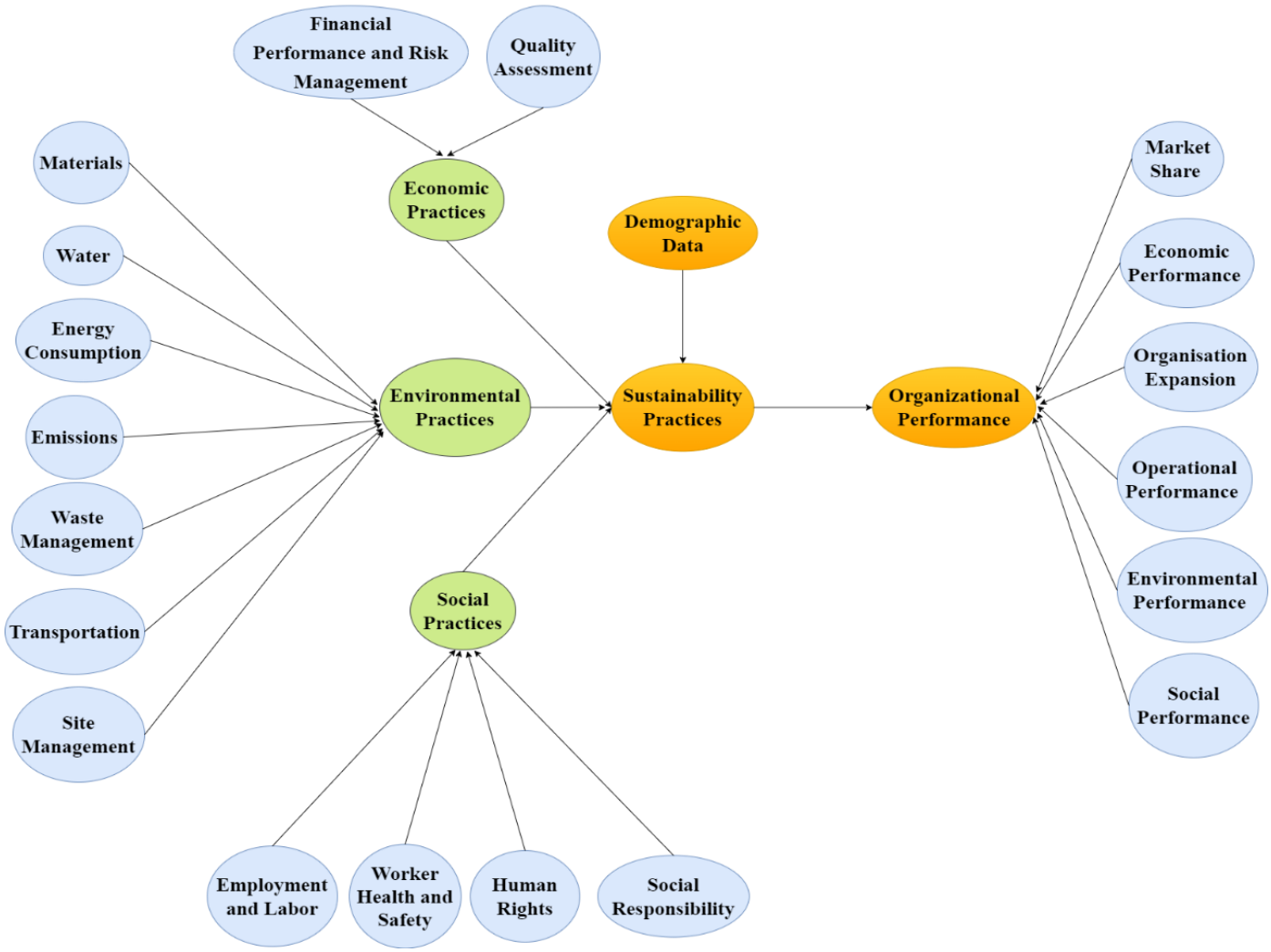

Figure 1. Conceptual sustainability—Organizational performance framework.

3. Research methodology

3.1. Summary of methodological steps

The methodology for executing this study encompassed a sequence of comprehensive steps, each contributing to the holistic investigation of sustainability and its implications for the dairy industry in Palestine. The elucidation of these steps below underscores the rigor and thoroughness of the study's approach:

Step 1: A literature review was conducted to gain insights into sustainability assessment in industrial and dairy sectors, exploring indicators used for evaluation, challenges faced by the dairy industry, and strategies adopted.

Step 2: A customized framework was developed to examine the relationship between sustainability aspects and organizational performance in the Palestinian dairy industry.

Step 3: Research hypotheses were formulated to investigate the relationship between sustainability practices and organizational performance across the milk supply chain stages (transportation, production, storage, packaging, distribution). A structured questionnaire was designed as the data collection tool.

Step 4: Well-established dairy factories with proficient administration and production systems were targeted through a sampling approach to ensure a realistic representation.

Step 5: Data analysis was performed to evaluate sustainability practices in the Palestinian dairy industry. Findings were discussed, focusing on implications for organizational performance. Conclusions and recommendations were also provided.

3.2. Sample size and representation

Baxter et al. (2015) state that convenience sampling is frequently utilized in industry user research. When implemented, the sample of the population mirrors individuals who were accessible (those you could reach) at a particular moment, rather than selecting a fully representative sample of the population. Instead of choosing participants from the entire population, you enlist participants from a convenient subgroup of the population. In this research, the study population is 41 (as mentioned before), from which a convenient sample of 15 (37% of the population) could be accessed, reached and used for data collection.

The geographical scope of this study was designed to be comprehensive, encompassing multiple governorates to encapsulate the diversity of the Palestinian context. The governorates included in the study have factories working in West Bank in Palestine. A notable limitation stems from the research's focus on tracking the dairy production chain from supplier to customer. This methodology inherently omits an integral stakeholder group in the dairy industry: the farmers. Farm-level dynamics, challenges, and their interplay with sustainability practices within the dairy factory remain beyond the scope of this study.

More specifically, data has been collected from the dairy factories with the largest market share in the dairy sector in Palestine and having well established administrative and production systems, resulting in a relatively small sample size of 15 factories. This selective approach ensures data accuracy and reliability; it is essential for readers and stakeholders to be aware of this constraint while interpreting the results, recognizing that the study's conclusions pertain primarily to this subset of large, well-established dairy factories within the chosen governorates.

3.3. Data collection tool

A structured questionnaire was designed and used to survey the selected sample of dairy factories. The main goal of this survey is to collect quantitative and qualitative data from Palestinian dairy factory owners, aiming to assess and enhance sustainability practices while understanding their influence on organizational performance. The questionnaire encompasses indicators spanning the three dimensions of sustainability (environmental, economic, and social) and organizational performance. In fact, the questionnaire was designed based on literature (Al Nasour et al., 2017; Boguniewicz-Zablocka et al., 2017; El-Khalil and Mezher, 2020; Euromilk, 2018; Feil et al., 2020; FAO, 2021; Jafari, 2017; Lapenu and Greeley, 2003; Shkoukani, 2008; Thöni and Matar, 2019; White, 1996). The questionnaire was reviewed by experts and piloted on two facilities before finally being modified. The questionnaire consisted of three main sections: demographic data, assessment of sustainability practices, and evaluation of

sustainability practices impact on the organizational performance of the Palestinian dairy industry. Namely, the questionnaire included the following sections:

Demographical data: Included respondent's as well as the dairy factory's demographic information.

Environmental indicators: Included data on materials (consumption of natural resources, consumption of recycled materials, usage of hazardous materials), water (consumption, reuse and recycling of wastewater), energy consumption, solid waste management, transportation, emissions, and site management.

Economic indicators: Included data on financial performance, risk management, and quality assessment.

Social indicators: Included employment and labor, workers' health and safety, human rights, and social responsibility.

Organizational performance: Included market share, organizational expansion, operational, economic, environmental and social performances.

3.4. Data collection

In the data collection phase, as stated before, emphasis was placed on engaging with well-established dairy factories holding significant market shares in Palestine. The data collection tool utilized was a structured questionnaire containing closed-format questions; enabling streamlined answer, comparison and analysis. The distribution of questionnaires involved employing a survey method; which encompassed factory visits, exploration of factory websites and electronic communication via email or phone to arrange for data collection and survey filling in a face-to-face interview with the factories top management representatives. Data has been collected during a three-month period from March to May 2023. Ultimately, 15 fully-filled and valid questionnaires were obtained from the selected factories. The data collection process encountered some challenges in data sourcing and communication with targeted factories. In some instances, field visits were declined, necessitating electronic communication for data collection via the questionnaire. Despite these, the study was successfully executed within the specified timeframe.

4. Analysis results and discussion

This section presents an analysis of the collected data and the findings of this study. The first section provides an analysis of demographic data. The second section included the tool reliability test. The third section included sustainability practices analysis, and fourth section included testing of hypotheses.

4.1. Demographic data analysis

Table 1 summarizes the descriptive statistics of the demographic profiles of the sampled dairy factories and the respondents who filled the questionnaires.

Results in **Table 1** show that 66% of the factories are located in residential and agricultural areas; hence emissions resulting from these factories such as waste gases, dust and unpleasant odors, in addition to wastewater, can affect the health and safety of people and crops. Therefore, we advise that the sector's factories be located in industrial areas, that is, away from residential and agricultural areas; this in fact

requires official enforcement as the age of 47% of the factories exceed 20 years and still two-third of them located out of industrial areas.

Table 1. Demographic data analysis.

Location of the factory	**Frequency**	**Percentage**
Northern cities (governorates)	6	40%
Middle cities	4	27%
Southern cities	5	33%
Location of the factory	**Frequency**	**Percentage**
Industrial Area	5	33%
Residential Area	8	53%
Agricultural Area	2	13%
The age of the factory	**Frequency**	**Percentage**
1–5 years	3	20%
11–15 years	2	13%
More than 20 years	10	67%
The number of employees in the factory	**Frequency**	**Percentage**
5–9	1	6%
10–19	7	47%
More than 20	7	47%
Number of milk tanker trucks from suppliers to factory	**Frequency**	**Percentage**
1–2	9	60%
3–5	3	20%
More than 5	3	20%
Number of distribution trucks including dealer trucks	**Frequency**	**Percentage**
1–5	6	40%
6–10	4	27%
More than 11	5	33%
Factory certificates	**Frequency**	**Percentage**
Having at least one of the following certificates (ISO 45001, ISO 22000, UHT Certificate, ISO 900, HACCP, CANDIA Franchise, Palestinian Quality Certificate (PS))	10	67%
No certificates	5	33%
Presence in local, regional and international markets	**Frequency**	**Percentage**
Local market	15	100%
Regional market	1	7%
International market	2	13%
Factory market share in Palestinian local market	**Frequency**	**Percentage**
1%–10%	6	40%
11%–15%	2	13%
16%–20%	3	20%
21%–25%	2	13%
26%–35%	2	13%

In general, the factory that imports a larger quantity of milk needs a larger number of distribution trucks; this indicates that the factory has a larger market share and the number of orders for its products is greater than others. We expect these factories apply sustainable practices related to their trucks so that they do not have a significant impact on the environment and follow the optimal path during transportation. Certifications are a credible assessment by knowledgeable and experienced parties, which means that these certifications take into account the application of sustainability practices in various aspects. Hence, increases the market share of the factory, reduces cost, increases efficiency and product quality, and increases the volume of factory exports which in turn leads to increased competition among the sector's factories. As mentioned before, the dairy sector is considered the least qualified sector in terms of international quality certificates and the ability to export (Palestinian Food Industries Federation, 2021). The results in our study came in agreement with this fact; only one factory out of the sample sells products in the regional markets and only two factories market their products in international markets. Perhaps one of the most important reasons for this limited export ability is the lack of certificates for these factories; as the results in our study showed 33% of the factories do not have certificates.

4.2. Reliability test

The overall measure consistency is referred to as reliability, which implies that if the researcher does the experiment numerous times under the same conditions, the results will be the same. Cronbach's alpha and composite reliability (CR) are used to assess consistency (Sekaran and Bougie, 2010). This exploratory research focused on assessing the sustainability practices within the Palestinian dairy industry. The study encompassed three dimensions: Environmental, economic, and social practices. It is important to note that while the reliability of the assessment was tested, the primary focus was on exploration rather than achieving high reliability. Consistency with CR values less than 0.5 is unacceptable, between 0.5 and less than 0.6 is poor, between 0.6 and less than 0.7 is acceptable, between 0.7 and less than 0.9 is good while it is excellent if CR is greater than or equal to 0.9 (Sekaran and Bougie, 2010). **Table 2** summarizes the CR values of the study dimensions and indicators. The results confirm the reliability of the data. Clearly, as all CR values are greater than 0.6 and less than 1 (i.e., range from acceptable to good levels) the overall consistency of the data related to the three pillars of sustainability practices as well as those related to the impact of such practices on organizational performance are confirmed.

Table 2. Composite reliability test.

Dimension	Indicators	Composite Reliability (CR)	
Environmental Practices (EnP)	Materials	0.662	Acceptable
	Water	0.882	Good
	Energy consumption	0.882	Good
	Emissions	0.691	Acceptable
	Waste management	0.810	Good
	Transportation	0.625	Acceptable
	Site management	0.780	Good

Table 2. (*Continued*).

Dimension	Indicators	Composite Reliability (CR)	
Economic Practices (EcP)	Financial performance and risk management	0.731	Good
	Quality assessment	0.662	Acceptable
Social Practices (SoP)	Employment and labor	0.747	Good
	Human rights	0.751	Good
	Social responsibility	0.891	Good
	Worker health and safety	0.640	Acceptable
Impact of sustainability practices (SP) on organizational performance (OP)	Market share	0.870	Good
	Operational performance	0.884	Good
	Environmental performance	0.888	Good
	Economic performance	0.939	Excellent
	Social performance	0.893	Good
	Organizational expansion	0.903	Excellent

4.3. Analysis of sustainability practices

The study utilized a five-point Likert scale to assess the environmental, economic, and social aspects, along with organizational performance of the targeted factories. The questionnaire was designed with closed-format sentence-based questions to facilitate variable comparison and answer analysis. The Likert scale values were designated as: "Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, and Strongly Disagree = 1". Responses were categorized into five equal intervals to determine implementation levels for each indicator. These intervals were computed by dividing the response range (5 for "strongly agree" minus 1 for "strongly disagree") by the number of levels (5 levels) within the Likert scale. The calculation, represented as $(5 - 1)/5 = 0.8$, defines the intervals. The intervals of the Five-Point Likert Scale correspond to distinct levels of implementation as follows: "Very Low" for 1–1.79, "Low" for 1.8–2.59, "Medium" for 2.6–3.39, "High" for 3.4–4.19, and "Very High" for 4.2–5. These intervals effectively categorize responses and provide a clear assessment of implementation levels for the study indicators.

Table 3 shows the level of implementation in a descending order for each indicator for environmental practices, economic practices, social practices and assessing the impact of sustainability practices on organizational performance in Palestinian dairy factories. The results of the environmental practices assessment revealed that the highest average is in the transportation indicator (4.00), reflecting a high level of implementation; most factories adopt optimal number and size of vehicles, and follow best route during product distribution; high attention given to transportation due to its direct influence on cost reduction. Additionally, the results showed relatively less level of implementation in waste management (average 3.69); several factories lack recycling of packaging materials and/or the use of environmentally friendly materials. On the other hand, the lowest average is found in the water indicator (3.08), indicating a medium level of implementation, this arises from the substantial water consumption in dairy factories for cleaning operations, but with least wastewater recycling and reuse practices. Hence, large amounts of

wastewater including volatile milk constituents, fats, and proteins need the use of contemporary techniques such as electrocoagulation technology and specialized filter systems; such techniques efficiently recover water and enable its reuse. Regrettably, these technologies are lacking in many Palestinian dairy factories, this gap highlights the urgent need for modernization to align with sustainable water management practices in the dairy industry.

Table 3. Assessment of sustainability practices and organizational performance.

Environmental Practices (EnP)	**Average**	**Level**
Transportation	4.00	High
Waste management	3.69	High
Materials	3.68	High
Emissions	3.63	High
Energy consumption	3.53	High
Site management	3.65	High
Water	3.08	Medium
Gross EnP	3.61	High
Economic Practices (EcP)	Average	Level
Quality assessment	4.83	Very High
Financial performance and risk management	3.97	High
Gross EcP	4.4	Very High
Social Practices (SoP)	Average	Level
Human rights	4.36	Very High
Worker health and safety	4.33	Very High
Employment and labor	4.09	High
Social responsibility	3.80	High
Gross SoP	4.15	High
Gross Sustainability Practices (SP)	3.92	High
The impact of sustainability practices (SP) on organizational performance (OP)	Average	Level
Social performance	4.03	High
Operational performance	4.03	High
Economic performance	3.99	High
Organizational expansion	3.97	High
Environmental performance	3.82	High
Market share	3.78	High
Gross impact of SP on OP	3.94	High

As also summarized in **Table 3**, the results of the economic practices assessment showed that the quality assessment indicator exhibits the highest average (4.83); which implies a remarkable level of implementation. This indicates, as expected, the adherence of products to the exact specifications of the dairy industry, reinforced by the presence of quality assurance in-house laboratories. Additionally, the financial performance and risk management indicator registers a slightly lower average (3.97),

denoting a high level of implementation; for example, most dairy factories focus on reducing transport and material handling cost, they also focus on profitable environmental practices such as the use of solar energy. Moreover, the factories invest in research and development, and formulate risk-mitigation strategies.

The results of the social practices assessment in **Table 3** show that the highest average is the worker human rights indicator (4.36), which implies very high level of implementation; the factories deal with workers as per the labor law, the workers are aware of their legal rights, they are paid for overtime hours, and no child-labor is in dairy factories. Conversely, the lowest average is the social responsibility indicator (3.80) with high level of implementation; most factories have documented policies to mitigate their impact on the surrounding communities, many factories participate in community development programs and are committed to annual contributions as societal responsibility. Of course, this lowest average (3.8) has to be improved as the dairy sector is one of the main profitable industrial sectors in Palestine. **Figure 2** presents the mean values of all sustainability indicators together ordered in a descending manner. As shown in **Table 3** and **Figure 3**, the highest average is in social performance and operational performance indicators, both indicators display high average of 4.03; this result demonstrates strong contribution of the sustainability practices to meeting the expectations of retailers and end consumers, improving employee skills, promoting quality and brand image, resulting in accurate delivery time, enhancing consumer loyalty, and reducing non-value-added work. On the other hand, the lowest average is the market share indicator (3.78); this indicates that the dairy factories need to strengthen its commitment to sustainable practices, potentially improving its market share status, enhancing its reputation, and increasing its export volume. This notion stems from the realization that pursuing sustainability can boost market competitiveness and expand market penetration, so strengthening the foundation for long-term growth and success.

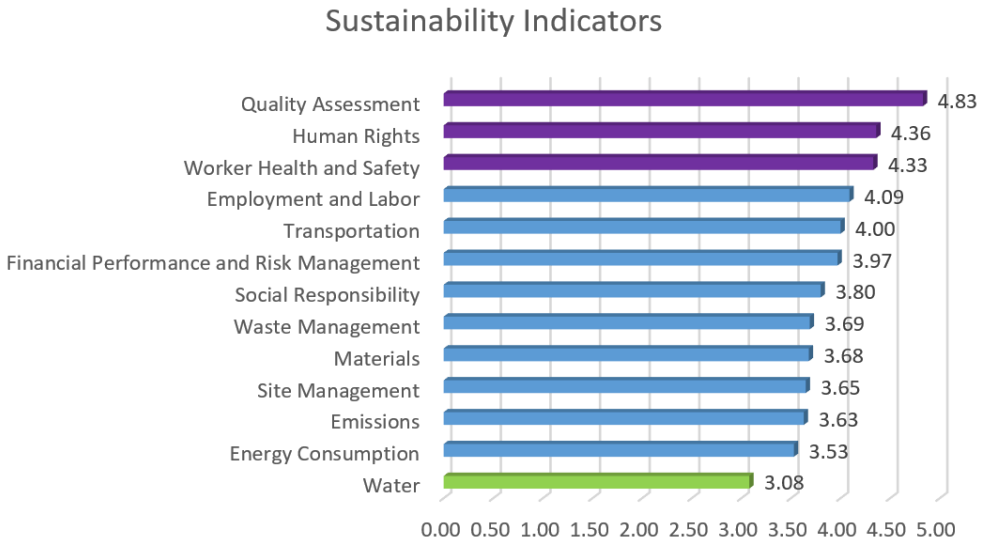

Figure 2. Mean values of sustainability indicators.

Figure 3 presents the mean values of the impact of sustainability practices (SP) on the organizational performance (OP) ordered in a descending manner.

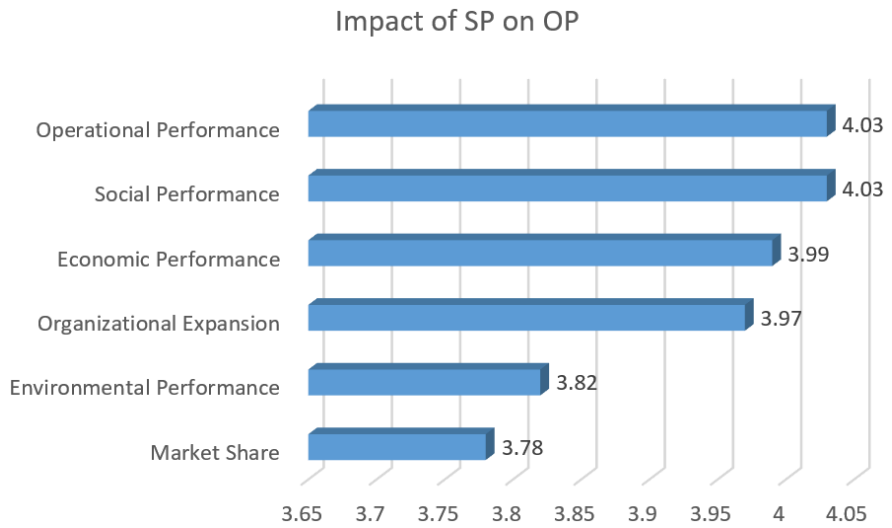

Figure 3. Mean values of impact of sustainability practices on organizational performance.

4.4. Hypothesis testing results

Before testing the hypotheses, the response data on each indicator within its sustainability dimensions were averaged to generate mean values for each sustainability dimension out of 5. More specifically, the mean value of EnP was computed by taking the average of the responses on its seven indicators. Similarly, the mean values of EcP and SoP were computed by averaging the responses on their respective indicators; two for economic and four for the SoP. Collectively, we averaged all these averages to come up with average values on sustainability practices (SP). Also, the mean OP values were computed from the values of its six performance indicators. Having this done, we ended up with five sets of data; namely, the first set includes 15 data points on EnP, the second set includes 15 on EcP, the third set includes 15 on SoP, the fourth set includes 15 on the SP and the last set includes 15 points on OP.

Normality testing on these data sets has been done and none of them proved to be normally-distributed. Hence, non-parametric tests, specifically, the Mann-Whitney test was employed to verify the first hypothesis. Namely, to test if there are significant differences between the median values of sustainability practices of the environmental, economic, and social dimensions. To this end, a pair-wise comparison tests between EnP, EcP and SoP have been done as shown in **Table 4**. When testing the difference between the median EnP and EcP, it was found that there is significant difference between them at significance level 5% and hence, H1 is supported; i.e., there is a difference between the median values of practices. When testing the difference between the median EnP and SoP, it was found that there is significant difference between them at significance level 5% and hence, H1 is also supported; i.e., there is a difference between the median values of practices. However, when testing the difference between the median EcP and SoP, it was found that there is no significant difference between them at significance level 5% and hence, H1 is not supported; i.e., there is no significant difference between the median values of the economic and social practices.

Table 4. Mann-Whitney testing results for sustainability practices (significance level = 5%).

Sample	*N*	Median	Difference	CI for difference	*W*-value	*P*-value	Result
EnP versus EcP							
EnP	15	3.40000	−0.807143	(−1.2928, −0.37857)	150	0.001	H1 is supported
EcP	15	4.42857					
EnP versus EcP							
EnP	15	3.40000	−0.807143	(−1.025, −0.0777778)	176.50	0.021	H1 is supported
SoP	15	4.14444	−0.641667				
EcP versus SoP							
EcP	15	4.42857	0.20000	(−0.028571, 0.45317)	277.00	0.068	H1 is not supported
SoP	15	4.41444					

Other hypotheses are tested using the Minitab program and the following analysis: regression analysis and analysis of variance (One-way ANOVA). Regression analysis is a set of statistical processes for estimating the relationships between a dependent variable and independent variables. R^2 is a statistical measure that represents the proportion of the variance for a dependent variable that is explained by an independent variable or variables in a regression model. The quality of R^2 value depends on the context of research. More specifically, in social contexts, relatively low values of R^2 (less than 50%) are acceptable. On the other hand, Ozili (2022) considers small values of R^2 less than 0.1 are sometimes acceptable in social sciences. However, in financial contexts, large values of R^2 (more than 70%) are desired as they indicate high correlation between the regression variables. As our study is a mix of social and non-social contexts, values of R^2 greater than 0.5 are considered acceptable. In addition, one-way analysis of variance (ANOVA) is a statistical method used to test the hypotheses related to differences among means for three and more groups of data (Kenton, 2021).

To test the second hypothesis, a simple linear regression model was built in which the SP was taken as the independent variable while OP was taken as the dependent (response) variable. It was found that the regression model of these two variables is as given in Equation (1):

$$\mathrm{OP} = -1.149 + 1.255 \times \mathrm{SP} \quad (1)$$

The ANOVA of the model is shown in **Table 5**. Clearly, at significance level of 5%, **Figure 4** shows the regression model, which is significant as the *p*-value is less than 0.05. The coefficient of determination (R^2) value was found to be 57.55% which means that the sustainability practices (SP) roughly explains more than 50% of the variability in the organizational performance (OP) in Palestinian dairy industry. The value of R^2 is of medium level.

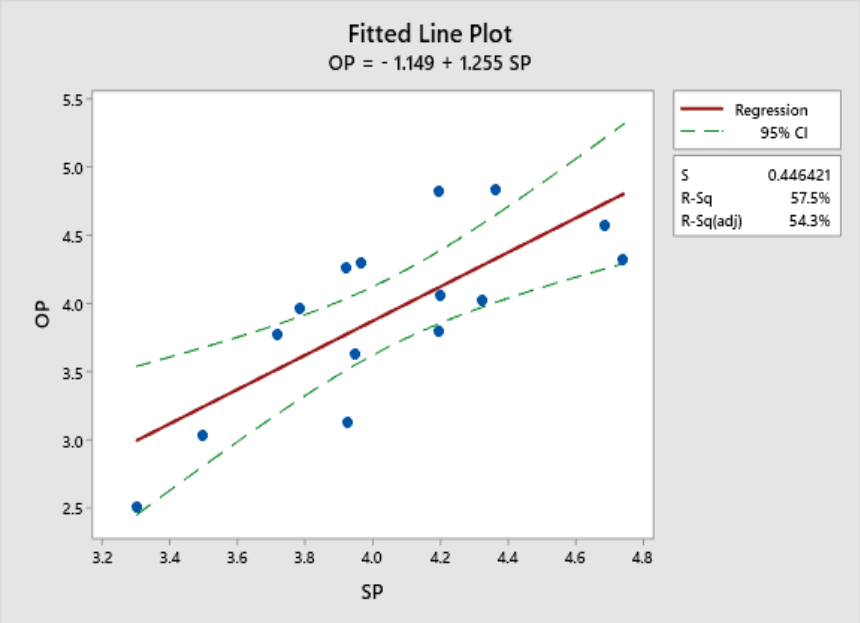

Figure 4. Regression analysis of SP and OP.

Table 5. ANOVA of regression model 1 (H2).

Source	DF	SS	MS	*F*-value	*P*-value	R^2	Result
Regression	1	3.51208	3.51208	17.62	0.001	57.55%	H2 is supported
Error	13	2.59079	0.19929				
Total	14	6.10288					

To investigate whether the regression model is adequate or not, the normality test for the error terms (residuals) has been done and found to be normal with almost zero mean, constant standard deviation and *p*-value of 0.181 (>0.05) using Minitab analysis.

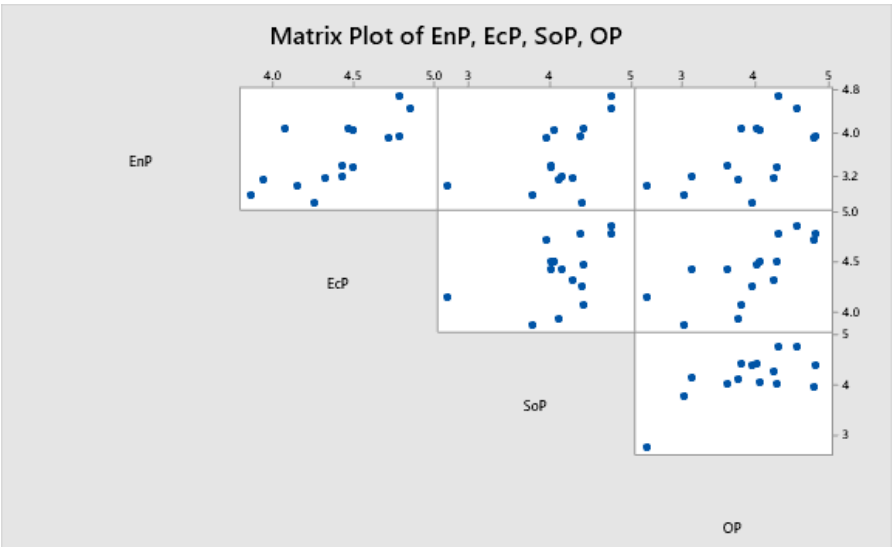

Figure 5. The scatter matrix for regression model 2.

To investigate H2en, H2ec and H2so, a multiple linear regression model that relates EnP, EcP and SoP with OP, has been built. Firstly, a scatter matrix between the three independent variables (EnP, EcP and SoP) with the dependent (response)

variable OP was drawn as shown in **Figure 5**.

Next, a stepwise selection of terms regression analysis method, with the default values of alpha to enter and alpha to leave of 0.15, was used in Minitab to build the regression model. The results revealed the following model:

$$\mathrm{OP} = -3.32 + 1.062 \times \mathrm{EcP} + 0.622 \times \mathrm{SoP} \quad (2)$$

Clearly, only economic and social sustainability (EcP and SoP) practices contribute positively to the organizational performance (OP) while the environmental practices (EnP) did not prove to have impact on OP. The ANOVA of the model is given in **Table 5**. As shown in the ANOVA the regression that both EcP and SoP have significant impact on OP as their *p*-values are less than 0.05 and hence the regression model is significant. Hence, H2ev is not supported (i.e., no impact of EnP on OP), while both H2ec and H2so are supported; i.e., there are significant impacts of both economic and social practices on the organizational performance of Palestinian dairy industry.

The ANOVA of the model is shown in **Table 6**. Clearly, at significance level of 5%, the regression model is significant as the *p*-value is less than 0.05. The coefficient of determination (R^2) value was found to be 66.59%; which means that both the economic and social sustainability practices (EcP and SoP) roughly explain about 66% of the variability in the organizational performance (OP) in Palestinian dairy industry. This value of R^2 is of medium level also as that in model 1.

To investigate whether the regression model is adequate or not, the normality test for the error terms (residuals) has been done and found to be normal with almost zero mean, constant standard deviation and *p*-value of 0.713 (>0.05) using Minitab analysis.

Table 6. ANOVA of regression model 1 (H2ec, H2en*, H2so).

Source	DF	Adj SS	Adj MS	*F*-Value	*P*-Value	R^2	Result
Regression	2	4.0639	2.0319	11.96	0.001		H2 is supported
EcP	1	1.1866	1.1866	6.98	0.021		H2ec is supported
SoP	1	0.9729	0.9729	5.73	0.034	66.59%	
Error	12	2.0390	0.1699	-	-		H2so is supported
Total	14	6.1029	-				

* H2en is not supported as it is not included in the regression model.

Moreover, **Table 7** proves that no multi-collinearity between the model independent variables have been found as all variance inflation factors (VIF) are less than 3.

Table 7. Multi-collinearity testing of model 2.

Term	Coef	SE Coef	*T*-Value	*P*-Value	VIF
Constant	−3.32	1.58	−2.09	0.058	-
EcP	1.062	0.402	2.64	0.021	1.28
SoP	0.622	0.260	2.39	0.034	1.28

Any regression model should satisfy some conditions to be adequate. More specifically, first the VIF of the independent variables (EcP and SoP) should be less

than 3 or 5 to confirm the non-existence of multi-collinearity (Montgomery and Runger, 2018). Second, the distribution of the residual (error) values should be normally-distributed with zero expected value and constant variance. Testing for normality revealed the satisfaction of the second condition as shown in **Figure 6**.

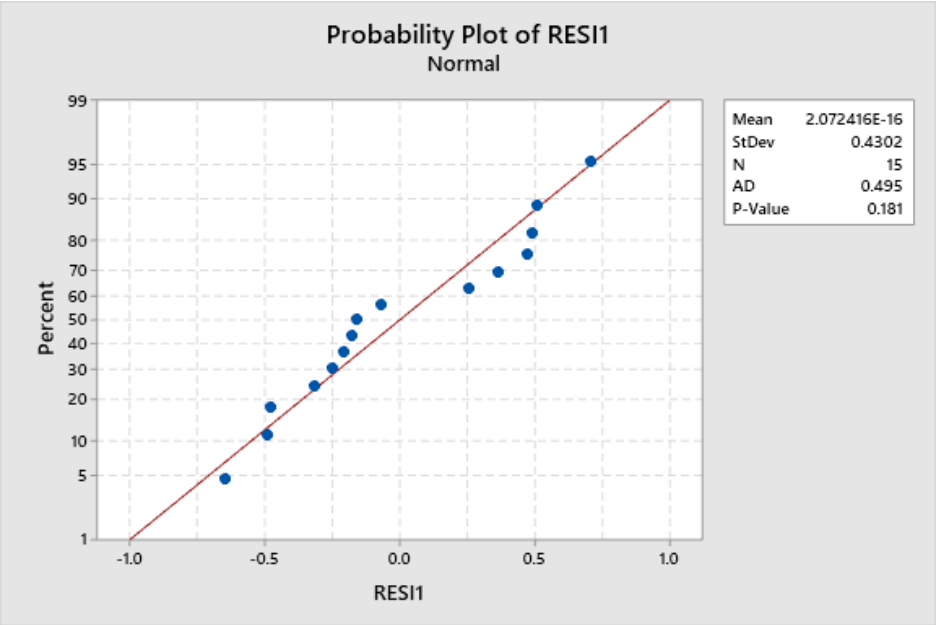

Figure 6. Normality testing of residual (RESI1) values.

4.5. Discussion of results

The current study investigated the impact of sustainability practices on the organizational performance in the Palestinian dairy industries. Based on the analysis and results, environmental sustainability practices (EnP) and social sustainability practices (SoP) proved to be of high levels where as the economic sustainability practices (EcP) proved to be of very high level in the diary industries. However, the non-parametric Mann-Whitney testing results proved that the median score of practices differ significantly at a significance level of 5% which supports the first hypothesis (H1). These findings coincide with those in Zanin et al. (2020), where all environmental, economic and social sustainability practices were found to be of high levels in rural farms supply chain of the western region of Santa Catrarina in Brazil, however, the authors did not test the differences between these levels statistically.

Within another developing country context, Attia et al. (2022) conducted a study to assess the sustainability practices in small dairy farms in Tunisia. They found that agroecological (environmental) and economic dimensions are high which agrees with our findings, however, to the contrary of our findings, the social practices were found to be of low level. One more difference between our study and that of Attia et al. (2022) is that their study focused only on assessing the sustainability practices, whereas our study is more comprehensive in that it considered, in addition to assessment, investigating the impact of these practices on the organizational performance in dairy industries.

At the indicator levels, the assessment of sustainability practices at the individual indicator level revealed that the levels of practices range from medium (3.08) for water

(environmental indicator) to very high (4.83) for quality assessment (economic indicator). This is an expected logical result; it is mainly attributed, as we mentioned before, to the nature of dairy industry which consumes large amounts of fresh water in processing and generated large amounts of wastewater (mostly not treated in Palestine), and hence the water indicator was found to be of medium level compared to other indicators. On the other hand, for the purpose of quality assurance and food safety, which are obligatory requirements in all milk-derivative dairy products, the quality assessment indicator proved to be highly-practiced in these industries. These results are supported by the work done by Srairi et al. (2019) who examined several key elements of sustainability including, water, gender and diversity with a specific focus on developing countries in Africa.

Concerning quality assurance and certification, **Table 1** shows that more than two-thirds of dairy industries in Palestine hold at least one certificate in quality assurance which supports the finding of having high level of the quality assurance indicator. Due to the importance of this issue in diary industry, a recent study by McGarr-O'Brien et al. (2023) went beyond quality assurance certification to investigate the sustainability certification standards in dairy industries. To this end, authors compared 19 global standards with respect to the three pillars of sustainability (economic, environmental and social). They found that the environmental pillar is most frequently and compressively investigated, followed by the social pillar while the economic pillar is less frequently and comprehensively addressed. Variability in standards would give farmers more flexibility in choosing the standard that fits their situation; however, it might create mistrust between farmers and consumers.

The results of testing the second hypothesis that is related to studying the impact of the sustainability practices on the organizational performance, revealed that economic (EcP) and social (SoP) sustainability practices have significant impact on organizational performance (OP), while environmental (EnP) practices proved to have no impact. The regression analysis showed that EcP and SoP loosely explains about 66% of the variability in the OP in dairy industries. This result highlights the importance of enhancing the sustainability practices (specifically, EcP and SoP) for enhancing the OP in dairy factories. However, EcP proved to have almost the double impact on OP compared to SoP as shown in Equation (2) where the rate of change of OP with respect to EcP is 1.026 while that of OP with respect to SoP is 0.622. The reason behind having no significant impact of environmental practices (EnP) on OP in this study is mainly the negative environmental practices of dairy industries represented by waste management, materials, site management, emissions, energy and water-related indicators as shown in **Figure 2**. Similar to our study, studying the relationships between sustainability practices and performance has been conducted by Kumar and Choubey (2023) and Zira (2023). More specifically, Kumar and Choubey (2023) developed a sustainable assessment system using fuzzy analytic methods for enhancing some SGDs and sustainable performance. However, Zira et al. (2023) assessed three cattle systems in South Western Europe in an integrative model that integrates life cycle sustainability assessment (LCSA) with assessment of feed-food competition and economic robustness.

5. Conclusions and recommendations

5.1. Conclusions

This study delved into assessing the influence of sustainability practices on the organizational performance of the Palestinian dairy sector, which commands a significant 75% market share. With a focus on the sector's long-term viability, a comprehensive evaluation of sustainability across environmental, social, and economic dimensions was conducted. This assessment was facilitated through a designed data collection tool, encompassing demographic information, sustainability practices evaluation (environmental, economic, and social), and the impact of these practices on organizational performance. Specifically, data pertinent to the three pillars of sustainability as well as the organizational performance was collected from a randomly selected sample from dairy industry in Palestine. A robust sustainability-organizational performance framework was developed, and inferential statistical analyses were conducted on the data using Minitab. The results revealed that there was a difference between the median values of environmental and economic practices and between the median values of environmental and social practices. However, there was no significant difference between the median values of economic and social practices. Additionally, the results showed that there was a medium relationship between sustainability practices and organizational performance. However, the economic practices proved to have the strongest impact then social practices. While, there was no impact of environmental practices on organizational performance, this is because dairy factories do not implement serious environmental practices to make production cost as per minimum. The results showed that this industry consumes larger amount of water as well as it generates large amounts of wastewater; most of which is discharged to the public sewage system without treatment for recycling or reuse, and large amounts of packaging materials that are randomly disposed in the local municipal solid waste system.

5.2. Recommendations

To enhance the long-term sustainability practices of Palestinian dairy factories, the following recommendations are stated:

- Enhance commitment to sustainable practices: More commitment to sustainable practices improves organizational performance in general.
- Further invest in renewable energies: Establish a strategy to optimize the utilization of solar energy, and prioritize research and development in this domain.
- Adopt pollution minimization strategies: Develop long-term strategies to reduce pollution such as recycling of packaging materials and further optimizing transportation, drawing insights from successful international dairy factories' experiences.
- Elevate hygiene and water management: Upgrade equipment and technology to enhance hygiene practices and implement effective water management strategies and technologies, including recycling and reuse to minimize disposed wastewater quantities.

- Raise awareness and training: Educate factory management, employees, and stakeholders about the significance of sustainability and its positive impacts on organizational performance and hence competitiveness.
- Disseminate sustainable approaches: Incorporate sustainable practices into worker training, with a focus on minimizing resource consumption and generated waste, hence increasing overall production efficiency.
- Emphasize social practices: Prioritize social engagement strategies such as participation in social development events, distributing samples, and enhancing social responsibility contributions to increase customers' satisfaction and expand market share.
- Strategic factory location: Select industrial areas for factory establishment, ensuring distance from residential and agricultural zones to mitigate impact on health and agriculture.
- Pursue certification: Encourage dairy factories to pursue relevant certifications for enhancing their market position, cost-efficiency, product quality, and potential expansion and export.
- Focus on market share: Recognize the vital role of market share in organizational performance, as it enhances competitiveness, efficiency, innovation, and income potential.
- Enforce abidance to official regulations: Responsible governmental bodies should follow up and enforce dairy factories to abide to the official environmental regulations in particular.

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References

Abboushi, N., & Alsamamra, H. (2021). Achievements and barriers of renewable energy in Palestine: Highlighting Oslo Agreement as a barrier for exploiting RE resources. Renewable Energy, 177, 369–386. https://doi.org/10.1016/j.renene.2021.05.114

Al Nasour, J., Najm, N. A., & Yousif, A. H. (2017). Sustainability and Its Role in Organizational Performance in The Jordanian

Pharmaceutical Industry. In: Proceedings of the 15th Scientific Annual.

Al-Bitawi, W. (2019). Developing competitiveness and increasing the market share of the national product: The Palestinian food industry sector. Palestinian Economic Policy Research Institute (MAS).

Al-Rai, M. I. (2004). A working paper on the dairy industry in Palestine. Ministry of National Economy.

Ameer, R., & Othman, R. (2012). Sustainability Practices and Corporate Financial Performance: A Study Based on the Top Global Corporations. Journal of Business Ethics, 108(1), 61–79. https://doi.org/10.1007/s10551-011-1063-y

Arman, H., Ramahi, A., Abubasha, F., et al. (2013). Assessment of perspectives and challenges on sustainability in Palestine. In: Proceedings of the 11th Global Conference on Sustainable Manufacturing.

Asaad, M., & Barakat, T. (2016). Dairy factories operate at 30% of their productive capacity. Palestine Economy Portal.

Attia, K., Darej, C., M'Hamdi, N., et al. (2022). Assessment of the sustainability of small dairy farms in the North of Tunisia. BASE, 26(3), 166–177. https://doi.org/10.25518/1780-4507.19826

Baxter, K., Courage, C., & Caine, K. (2015). Understanding your users: A practical guide to your user research methods, 2nd ed. Morgan Kaufmann.

Bilgin, N., Yetimoglu, T., & Ozel, C. (2012). Use of waste marble powder in brick industry. Construction and Building Materials, 29, 449–457. https://doi.org/10.1016/j.conbuildmat.2011.10.011

Boguniewicz-Zablocka, J., Klosok-Bazan, I., & Naddeo, V. (2017). Water quality and resource management in the dairy industry. Environmental Science and Pollution Research, 26(2), 1208–1216. https://doi.org/10.1007/s11356-017-0608-8

Bond, A., Morrison-Saunders, A., & Pope, J. (2012). Sustainability assessment: The state of the art. Impact Assessment and Project Appraisal, 30(1), 53–62. https://doi.org/10.1080/14615517.2012.661974

Braik, A., Saleh, Y., & Jaaron, A. A. M. (2023). Green marketing practices and organizational sustainable performance in developing countries context: An empirical study. Journal of Foodservice Business Research, 1–41. https://doi.org/10.1080/15378020.2023.2205337

Buys, L., Mengersen, K., Johnson, S., et al. (2014). Creating a sustainability scorecard as a predictive tool for measuring the complex social, economic and environmental impacts of industries, a case study. Journal of Environmental Management, 133, 184–192. https://doi.org/10.1016/j.jenvman.2013.12.007

Deif, A. M. (2011). A system model for Green Manufacturing. Journal of Cleaner Production, 19(14), 1553–1559.

El-Khalil, R., & Mezher, M. A. (2020). The mediating impact of sustainability on the relationship between agility and operational performance. Operations Research Perspectives, 7, 100171. https://doi.org/10.1016/j.orp.2020.100171

Euromilk. (2018). Reusing water in the dairy sector. Available online: https://eda.euromilk.org/old-pages/read/article/reusing-water-in-the-dairy-sector.html (accessed on 25 September 2023).

Feil, A. A., Schreiber, D., Haetinger, C., et al. (2020). Sustainability in the dairy industry: a systematic literature review. Environmental Science and Pollution Research, 27(27), 33527–33542. https://doi.org/10.1007/s11356-020-09316-9

Ferreira, F. U., Robra, S., Ribeiro, P. C. C., et al. (2020). Towards a contribution to sustainable management of a dairy supply chain. Production, 30. https://doi.org/10.1590/0103-6513.20190019

Food and Agriculture Organization (FAO) of the United Nations. (n.d.). Gateway to dairy production and products: Health hazards. Available online: https://www.fao.org/dairy-production-products/products/health-hazards/en/ (accessed on 25 September 2023).

Galliano, D., & Siqueira, T. T. S. (2021). Organizational design and environmental performance: The case of French dairy farms. Journal of Environmental Management, 278, 111408. https://doi.org/10.1016/j.jenvman.2020.111408

Grout, L., Baker, M. G., French, N., et al. (2020). A Review of Potential Public Health Impacts Associated With the Global Dairy Sector. GeoHealth, 4(2). https://doi.org/10.1029/2019gh000213

Jafari, M. (2017). Assessing the Impact of Sustainable Practices on Organizational Performance [PhD thesis]. Concordia University.

Juuti, K., Andrade, I., Araújo e Sá, M. H., et al. (2021). Framework for education for sustainability: Enhancing competences in education. UA Editora. https://doi.org/10.48528/e94f-8142

Knips, V. (2005). Developing Countries and the Global Dairy Sector Part I Global Overview (Pro-Poor Livestock Policy Initiative, 58). Food and Agriculture Organization of the United Nations.

Kumar, M., & Choubey, V. K. (2023). Sustainable Performance Assessment towards Sustainable Consumption and Production: Evidence from the Indian Dairy Industry. Sustainability, 15(15), 11555. https://doi.org/10.3390/su151511555

Kichili, H. (2020). Assessment of raw milk supply change challenges in Meru District [Master's thesis]. Institute of Accountancy

Arusha.

Lior, N. (2008). Energy resources and use: The present situation and possible paths to the future. Energy, 33(6), 842–857. https://doi.org/10.1016/j.energy.2007.09.009

McGarr-O'Brien, K., Herron, J., Shalloo, L., et al. (2023). Characterising sustainability certification standards in dairy production. Animal, 17(7), 100863. https://doi.org/10.1016/j.animal.2023.100863

Miller, T. R., Wiek, A., Sarewitz, D., et al. (2013). The future of sustainability science: A solutions-oriented research agenda. Sustainability Science, 9(2), 239–246. https://doi.org/10.1007/s11625-013-0224-6

Montgomery, D. C., & Runger, G. C. (2018). Applied statistics and probability for engineers, 8th ed. John Wiley & Sons.

Munyaneza, C. (2018). Assessing sustainability of smallholder dairy and traditional cattle milk production systems in Tanzania. Sokoine University of Agriculture.

Ndambi, A., Pishgar Komleh, H., & van der Lee, J. (2020). An overview and analysis of integral tools to monitor people, planet and profit sustainability dimensions of dairy development in East Africa. Wageningen Livestock Research.

Organization of Economic Cooperation and Development (OECD) & Food and Agriculture Organization of the United Nations. (2021). Dairy and dairy products. OECD-FAO Agricultural Outlook 2020-2029. Available online: https://www.oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2020-2029_aa3fa6a0-en (accessed on 25 September 2023).

Ozili, P. K. (2022). The Acceptable R-Square in Empirical Modelling for Social Science Research. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4128165

Palestinian Central Bureau of Statistics PCBS. (2020). Available online: https://www.pcbs.gov.ps/ (accessed on 25 September 2023).

Palestinian Food Industries Federation PFIF. (2021). Palestinian News & Info Agency—Wafa. Available online: https://info.wafa.ps/ar_page.aspx?id=9669 (accessed on 25 September 2023).

Ramahi, A., Saleh, Y., Binsaddig, R., et al. (2023). Assessing the waste management practices in stone and marble industry in Palestine: Practical implications. Applied Mathematics & Information Sciences, 17(4), 663–671. https://doi.org/10.18576/amis/170415

Raya Media Network. (2019). Policy Monitor: Small farmers are the base of dairy industry development. Available online: https://www.raya.ps/news/1067760.html (accessed on 25 September 2023).

Satoloa, E. G., de Camposb, R. S., de Andrade Ussunaa, G., et al. (2020). Sustainability Assessment of logistics activities in a dairy: An example of an emerging economy. In: Sustainability in Transportation and Logistics. PwC Germany.

Sraïri, M. T., Chatellier, V., Corniaux, C., et al. (2019). Reflections on the development of the dairy sector and its sustainability in different parts of the world (French). INRA Productions Animales, 32(3), 339–358. https://doi.org/10.20870/productions-animales.2019.32.3.2561

Satolo, E. G., Campos, R. S. de, Ussuna, G. de A., Simon, A. T., et al. (2020). Sustainability Assessment of logistics activities in a dairy: An example of an emerging economy. Production, 30. https://doi.org/10.1590/0103-6513.20190036

Sekaran, U., & Bougie, R. (2010). Research Methods for Business: A Skill Building Approach, 5th ed. John Wiley & Sons.

Singh, A. B., Bhakar, V., Gaurav, G., et al. (2024). Environmental sustainability of milk production: a comparative environmental impact analysis and sustainability evaluation. Frontiers in Sustainability, 5. https://doi.org/10.3389/frsus.2024.1352572

Sumuni, C. (2019). Sustainability Performance in Supply Chain of Dairy Products: Examining the Constraints of Dairy Sector Using Value Chain Approach in Northern Regions, Tanzania. European Journal of Business and Management, 11(32).

Thöni, V., & Matar, S. K. I. (2019). Solid Waste Management in the Occupied Palestinian Territory West Bank including East Jerusalem & Gaza Strip. Overview Report. Heinrich Böll Stiftung.

Tibi, N., & Ramahi, A. (2005). The effect of efficient lighting on the environment: pilot project in Palestine. Clean Technologies and Environmental Policy, 7(3), 213–218. https://doi.org/10.1007/s10098-005-0274-2

von Keyserlingk, M. A. G., Martin, N. P., Kebreab, E., et al. (2013). Invited review: Sustainability of the US dairy industry. Journal of Dairy Science, 96(9), 5405–5425. https://doi.org/10.3168/jds.2012-6354

Wattiaux, M. A. (2023). Sustainability of dairy systems through the lenses of the sustainable development goals. Frontiers in Animal Science, 4. https://doi.org/10.3389/fanim.2023.1135381

White, G. P. (1996). A survey and taxonomy of strategy-related performance measures for manufacturing. International Journal of Operations & Production Management, 16(3), 42–61. https://doi.org/10.1108/01443579610110486

Zanin, A., Dal Magro, C. B., Kleinibing Bugalho, D., et al. (2020). Driving Sustainability in Dairy Farming from a TBL Perspective: Insights from a Case Study in the West Region of Santa Catarina, Brazil. Sustainability, 12(15), 6038.

https://doi.org/10.3390/su12156038

Zira, S., Röös, E., Rydhmer, L., et al. (2023). Sustainability assessment of economic, environmental and social impacts, feed-food competition and economic robustness of dairy and beef farming systems in South Western Europe. Sustainable Production and Consumption, 36, 439–448. https://doi.org/10.1016/j.spc.2023.01.022