University of Patras

Greece

SymbioTech

Department of Food Science & Technology

Industrial Symbiosis Readiness
The case of the Greek food sector

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Webinar:
Digital Industrial Symbiosis: Advancing Sustainability and Innovation
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The structure of the presentation

1. Literature review in IS (motives, definition, application, publication)
2. The literature gap and future research agenda
3. The aim of the study
4. Defining IS readiness and Research question
5. Methodology
6. Results
7. Conclusions & practical implications
8. Limitations and future research recommendations

Management of resources and sustainability

Industrial Symbiosis

Nowadays, there is an alarming need for industrial companies to find resource-intensive solutions to deal with the current environmental concerns including sustainability.

Industrial Symbiosis

Transitioning to a sustainable and resource-efficient society requires the adoption of new, cleaner ways of producing goods.

Industrial Symbiosis (IS)

Industrial Symbiosis

Several initiatives are moving companies towards increased resource and energy efficiency, and a more sustainable industrial system.

Industrial Symbiosis

One such initiative is Industrial Symbiosis (IS).

IS definition

Industrial Symbiosis

IS is a synergistic association between two or more industries wherein the waste or by-products of one industry become the raw materials or immediate materials of another industry, thus, fostering a closed-loop system.

Industrial Symbiosis

IS is considered a way for industries to engage into the transition towards a more ecological and ethical approach to business and has been proved to be a strong ally for the achievement of environmental, economic and social objectives.

Industrial Symbiosis (IS) and Circular Economy (CE)

Industrial Symbiosis

Through the implementation of IS business models in the industrial sector, the principles of Circular Economy (CE) are practically implemented. Thus, IS is considered as a subfield of CE.

Industrial Symbiosis

The development of IS is part of the European Union's sustainable industry policy programme and the Green Deal.

IS implementation

Industrial Symbiosis

Although, cases of IS have been growing over recent years and are scattered all over the world whether in developed regions, or in countries with developing economies,

Industrial Symbiosis

the development of IS networks is still lagging globally and specifically in Europe. Authors support the view that IS implementation is slow and that it has gained notoriety in the international context.

IS in the food sector

Industrial Symbiosis

IS is a novel approach that can be applied for the minimization of food waste which is a significant challenge in the global food industry.

Industrial Symbiosis

The understanding of the intersection of IS and food intricate networks is vital for developing sustainable solutions that promote harmony between industry and nature.

Industrial Symbiosis publication

Industrial Symbiosis

Industrial symbiosis is an important topic in the literature that has recently attracted noteworthy attention by researchers and scholars. As a result, many papers in the field of IS have been written by authors across the globe.

Industrial Symbiosis

The different levels of IS application, IS frameworks, methods, and tools, the impacts of IS, the new trends in IS, are among the main topics examined in the published articles.

Literature gap

1. There is a limitation of studies about the companies' readiness to implement IS.

2. The appropriateness of IS for the food sector has not been extensively examined.

Research study on IS in food sector

Need for further research

1. Determine companies' willingness for IS.
2. Analyze the current situation of IS by region and industry.
3. Study IS in the food supply chain and the agricultural sector.

The purpose of the study

To determine the readiness of the Greek food manufacturing companies to implement IS.

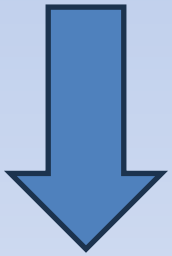
IS dimensions to diagnose IS readiness

The IS dimensions identified in the literature to formulate an assessment tool to diagnose IS readiness are the following:

- the exchange resources dimension which diagnoses the company's ability to have the necessary exchange resources to IS implementation (water, energy, by-products, and waste),
- the exchange capacity dimension which diagnoses the company's enabler factors to IS implementation (trust, information, access conditions, and infrastructure).

Research question

- In Europe and Asia there is a higher prevalence of IS.
- The manufacturing sector is the one that presents the highest prevalence in the IS relations.
- The agricultural companies are among those actively involved in the IS networks in Europe, the USA, China, India and Australia.
- IS practitioners undervalue the need to integrate agricultural/food companies into IS networks.



RQ: What is the readiness of the Greek food manufacturing companies to implement IS?

Methodology 1/2

A questionnaire survey instrument was designed.

The items of IS dimensions were drawn from the studies of Agudo et al. (2022, 2023).

The draft questionnaire was checked by three academicians and three practitioners. A pilot study was conducted based on a sample of 5 food companies.

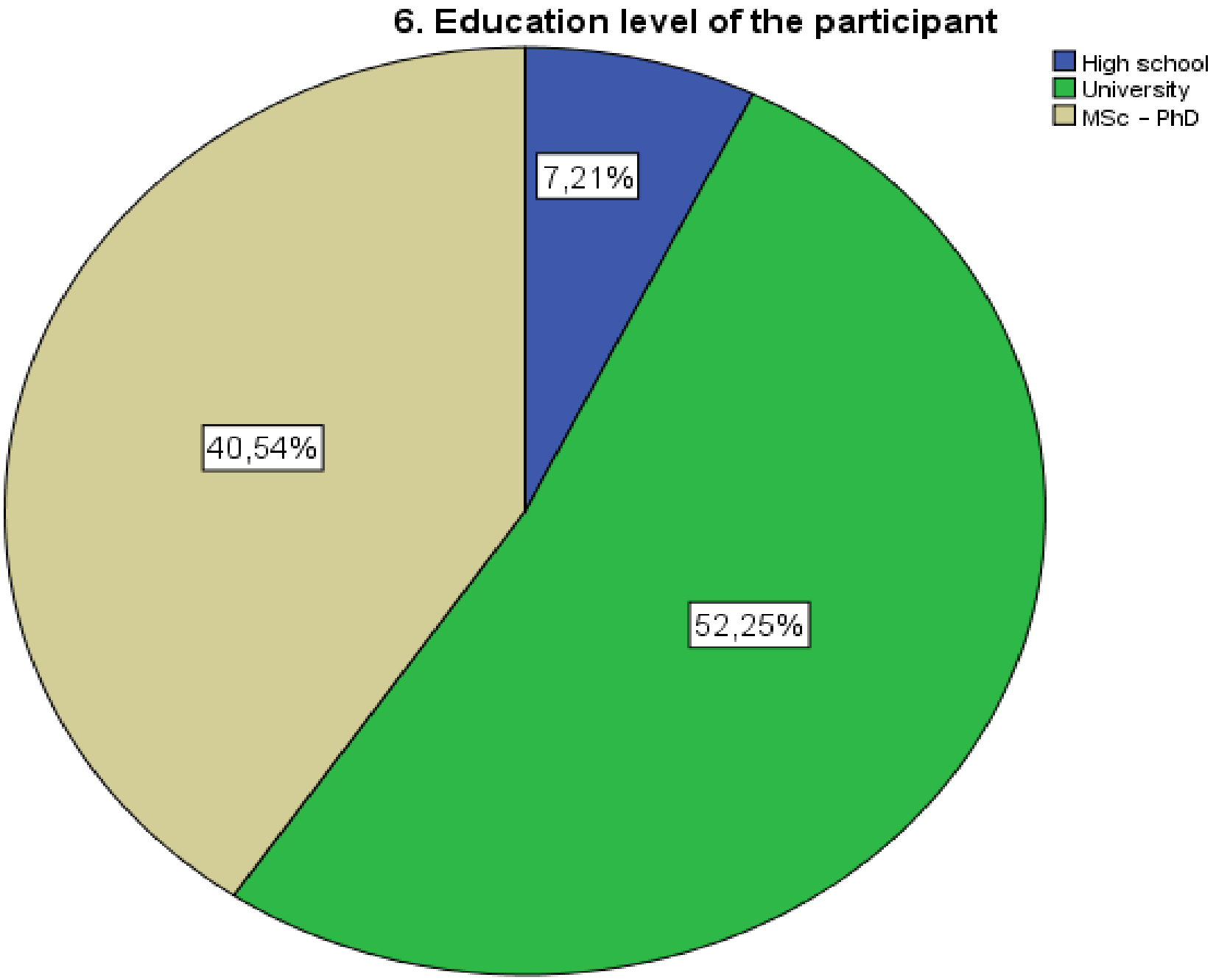
A seven-point Likert scale (1 represented “strongly disagree” and 7 represented “strongly agree”) was used.

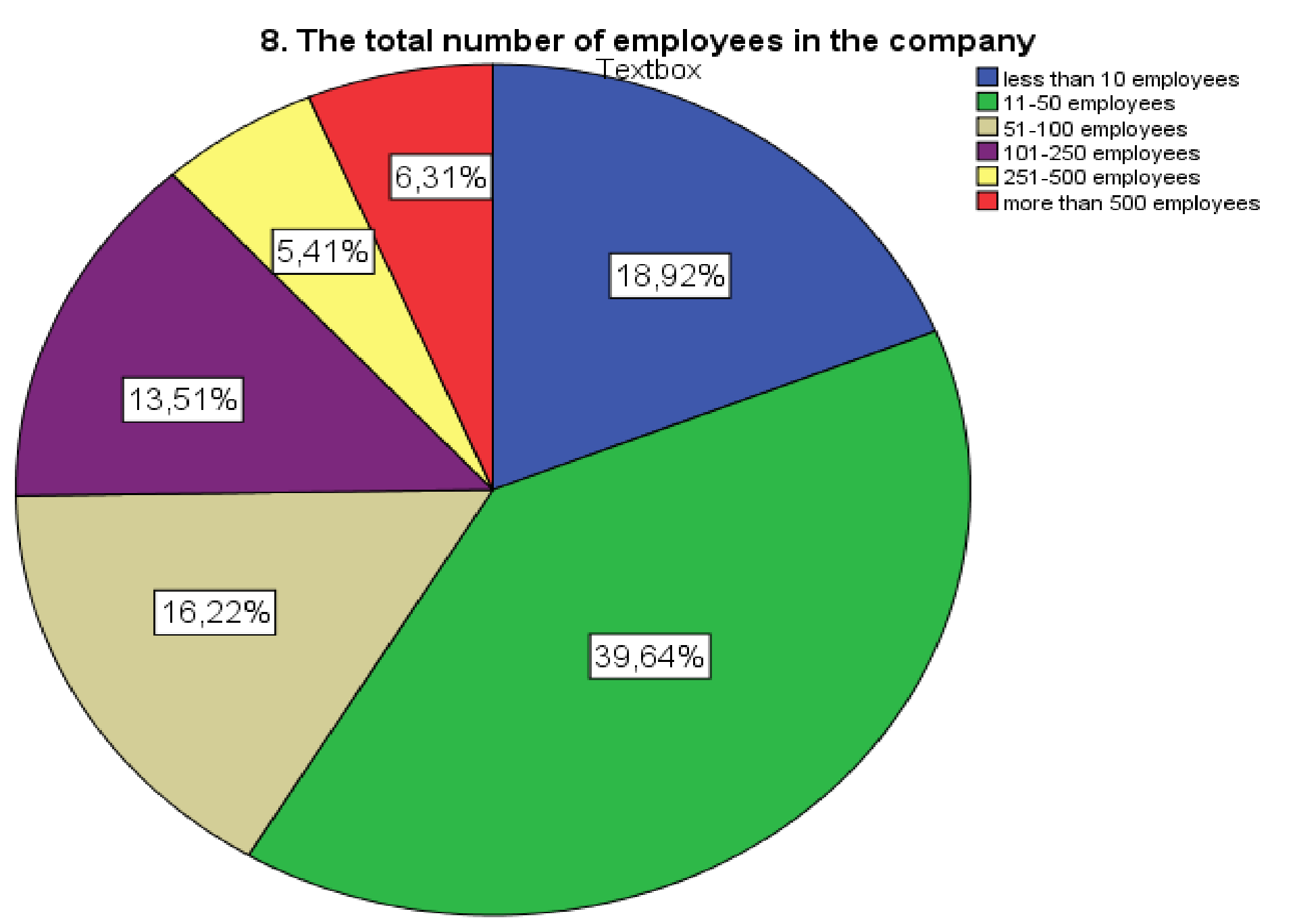
Methodology 2/2

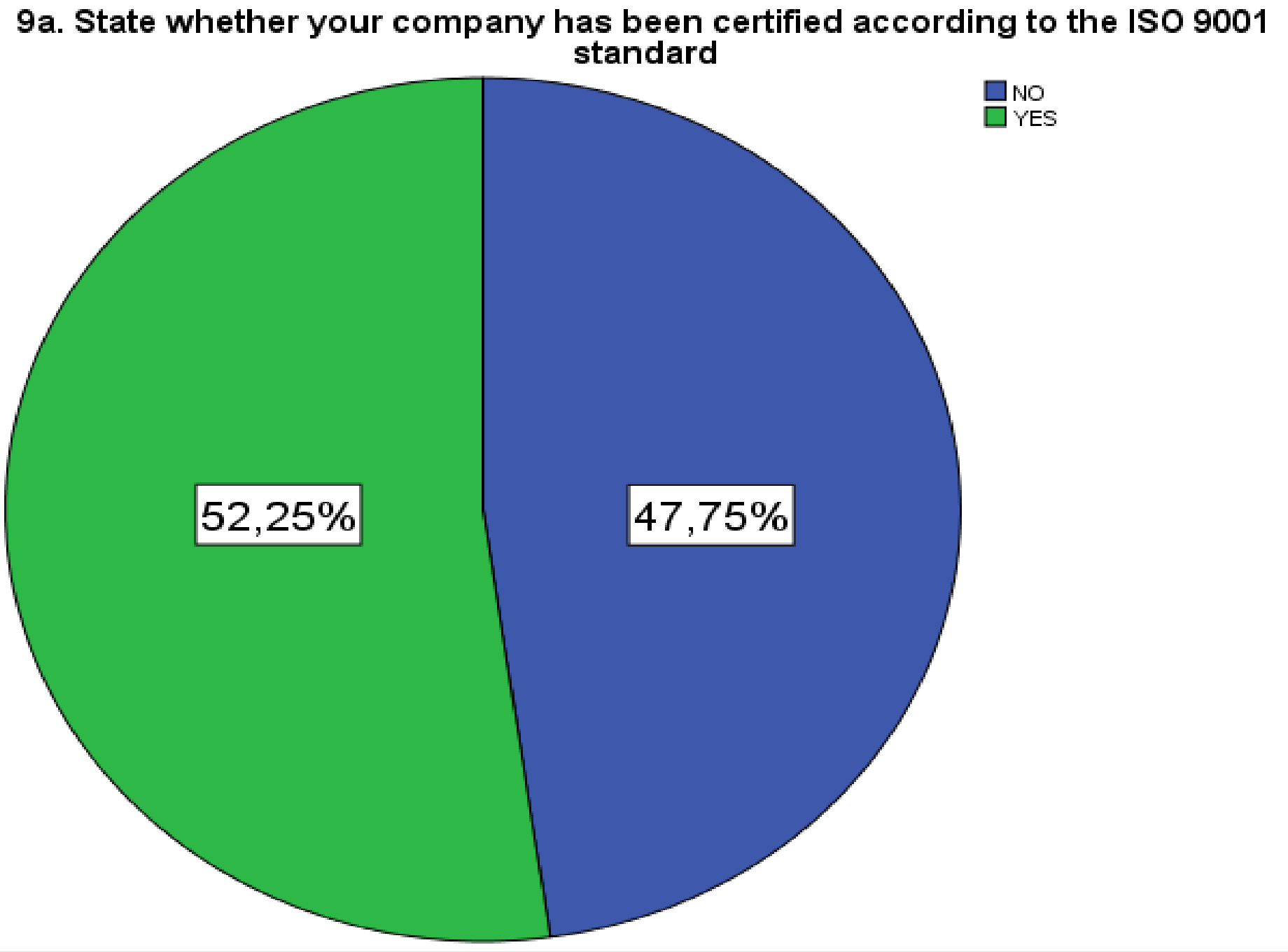
The questionnaire was sent to the CEO of 500 Greek food manufacturing companies randomly selected from the full list of the 1794 food manufacturing companies of ICAP.

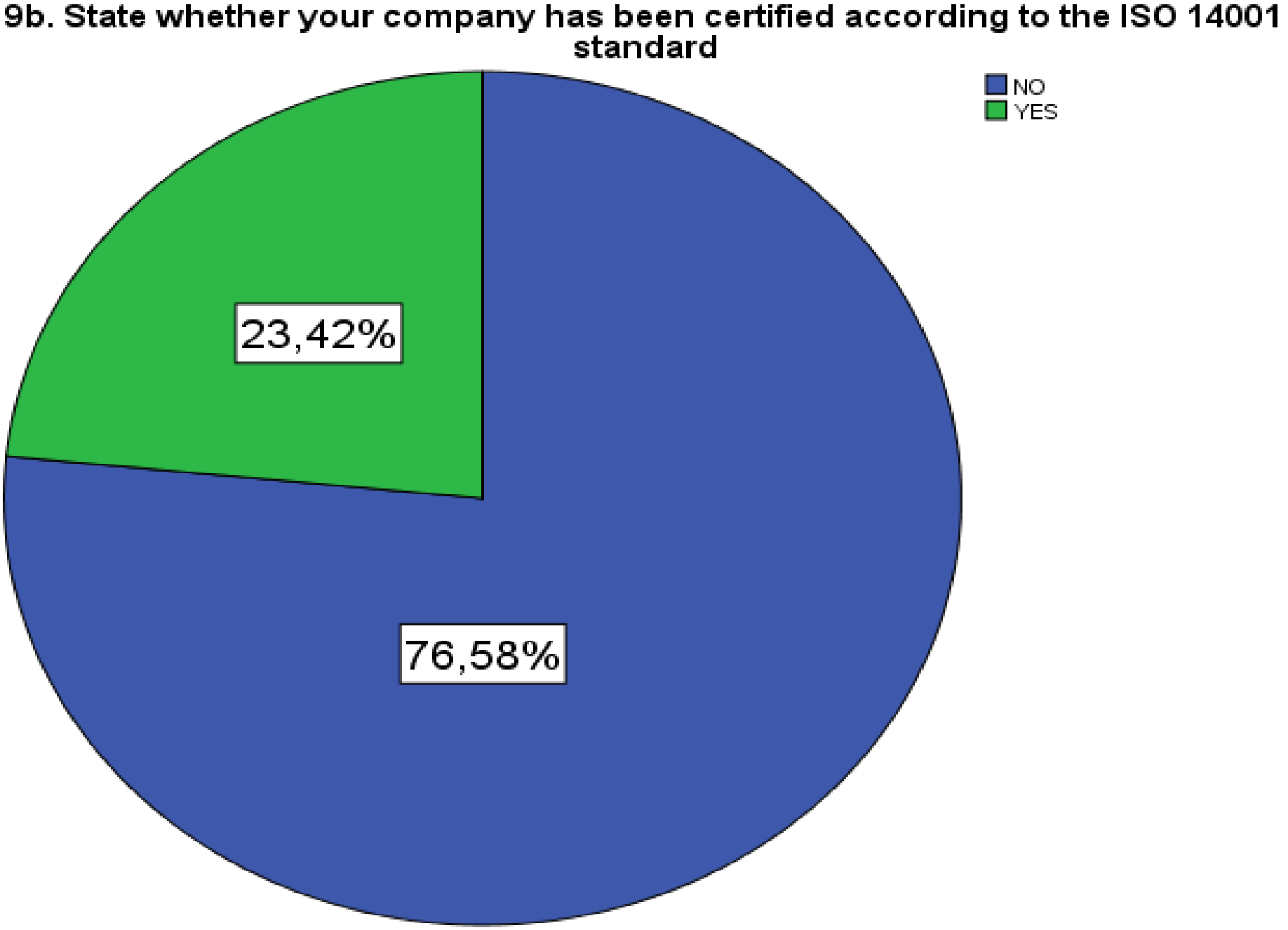
111 valid questionnaires were collected - a response rate of 22.2%. The time-period of the questionnaire survey was from January 2025 to March 2025.

Descriptive statistics and correlation analysis were applied to analyze the data.

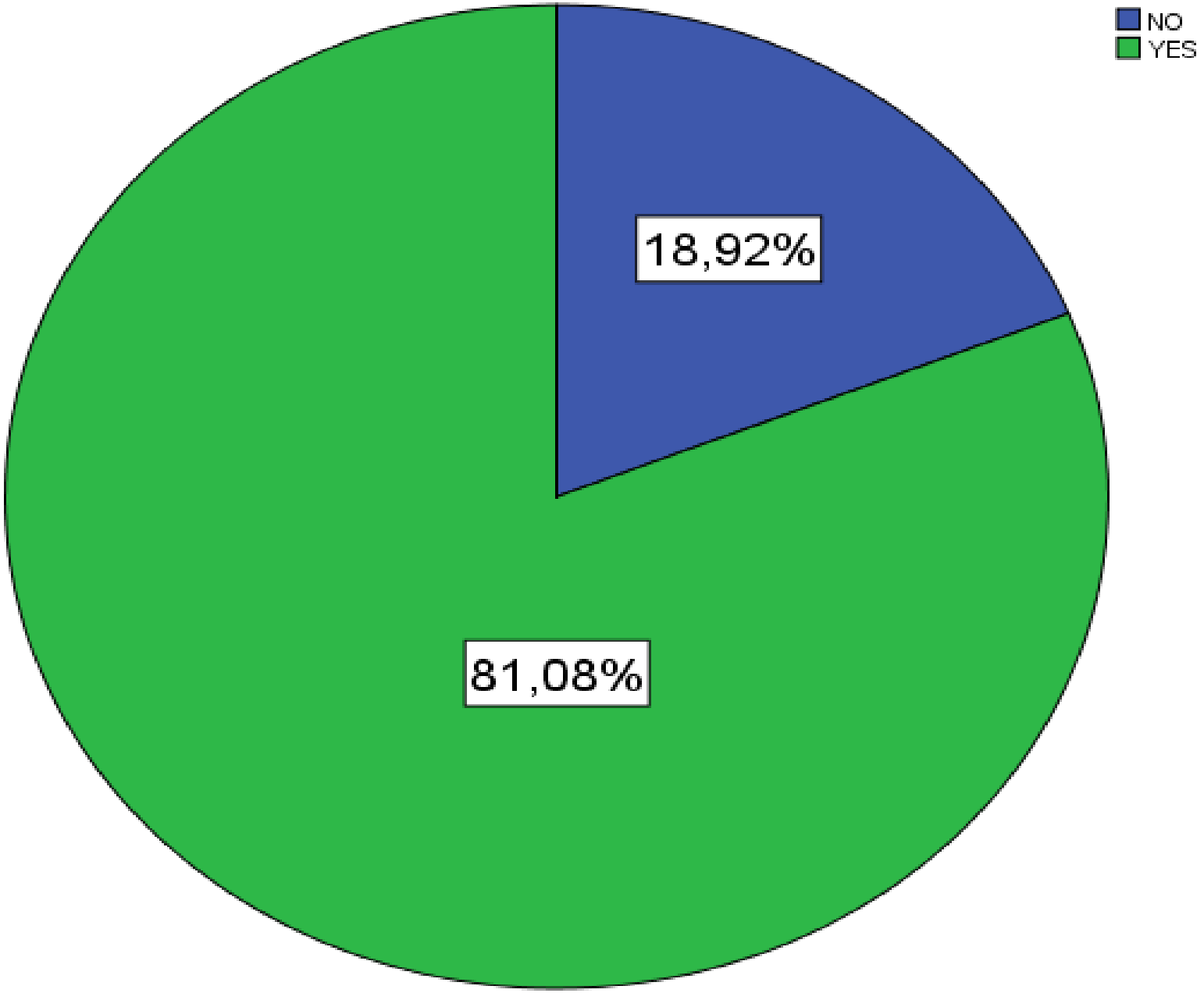

6. Education level of the participant
High school
University
MSc - PhD
7,21%
52,25%
40,54%


8. The total number of employees in the company
Textbox
less than 10 employees
11-50 employees
51-100 employees
101-250 employees
251-500 employees
more than 500 employees
18,92%
39,64%
16,22%
13,51%
5,41%
6,31%


9a. State whether your company has been certified according to the ISO 9001 standard
NO
YES
52,25%
47,75%

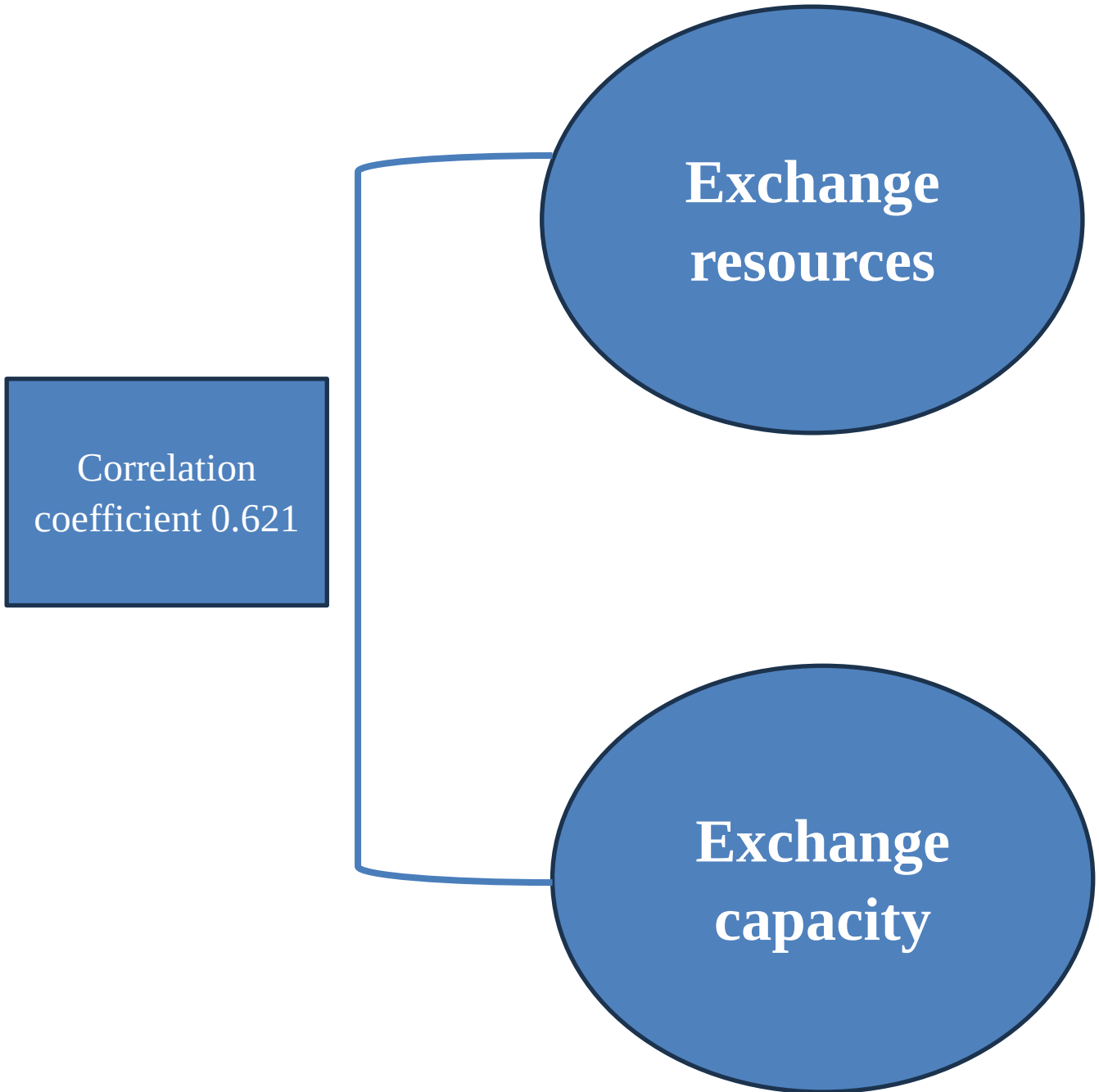

9b. State whether your company has been certified according to the ISO 14001 standard
NO
YES
23,42%
76,58%

9c. State whether your company has been certified according to the ISO 22000



Exchange resources	Mean	S.D.
Ability to share means of transport of goods with another company (either geographically close or not).	3.432	1.802
Ability to share by-products with another company (either geographically close or not).	3.387	1.945
Ability to share waste with another company (either geographically close or not).	3.216	2.029
Ability to share warehouses/goods storage infrastructures with another company (either geographically close or not).	3.027	1.692
Ability to share energy with another company (either geographically close or not).	2.297	1.505
Ability to share water with another company (either geographically close or not).	2.171	1.531
Mean value	**2.922**	

Exchange capacity	**Mean**	**S.D.**
Ability to develop trusting relationships with another company	4.423	1.523
Ability to share production information with another company	3.559	1.553
Ability to enter into new partnerships to share resources with another company	3.514	1.554
Ability to access consultants in the field of IS as well as related chambers.	3.514	1.589
Ability to access the resource sharing infrastructure (e.g. digital platforms).	3.405	1.534
Ability to access sources of finance to make investments to implement IS.	3.378	1.613
Capacity of environmental policies and regulations to encourage IS.	3.342	1.564
Ability to access production data/information from another company.	3.225	1.650
Ability to have access to subsidies for the formation of networks to exchange resources.	3.090	1.593
Mean value	3.494	


Exchange resources
Correlation coefficient 0.621
Exchange capacity

Conclusions

- ✓ The IS readiness level of the Greek food manufacturing companies is deemed low to medium.
- ✓ The company's ability to have the necessary exchange resources to IS implementation (water, energy, by-products, and waste) is low.
- ✓ The exchange capacity - the company's enabler factors to IS implementation (trust, information, access conditions, and infrastructure) is low to medium.
- ✓ The two dimensions of IS meaning the exchange resources and exchange capacity are highly interrelated.

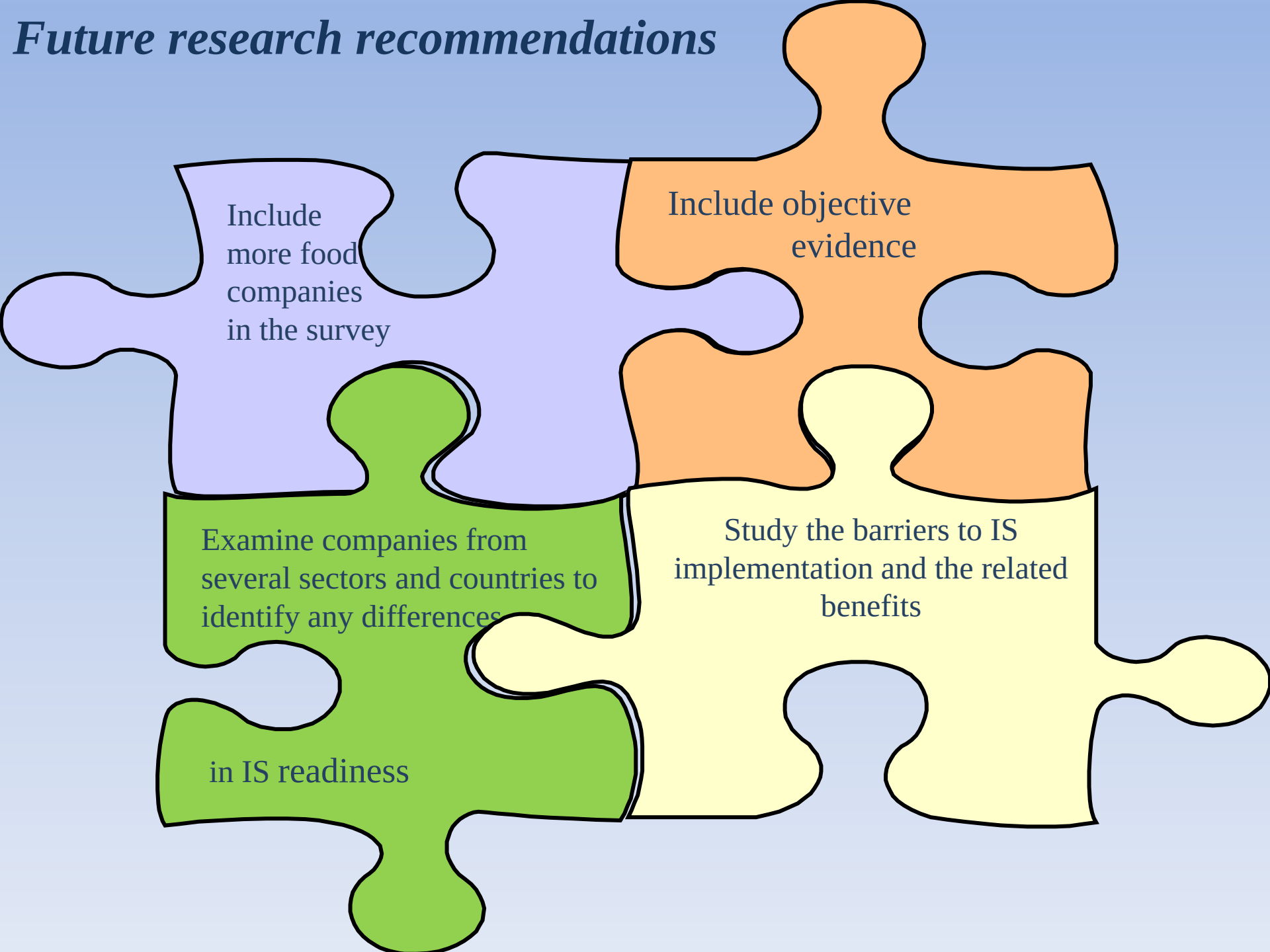
Practical Implications

The present study findings can be considered as a motive for food companies to adopt IS as well as for public policy makers to develop strategies towards IS and circular economy.

Limitations

- the small size of the sample of companies participating in the survey
- the fact that the reasons for companies not implementing IS were not examined.

Future research recommendations



Thank you for your attention!