XV Congreso de Economía Agroalimentaria
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A study of the intention to adopt a blockchain traceability system in beekeeping sector

Dr. Yamna Erraach

- **(%) of honey fraud are high in several countries**

  - **In Europe: 50% of imported honeys fraudulent: China**

  - **In Canada: 18 of the 80 honey samples** ⟹ **fraudulent**

  - **In Tunisia:**   ➢ **80% honey** ⟹ **fraudulent**
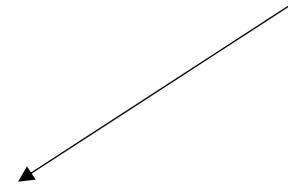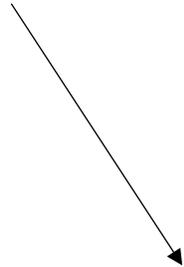
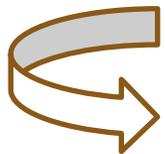   ➢ **3 of 13 honey brands sold satisfactory**

Alarming rise in honey fraud $+$ Lack of **transparency** and **Traceability**

- Serious, growing problem affecting **consumer** confidence and ethical Beekeepers

Blockchain-based traceability system

Introduction and objectives

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The blockchain = distributed ledger technology **:** • **Secure**

• **Decentralized**

➡ Securely records and verifies transactions in an **immutable** and **transparent manner**

➢ **Role: Guarantee** • **transparency**

• **Safety**

Introduction and objectives

1. What factors are influencing the beekeepers' intention to adopt blockchain ?

2. How can the extension of TPB model improve the prediction of intention to adopt blockchain product?

Hypothesis

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H1: Performance expectancy has positive impact on behavioral intention to adopt BCT.

H2: Effort expectancy has positive impact on behavioral intention to adopt BCT.

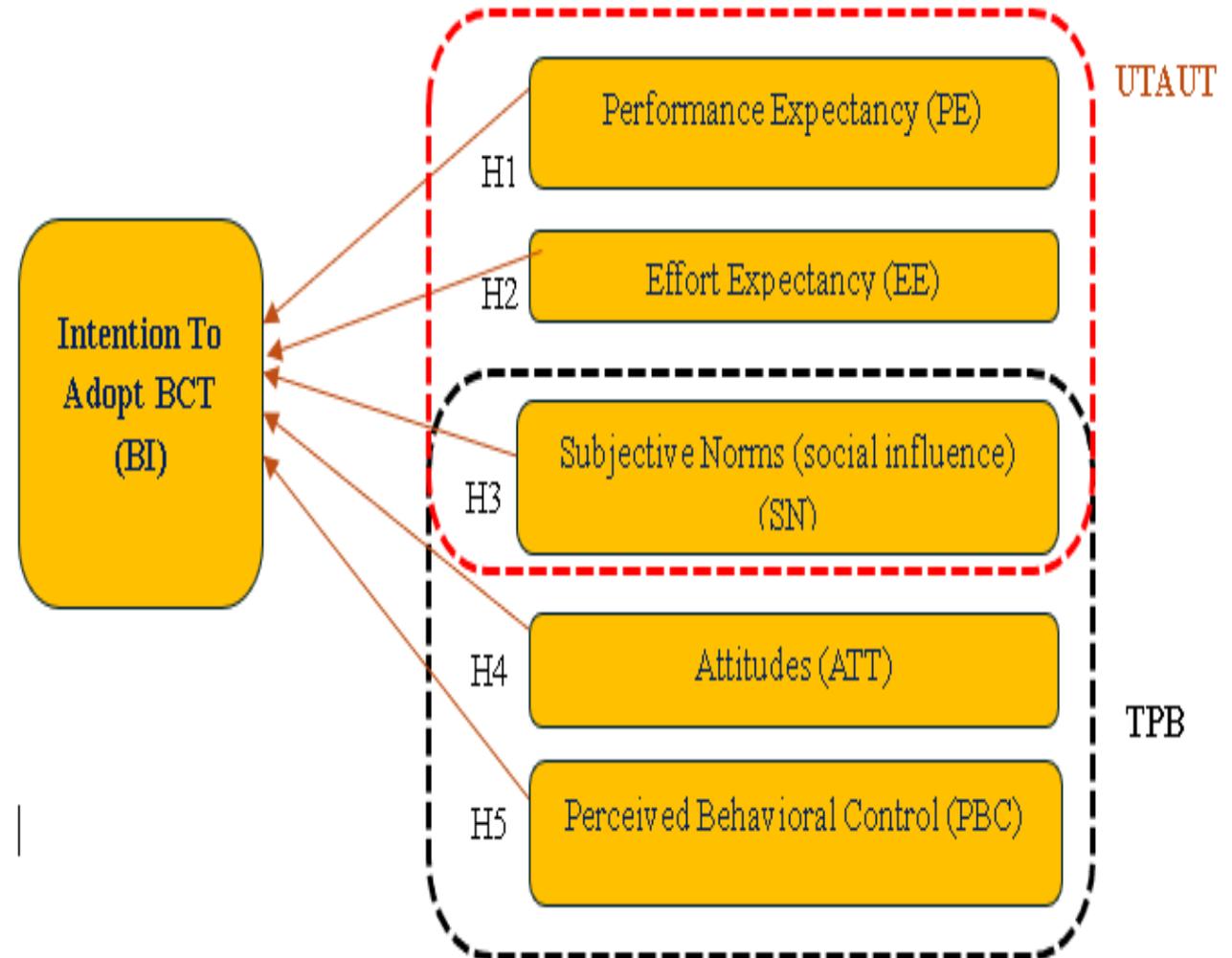*H3: People's subjective norms have positive impact in behavioral intention to adopt BCT.*

H4: Attitudes have positive impact on behavioral intention to adopt BCT.

H5: The perceived behavioral control has positive impact on behavioral intention to adopt BCT.

Methodology

Data collection → **A survey of 159 beekeepers**

November 2023 to March 2024

qualtrics XM

Data processing

Smart PLS

Excel

Descriptive Analysis

Structural Equations Models

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Measurement items for beekeepers' intentions to adopt BCT based on UTAUT and TPB models.

Models	Indicators	Constructs
TPB	Behavioral intention (BI)	BI1: I intend to adopt or continue adopting blockchain technology in the future BI2: I will always try to adopt blockchain technology in my apiary activity BI3: I plan to adopt or continue adopting blockchain technology frequently
	Subjective Norms (SN)[2]	SN1: The opinions and views of my friends and co-farmers are important for my decision to use BCT SN2: People who are important to me would recommend using BTC SN3: People who are important to me would find using BCT beneficial SN4: People who are important to me would find using BCT a good idea
	Perceived behavioral control (PBC)	PBC1: Our farm could well use the BCT PBC2: Our farm governs the use of BCT PBC3: The resources, knowledge, and ability of our farm to use BCT are available
	Attitudes (ATT)	ATTIT1: I believe that BCT should be used in beekeeping sector ATTIT2: I believe that the beekeeping sector will use BCT ATTIT3: It is a good idea to use BCT ATTIT4: In general, I have a positive attitude to BCT
UTAUT	Performance Expectancy (PE)	ECO1_FACT: I find using blockchain technology increases my productivity ECO2_FACT: The use of blockchain technology leads to reducing the cost of beekeeping ECO3_FACT: I find using blockchain technology helps me accomplish things more quickly the beekeeping activity ECO4_FACT: I find using blockchain technology helps me to increase the income from my apiary activity. ECO5_FACT: I think that using blockchain technology DT enhances the honey' quality and safety
	Effort Expectancy (EE)	EE1: It is easy for me to learn BCT technology EE2: My farm can quickly move to BCT EE3: For the implementation of BCT management support is essential

Methodology

- *Measurement model assessment*:

  o Reliability tests (Loading λ, Cronbach's alpha, composite reliability)

  o Validity tests (convergent(AVE), discriminant(Fornell–Larcker criterion,cross-loadings)

- *Structural model evaluation* (hypothesis testing, path coefficients)
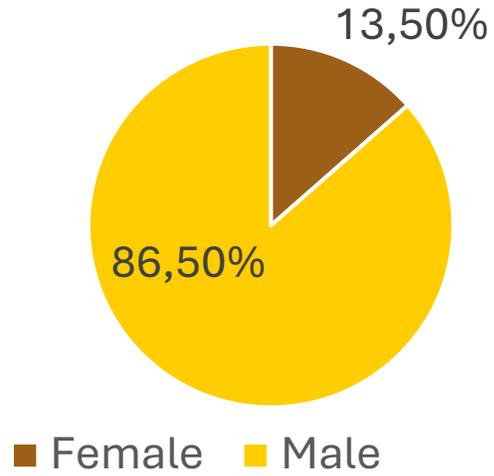
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Sample description

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13,50%

86,50%

■ Female ■ Male

Figure 1: Distribution of beekeepers by gender

3,50%

20,50%

39%

37%

■ Uncompletedprimary studies   ■ Primary studies

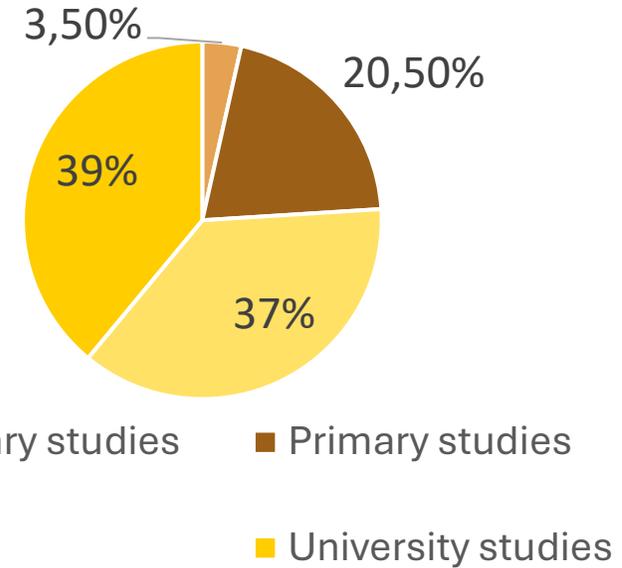■ Secondary studies   ■ University studies

Figure 2: Distribution of beekeepers by level of study

Table 1: Distribution of beekeepers surveyed by age group

Age Range (years)	Percentage (%)
18-25	1,97
26-35	17,24
36-49	**48,27**
50-65	27,58
>65	4,92

Most beekeepers are **young people**

Characteristics of beekeeping structures

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Size of beekeeping activity

7,39%

31,03%

61,58%

■ Profesional activity   ■ Non profesional   ■ Self-consumption
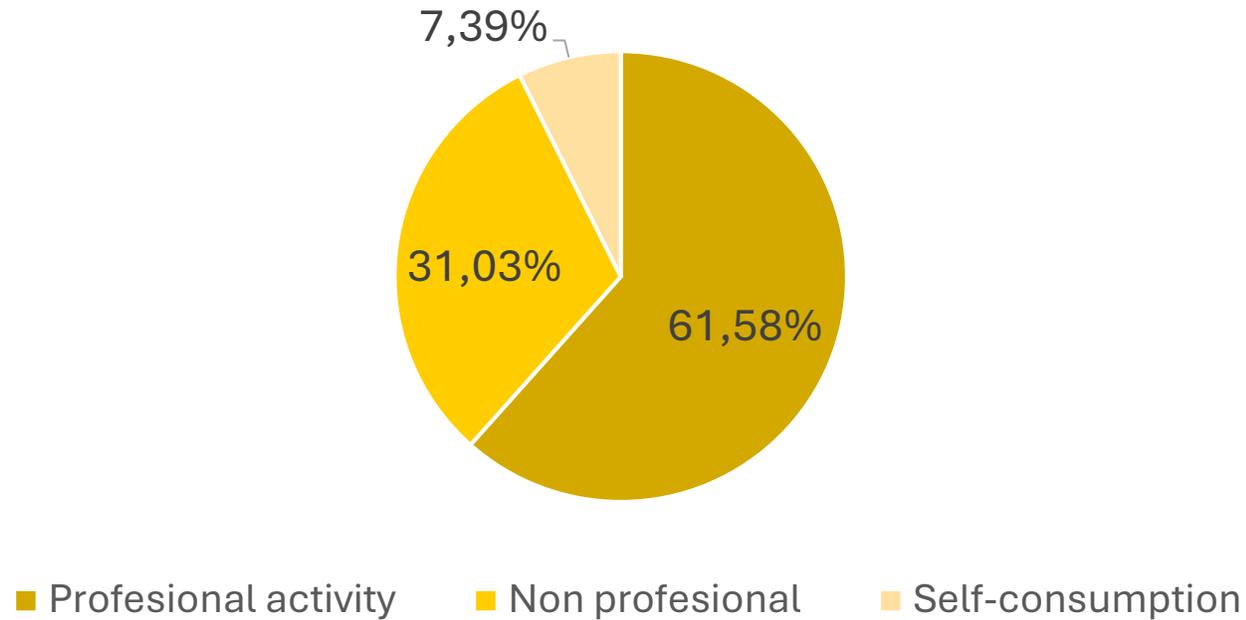
Figure 3: Types of beekeeping activity

➡ The importance of professional beekeepers in the sector

Fraud perception and honey traceability

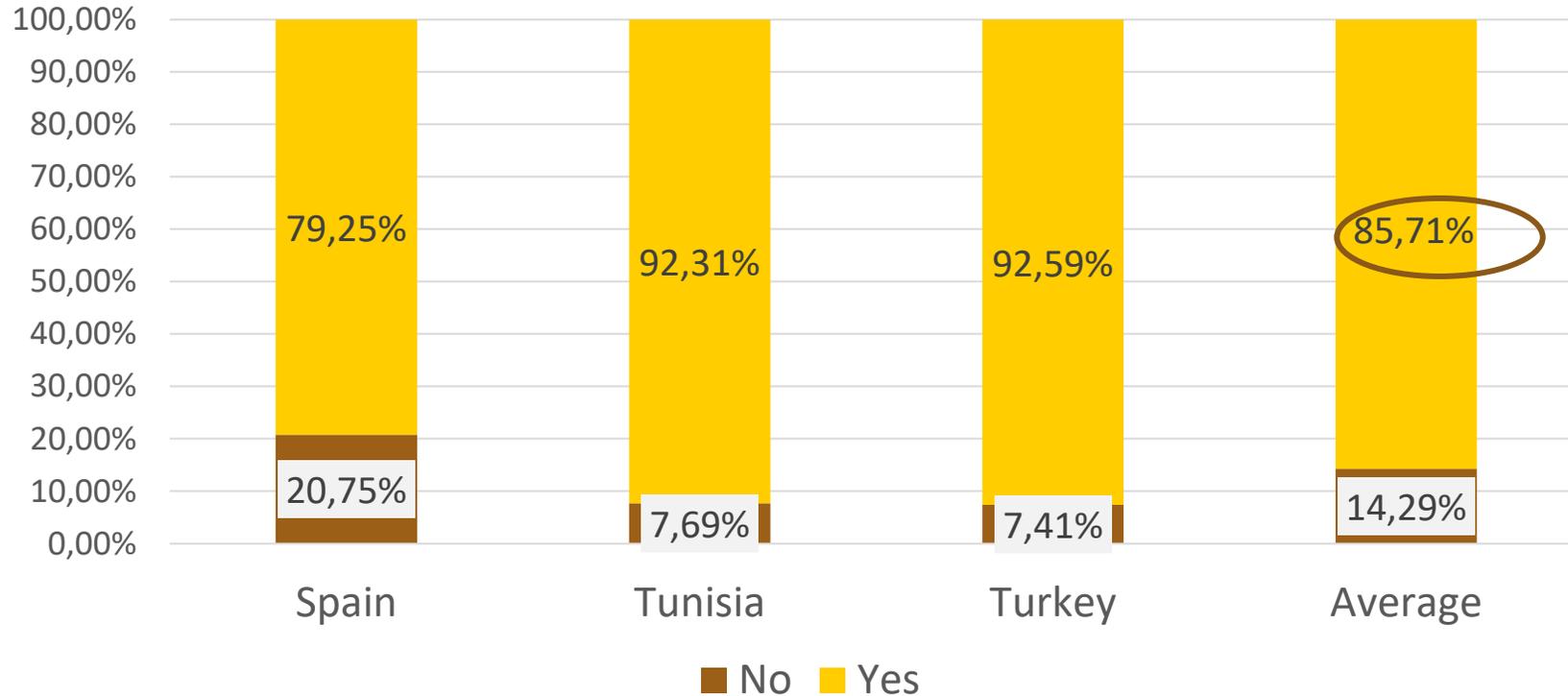## Beekeepers' opinion about the rise of frauds

8,70%

91,30%

■ Yes ■ No
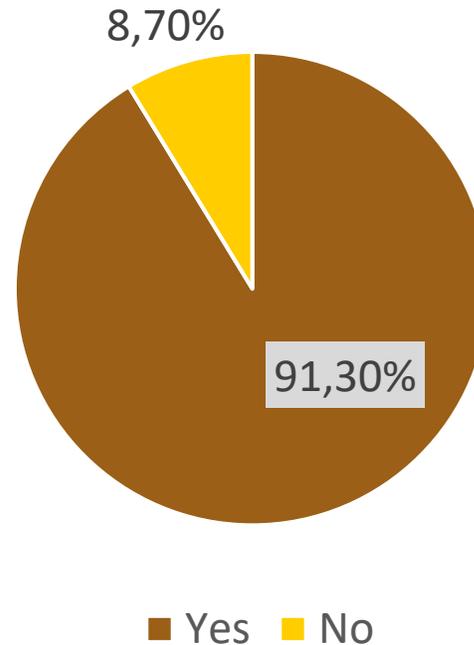
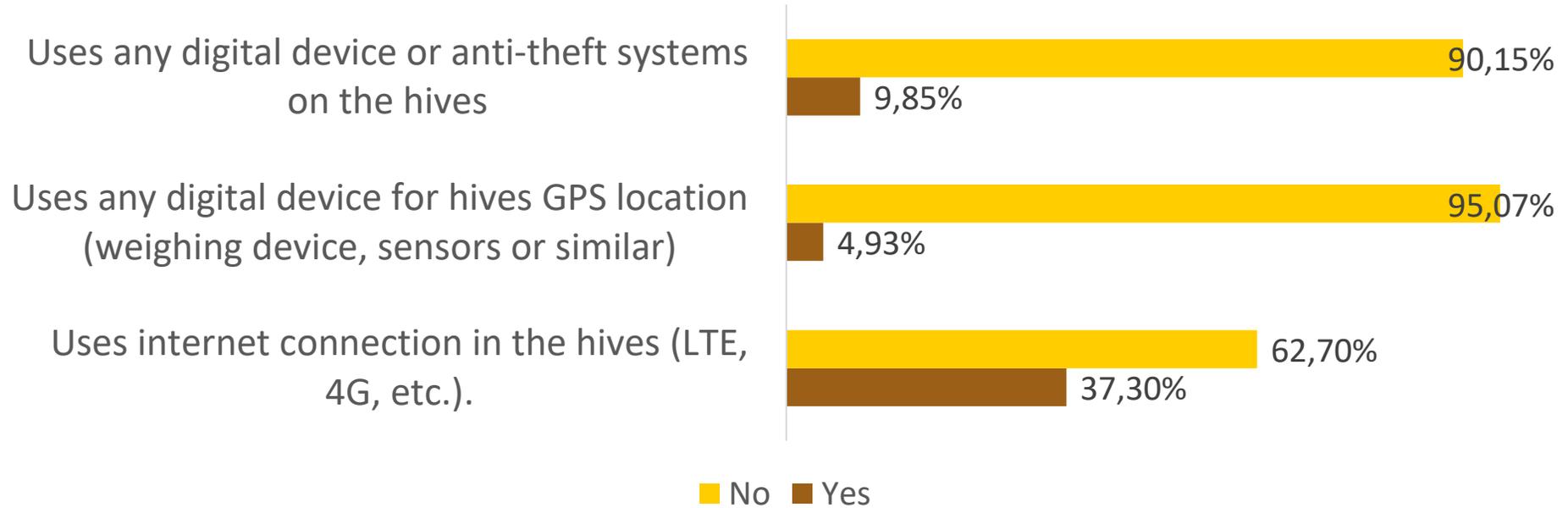**Figure 4: Beekeepers' opinion about the rise of frauds**

➡ A widespread concern about the integrity and quality of honey

Awareness of the need for more traceability

Figure 5: Awareness of the need for traceability

Current Use of Technology in Beekeeping

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Uses any digital device or anti-theft systems on the hives
- 90,15%
- 9,85%

Uses any digital device for hives GPS location (weighing device, sensors or similar)
- 95,07%
- 4,93%

Uses internet connection in the hives (LTE, 4G, etc.).
- 62,70%
- 37,30%

■ No ■ Yes

➡ **Low level of digitalization**

Knowledge of blockchain

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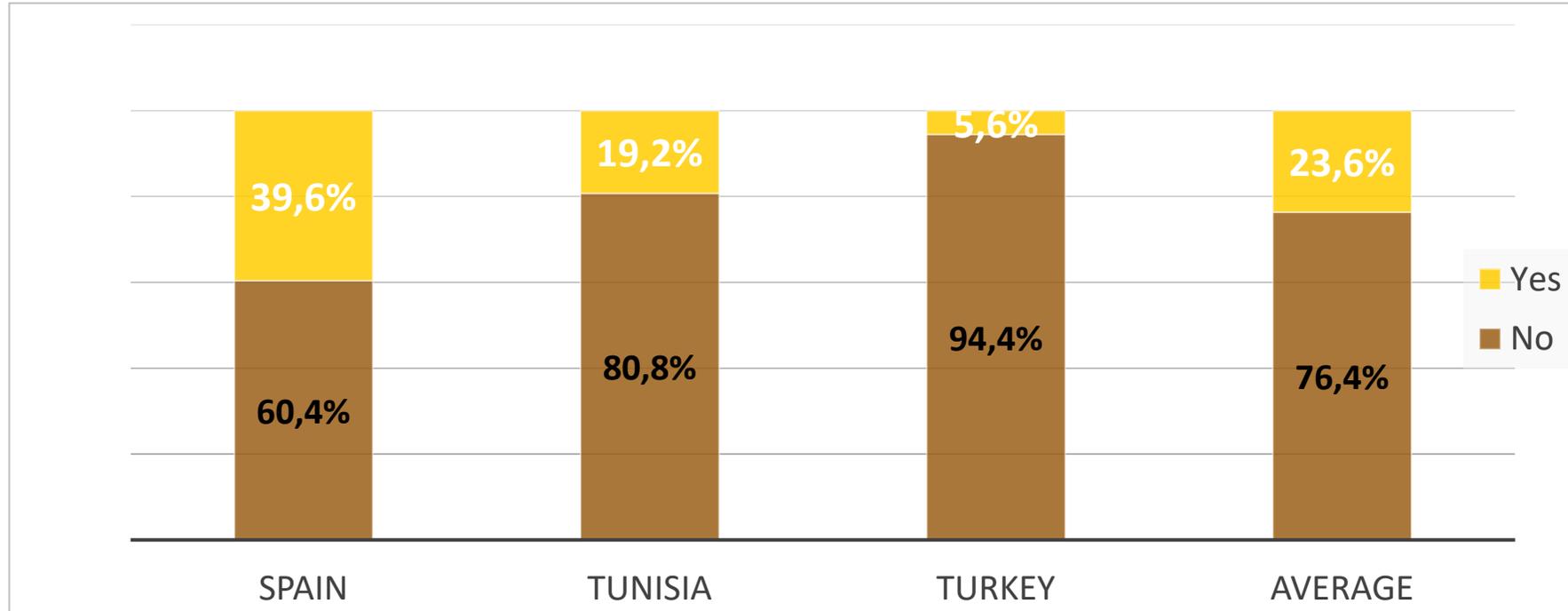
Figure 6: Knowledge of blockchain technology

➡ A general lack of familiarity with this innovation

Structural equation model of the blockchain adoption

Hypotheses	Path estimates	β	T statistics	P values	Decision
H1	PE -> BI	0,255	3,243	0,001	Supported
H2	EE -> BI	0,238	3,095	0,002	Supported
H3	SF -> BI	0,112	1,367	0,172	Rejected
H4	PBC -> BI	0,190	2,364	0,018	Supported
H5	ATT -> BI	0,239	3,501	0,000	Supported

➤ H3:Beekeepers' decision to adopt blockchain technology is not influenced by their <u>social network </u>or the adoption opinions of friends, family members, and peers.

Structural equation model of the blockchain adoption

- Following the **TPB model**, beekeepers' intention to adopt BCT is influenced by perceived behavioral <u>control</u> and <u>attitudes</u> toward blockchain technology.

👉 *If beekeepers feel* self-confidence in their ability to manage the situation *and have a positive outlook on blockchain, they are more likely to use it*.

- There is a meaningful relationship between <u>Effort Expectancy</u> and the <u>intention to adopt BCT</u> **=>** a user-friendly blockchain application can enhance its perceived ease of use and accessibility while maximizing its utility.

- Beekeepers will not adopt BCT unless the expected benefits outweigh the effort needed to use it.

- 👉 *Technology design and usability are just as important as the technology's potential benefits*.

Structural equation model of the blockchain adoption
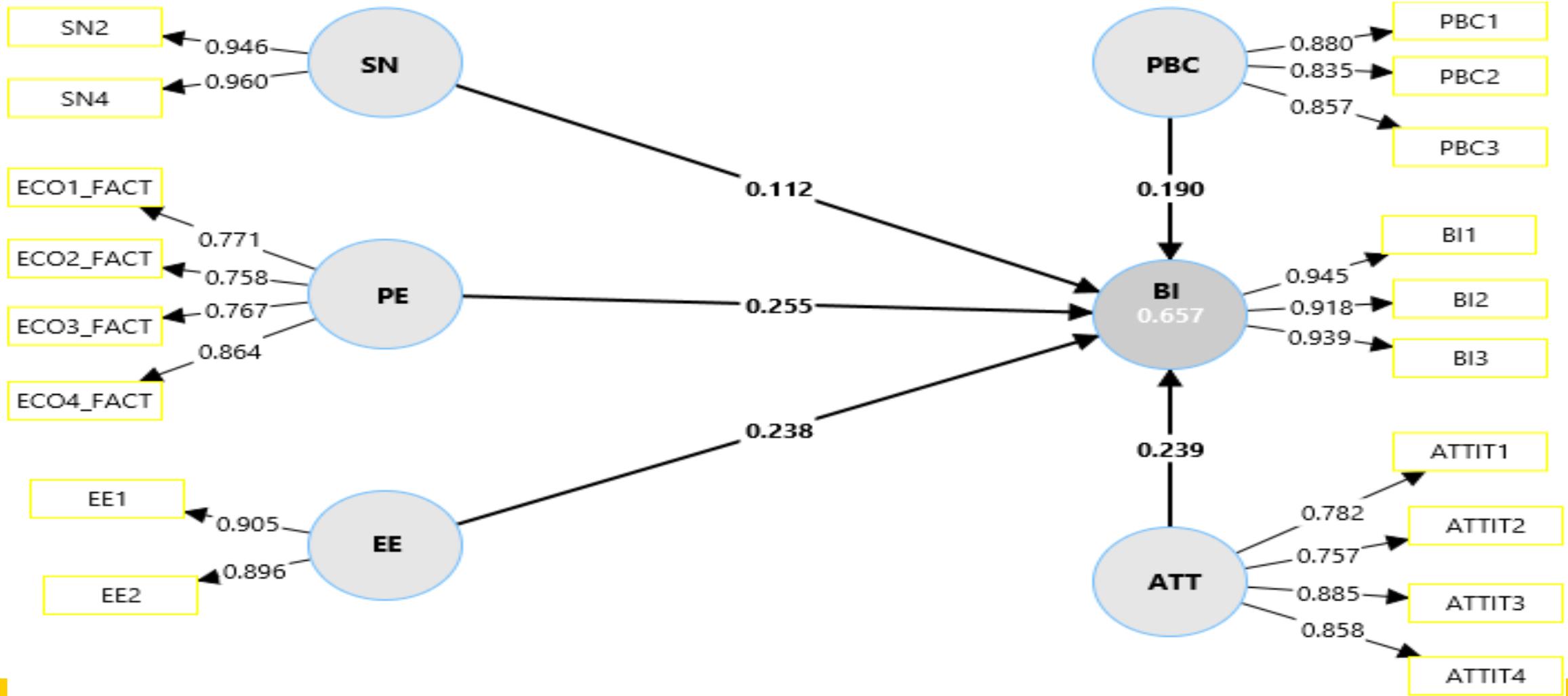
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Barriers for the adoption o blockchain in beekeeping

- High implementation costs
- Limited infrastructure
- Lack of technical expertise

CONCLUSION

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Key Determinants of Adoption of Blockchain in Beekeeping

👉High Awareness of Fraudulent Honey

👉 Consensus on Traceability

👉 Low Digital Adoption

👉Despite its potential, awareness of blockchain technology remains low

- **Perceived behavioral control** and **positive attitudes** directly influence beekeepers' intention to adopt blockchain.
- **Performance expectancy:** Beekeepers believe blockchain can improve efficiency, transparency, and value creation in their activities.
- **Effort expectancy:** User-friendly, simple, and flexible blockchain applications enhance ease of use and significantly strengthen adoption intention.

Policy & Practice

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Design **User-friendly, accessible and ergonomic interfaces**

Awareness campaigns and specialized training

Share **successful implementation examples**

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Muchas gracias por su atención !

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