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# Use of Digital Technology in Food Industry and its Effects on Business Development: An Ethical Perspective

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## ABSTRACT

*The fast penetration of digital technologies has radically redefined the way of operation and strategic courses in the food industry. The study explores the ethical aspects of using digital technologies in development of businesses. The sample was gathered using the purposive sampling method of food companies that have adopted digital tools: online distribution channels, automation systems, and data-based quality control procedures, online traceability platforms. To evaluate the study in an empirical way by addressing the correlation between adoption of digital technology and the result of business development, logit and probit regression were used. The results demonstrate strong and significant connection between the implementation of digital technology and significant pointers of business performance such as market expansion, efficiency, and improved quality of the products. Moreover, the study highlights the moral aspects of the digital transformation, especially in relation to the privacy of data, transparent supply chains, and fair access to technology. In general, the research demonstrates how morally-oriented digital innovation creates a competitive advantage and facilitates the long-term business success in the food sector.*

## Introduction

The advancement of the digital technologies has triggered the significant revolution in the world industry, and the sphere of food is one of the most dynamic spheres of change. The food industry has traditionally been manual, geographically limited in supply chains, and direct in their engagement with customers, but as the consumer demands and intricacies of its operations have grown, the industry has turned to automation and digitalization (Kamble, Gunasekaran, and Sharma, 2020). The area of artificial intelligence (AI) and other innovations are making more advanced decision-making processes in the field of quality control, inventory, and agricultural

applications. Robotics is making food production and packaging easier and more efficient, and blockchain technology is accelerating supply chains and improving their transparency and reliability. Besides, the Internet of Things (IoT) is establishing connected networks that enhance food safety, reduce wastage, and optimize productivity. This is done through connecting all things between the smart fridges to the high-tech farm equipment. The consumer experience has similarly been redefined through mobile applications and online platforms that have made the services of food more customized and easily accessible. Groceries, meals, or premium items can now be ordered with only a handful of taps, and businesses have an opportunity to replace or complement traditional business models based on physical locations only (Barykin et al., 2021). This diversification has increased market accessibility but at the same time, it has increased competition, hence necessitating companies to undertake continuous innovation in order to remain relevant. Simply put, embracement of digital technologies has developed a more dynamic, efficient, and competitive landscape, thus making technology an important factor of sustainable growth in the food sector.

**Role of Digital Technology in the Development of business.**

Digital technology has emerged as an important aspect of corporate growth and development in the food industry. With great assistance of sophisticated robotics and AI-powered systems, automation of production lines greatly increased the efficiency of operations through the reduction of human error, increased production speed, and homogenous product quality. The AI-driven inventory management systems help a company to keep track of stock prices in order, predict demand trends as well as automatize re-ordering, which minimizes wastage and operational expenses (Wamba et al., 2020). Also, predictive analytics that are based on big data offer valuable information about the consumer preferences whereby businesses are able to come up with products and services that are more likely to meet the consumer needs. With the introduction of mobile applications and e-commerce platforms, the methods of interaction between food businesses and their customers have in essence changed.

The digital platforms have also enabled businesses to reach a variety of audiences whose geographical boundaries are not limited, both locally, nationally, and internationally (Sundström, 2019). Consumers have now a great desire of being able to have the convenience of ordering groceries, food and meals online, as well as to have them delivered at their homes. Mobile applications can improve the interaction with the customer by giving rewards to them, providing tailored offers, and providing feedback, and simplifying the transactions. As a result, companies are investing more resources to make sure that they gain competitive edge by creating smooth online experiences and user-oriented online interfaces. Moreover, in the food industry, the internet marketing has emerged as a key instrument of enhancing brand recognition and creating brand loyalty.

With the help of several strategies, including content marketing campaigns, influencer collaboration, social media campaigns, and targeted online ads, brands can build one-on-one relationships with their target audiences (Grewal et al., 2020). Organizations working in the food industry can use social networks such as Facebook, Instagram, and Tik Tok to present their offerings in a creative way, communicate with the audience directly, and create dynamic communities around the brand. By developing long-term emotional relationships with the customers, these digital strategies not only improve the instant sales but also aid the long-term growth of a brand. Through sustaining innovation and adapting to the changing digital trends, companies can be resilient and survive to the long-run in an ever-digitized market.

**Moral Consequences of Intersection of Digital Technology**

The fact that digital technology is integrated into the food industry offers significant advantages but, at the same time, this phenomenon raises essential ethical issues that should be examined in greater detail. Two main areas of concern are the consumer consent and data privacy. The growing dependency of the businesses on the consumer data to create targeted advertising, loyalty programs, and custom marketing practices increases the risks of information leakage and abuse (Martin and Murphy, 2017). People readily give personal information without understanding in detail how it is going to be used, and this is to a great extent the issue that begs the question of data privacy and informed consent. Transparency should therefore be one of the main principles of businesses that hold ethical values and in that, the customers are aware and comfortable with the gathering, administration, and sharing of their information. Moreover, another important type of ethical dilemma brought about by the digitalization of the food industry is the labor-related issues. In many traditional jobs such as customer service employees and food production line employees are being replaced by automation and artificial intelligence (Makridakis, 2017). Although these technological advancements have the capability of increasing productivity and minimizing costs, they can also cause massive unemployment especially to people who were less skilled and are less able to adjust to the new careers. To solve these imminent changes, A another ethical issue is the digital divide which defines the gap between big companies and small food producers. Emerging technologies, including blockchain traceability platforms and AI-based logistics, can require significant financial and technological investments, and these resources are normally available only to well-funded companies (Heeks, 2017). This will cause an unequal competition level thus hindering the competitive capacity of the small and local businesses and they may be pushed to the peripheral. In turn, the ethical implication of the digital era is the need to advance inclusiveness and availability of technological developments to allow the involvement of the smaller players of the digital economy. Moreover, in order to support the principles of ethical standards in business activities, the organizations should support the digital advancement with the larger societal goals such as the enhancement of social equity and reduction of environmental impact.

**Influence on Consumer Experience and Consumer Behavior**

Digital technology has essentially transformed the consumer expectations and buying habits in the food industry. With the modern consumer having access to smart phones and unlimited access to the internet nowadays, consumers have come to expect smooth digital experiences, faster service delivery, and instant access to information. Moreover, they are also proactive in their search of brands that resonate with their own values and health-related ambitions, and they are more demanding as far as transparency in terms of origin, production processes, and nutrition is concerned (Pantano and Gandini, 2017). In order to satisfy these increased expectations, food companies have to provide comprehensive product details online, provide easy buying channels, and take into account the sustainability and morality of their supply chains. Digital loyalty programs, real-time delivery tracking, mobile-ordering applications, and interactive digital menu have become part of the standard in the sector due to technological innovations. These solutions greatly improve client interaction, client satisfaction and also boost operation effectiveness. Moreover, the use of advanced technologies, like virtual reality (VR) and augmented reality (AR) is used to establish immersive experiences with brands. To illustrate, although VR is also applied in marketing campaigns to tell strong brand stories, some restaurants utilize AR to enable clients to see food items before placing an order (Flavián, Ibáñez-Sánchez, and Orús, 2019). Customers become more emotionally engaged to businesses through these interactive experiences thus affecting their buying decisions and brand loyalty. On the other hand, the consumer centric digital economy creates significant ethical issues of data protection and privacy. A large amount of data regarding the customers enables businesses to make very personalised offers. Nevertheless, there is

the danger of abuse and overextension, with this practice. Unless done with responsibility, targeted marketing can also control gullible groups of people such as children and low-income earners. Companies should therefore make sure that their data practices do not violate privacy rights and enhance informed choices by consumers. This entails earning trust by being transparent on data usage, gaining express consent.

**Future Sustainable Innovation and Trends**

The use of the digital technology in the food sector has been estimated to be more advanced and extensive in the next few years. Food products are being transformed by the innovative tools, including artificial intelligence-based product creation and intelligent kitchens that use Internet of Things (IoT) devices to automate cooking (Galvez et al., 2018). Moreover, blockchain technology, as the bierce to irrevocably documented sourcing, production and distribution, are also being established to improve the supply chain transparency. The technologies breed trust and responsibility in the marketplace because they streamline activities and give the consumer more insight into the production and handling of their food. Besides optimization of operations, the digital transformation projects in the food sector are expected to focus on sustainability. Consumers, regulatory agencies, and environmental organizations put increasing pressure on businesses to benefit the environment, waste minimization, and ethical procurement of raw materials (Bolton et al., 2018). The digital technology is vital in the realization of these objectives. As an illustration, IoT sensors can be used to track energy usage in real-time, thus increasing the efficiency of resources, and AI algorithms can be used to optimize inventory management to reduce food spoilage. Also, the blockchain solutions have the potential to support the overall sustainability performance by ensuring compliance with the fair trade and environmentally responsible procurement practices throughout the supply chain. The intersection of sustainability priorities and digital innovation presents an important opportunity to businesses to make their profitability more aligned with more general social and environmental concerns. Businesses that focus on ethical online activities, such as ensuring the privacy of their data, fostering equal technological access, and maintaining fair labour practices are likely to become the most successful in the industry. This can be achieved by instituting stricter measures of ethical growth, which will not only improve their brand name, but will also help them in the development of the society. Ethical digital innovation in this changing environment is not a choice but a strategic necessity in the paths to the future and the top of the industry.

**Research Objectives**

The mission is to determine the impact of the use of digital technologies on the efficiency of operations in the food industry. The study will also explore the relationship between the digital marketing strategies and consumer behavior within the food industry. Lastly, the study attempts to determine the ethical implications of the data privacy issue and labour displacement due to the introduction of digital technology in the food sector.

**Problem Statement**

The speed at which the food industry has adopted digital technology has fundamentally changed the consumer interaction process, promotional tactics, and business practices. There are several advantages associated with these advancements but they have many challenges that must be addressed. Some of the major issues include the ethical aspect of the privacy of data, the possibility of automation to replace the manual jobs, and the unequal access to technology between small businesses and big firms. In addition, the increasing reliance on the digital sphere also questions the rights of consumers, transparency, and long-term sustainability of these technological changes. The paper aims to explore the effect of digital technology on the food industry, its

benefits as well as its ethics, and will provide the viewpoints that can bring about a more responsible and efficient approach to the introduction of digital innovations into the industry.

### Significant of the Study

This work is important because it can bring a full picture regarding the multi-faceted effects of the digital technology in the food industry. With the sector embracing various technologies, like blockchain, automation, and artificial intelligence, there is a pressing need to examine the operational and financial advantages of the technologies as well as the ethical implications of these, including the issue of data privacy, displacement, and access disparities. By analyzing the dimensions, the study will provide useful insights to consumers, policymakers and other stakeholders in the food industry, which will help in the implementation of such technological advancements in a way that considers sustainability, equity, and consumer protection. Moreover, the study is relevant to the stakeholders wishing to work in the changing digital landscape since it can help develop future policies on how the digital innovations can be integrated in a manner that enables it to become commercially viable and responsible to the society it serves.

## Literature Review

### Digital Technology Effect on Operational Efficiency

Food production lines automation has radically changed the business environment of food companies, allowing them to achieve higher production speeds and greater product standardization. In the past, a major percentage of food processing activities relied on manual labour which was also labour intensive and prone to human mistakes hence contributing to product variation in quality. However, the introduction of automation technologies, including robotics and conveyor systems, have made  The Internet of Things (IoT) turn out to be a game-changer in food supply chains and production, increasing the efficiency of operations. With the help of IoT devices and sensors, companies are now in a position to track equipment, inventory, and supply chain performance in real-time, and get an instant idea about any problems that occur. Those IoT-sensors can identify lost stock or faulty equipment, which helps businesses to resolve issues before they cause expensive downtime or cause stock-outs. Moreover, monitoring such important variables as temperature and humidity, which directly influence the quality of products and their shelf life, the role of the IoT technology in reducing food waste is significant. Using these real-time data points, the business will be able to provide maximum control over food handling and storage which will ultimately streamline the processes and save money that otherwise goes to waste. This in its turn increases sustainability and profitability.

### Digital Marketing and its impact on the consumer behavior

Digital marketing strategies have gained essential influence of consumer behavior in the food business. Social media platforms, such as Facebook, Instagram, and Twitter have provided food manufacturers with the unique and fascinating chance to share with their customers, building a more solid connection and brand perception. Due to the authenticity of the recommendations that influencers make to their followers, influencer marketing has become an increasingly important part of digital marketing. According to Grewal et al. (2020), such interaction allows food companies to have a more significant relationship with customers and develop their own specific messages that can be enhanced by individual beliefs, preferences, and way of life of a customer. The targeted marketing campaigns will be more effective and demographic as food brands will be able to target specific demographic groups with tailored messages. This strategy enhances brand identity by providing consumers with a better sense of attachment to the businesses they subscribe to, as well as consumer loyalty. Moreover, the use of mobile apps and e-commerce websites has

radically changed the way consumers relate to food companies. Such systems offer unmatched convenience where customers can order food and even monitor deliveries in real-time and tailor their culinary choices at their homes. According to Sundstrom (2019), the ability to make purchases with the least effort has helped substantially enhance the customer experience and allows the companies to expand their markets. Additionally, e-commerce is not limited by geographical boundaries, therefore, increasing the market size of food business enterprises beyond local geographical boundaries. At the same time, the mobile application development has created a new form of loyalty programs that give customers points or incentives to buy their products, thus establishing repeat business and creating long-term customer relationships. Moreover, the use of digital marketing tools has produced useful information, and companies can use such information to improve their approach, thus, raising customer satisfaction. Through the study of consumer behavior, companies understand the trends on the products that are used by their consumers, the effectiveness of their marketing campaigns as well as how their customers relate with their brands.

This information then informs the decisions on inventory control, product choice and promotion. As a result, companies will be able to create very specific and individual marketing campaigns that will appeal to their target audience due to constant data analysis. The food companies adopting these digital marketing innovations will be in a better position to adjust to the changing trends, and form closer relationships with their customers hence guaranteeing long term growth and success amidst the changing consumer demands.

**Ethical Consequences of the Digital Technology Incorporation**

The adoption of digital technology in the food industry presents a range of ethical issues that require an answer to help avoid unethical and irresponsible business conduct despite the significant advantages. Two major concerns are, consumer consent and data privacy. The likelihood of data breach and abuse increases as the food companies continue to store increasing numbers of customer information to perfect their marketing plans. According to Martin and Murphy (2017), the increased reliance on personalised marketing campaigns based on information regarding the customers might result in cases of poor protection of data on the customers. The understanding of data usage and sharing practices by customers is at times partial and this poses a big challenge towards privacy concerns. Lack of proper data protection measures may lead to a loss of customer confidence, which is a key component in a long-term relationship in the highly competitive food market. In order to reduce the risk of possible harm to people connected with gathering and storage of large amounts of personal information by online resources, companies should promote the notion of transparency, informed consent, and effective safety protocols. Moreover, another ethical dilemma is presented by automation of processes which use a lot of labor, especially within food production.

The AI and automation technologies represent a two-sided sword: not only they may be used to destroy the laborers, particularly the low-skilled ones, but also promise the efficiency and the decrease of the operational costs. According to Makridakis (2017), employees who do not have the necessary skills to switch to more technologically advanced jobs can lose their jobs because of food processing automation. Even though automation is increasing productivity, it has no effect on the less positive implications and effects on the wider society, including displacement, elimination of employment opportunities to some sections of the working population. This means that to cope with these ethical issues, companies need to use strategies to assist the employees who have fallen victim to the automation process, such as retraining and reskilling solutions, so that the automation process does not disproportionately negatively affect the poorer populations or worsen the situation between the various economic classes.

**Digital Inequality and Technological Divide**

The gap between big businesses and the small-scale producers and local business is only widening as more and more digital technology is being introduced in the food industry. Heeks (2017) notes that small food producers tend to encounter numerous problems when trying to implement such state-of-art technologies as blockchain, artificial intelligence (AI), and the Internet of Things (IoT) in their work. Such small businesses are often not equipped with the right amount of finances, technical knowledge, and infrastructure to make proper use of these technologies. As a result, smaller companies in the food industry are incapable of competing with other larger companies, which have the financial ability to implement these technological innovations.

The technological gap is thus a possible risk in exacerbation of the marginalization of the small-scale manufactures and thus hindering their ability to maximize operational efficiency, diversify their market scale and meet customer requirements.

Enterprises of large scope will benefit a lot by implementing digital technologies. These organizations can use the Internet of Things (IoT) to monitor production and distribution operations in real-time, apply artificial intelligence (AI) to control inventory, and apply blockchain technology to simplify the supply chain; all these innovations contribute to more high-productivity, fewer costs, and better understanding of the customer. This development provides these large companies with competitive advantage through the provision of increasingly personalized experience, better services and lower costs to their customers.

The continuous use of such technologies by bigger companies not only strengthens their dominance in the market, but also creates a self-perpetuating cycle, where their share in the market widens, and thus the ability to compete of smaller organizations is hindered. This technological advantage puts smaller firms in a disadvantaged position, as they have less access to similar resources and growth opportunities and thus the power is concentrated in the hands of a few players of dominance.

This means that fair allocation of the benefits of digital technology in the food industry is an ethical requirement. It is of critical importance to tackle the technological gap between big companies and small manufacturers. Heeks (2017) promotes the programs aimed at providing small businesses with resources and knowledge to use digital technologies. These efforts may take the form of joint undertaking, government subsidies or allowances, thus, making smaller manufacturers to take advantage of already applicable technology without the high cost that is prohibitive. Moreover, it is possible to have a win-win situation when large corporations cooperate with small-scale producers.

**Sustainability and Digital Technology and Ethical Practices**

The Internet of Things (IoT) implementation into the food sector contributes to sustainability by enabling businesses to instantly access information related to food spoilage, energy consumption, and the distribution of resources. With the implementation of IoT-based sensors across the entire production cycle and supply chain, companies are granted the ability to track the key indicators, which helps to reduce waste and manage resources optimization (Galvez et al., 2018). Using an example, sensors may be used to measure temperature that may point to possible spoilage hence enabling a company to take remedial actions before a lot of waste is registered. In addition, the IoT devices also enable real-time tracking of energy use that enables business organizations to detect inefficiency and implement energy-conserving measures, thus reducing their carbon footprint. Such a feedback mechanism of real time is a way of promoting more ecologically sensitive operational practices through reduction of wastes and saving of important resources.

Moreover, AI-based solutions can help in the improvement of sustainability in the food sector. Artificial intelligence (AI) can be used to observe trends and automate processes through the use of machine learning algorithms on the data obtained as a result of production processes. Therefore, this strategy makes the use of resources more effective.

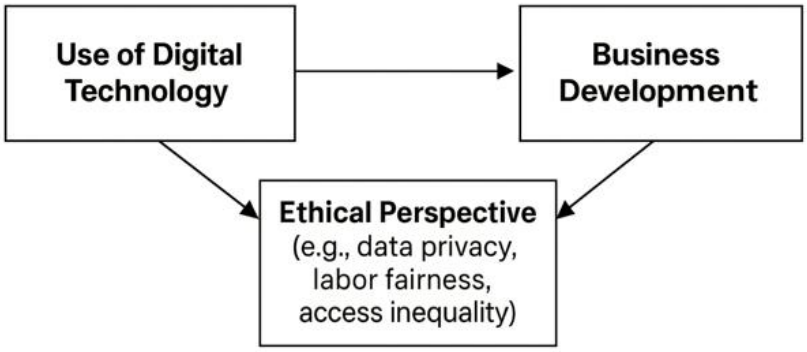
An example of this is AI, which will reduce the volume of production and food waste by streamlining food production processes with the use of resource inputs based on demand projections (Galvez et al., 2018). Moreover, AI has the potential to improve the productivity of the food delivery process, and goods are delivered to customers in the most optimal conditions, which reduces the environmental impact of the transport process. The intentional application of digital solutions, such as blockchain.

**Hypothesis**

**H1**: The food industry's adoption of digital technology significantly boosts company growth.

**H2**: The relationship between digital technology use and company development is moderated by ethical factors (such as data privacy, labor justice, and access inequality).

**H3:** The positive impact of digital technology on business development is stronger when ethical practices are effectively implemented.




Use of Digital Technology in Food Industry and its Effects on Business Development: An Ethical Perspective" here is the classification of independent and dependent variables:

| **Variable Type** | **Variable Name** |
|---|---|
| Independent Variable | Use of digital technology in the food industry |
| Dependent Variable | Business development |
| Moderating/Ethical Lens (contextual focus) | Ethical perspective (e.g., data privacy, labor fairness, access inequality) |

**Methodology**

**Research Philosophy, Approach, and Design**

**Philosophy & Approach.** This study adopts a positivist, deductive approach to test theory-driven hypotheses about how digital technology use affects business development in the food industry and how ethical practices moderate that effect (Persis eet al., 2021).

Design. The research employs an explanatory, cross-sectional survey of food industry firms (processing, distribution/wholesale, retail/HoReCa). Primary data are collected via a structured questionnaire administered to firm owners/managers (Belas et al., 2023).

**Hypotheses.**

- **H1:** The use of digital technology in the food industry has a significant positive effect on business development.
- **H2:** Ethical considerations (data privacy, labor fairness, access/inclusion) moderate the relationship between digital technology use and business development.
- **H3:** The positive impact of digital technology on business development is stronger when ethical practices are effectively implemented.

Because adoption and the primary outcome are binary, the core analyses use logit and probit models.

**Population, Setting, and Sampling**

**Target population.** All registered food industry firms (micro, small, medium, and large) operating in the study country's food sector and located in urban, semi-urban, and rural areas. The population, therefore, covers processing, distribution/wholesale, retail, and HoReCa firms that are formally registered and actively trading during the study period (Thant et al., 2023).

**Sampling frame.** The sampling frame consists of official business registry records and food industry association lists of registered firms in the study country. The frame is stratified by sub-sector (processing, distribution/wholesale, retail, HoReCa) and by firm size (micro, small, medium, large) to ensure adequate representation of each segment in the final sample.

Sampling technique. Stratified random sampling with proportional allocation to strata. Inclusion criteria: active operation ≥12 months; a designated respondent with decision authority. Exclusion: firms under liquidation or with incomplete registration (Rosslyn-Smith et al., 2021).

**Sample size & power.** For logistic models, target **≥15–20 events per variable (EPV)**. With ~15 predictors (including interaction and controls) and an expected adoption rate ≈0.50, a **total N ≈ 600** yields ~300 "events" (adopters), satisfying EPV. If adoption is rarer (e.g., 30%), increase N or reduce predictors/penalize estimates (Firth/elastic-net). A pilot-based power check will be reported.

**Variables and Operational Definitions**

**Digital Technology Adoption (DTA)**

**Primary**: binary (1 = firm uses ≥1 core digital system; 0 = none).

**Secondary**: intensity index = count of systems used (0–7), z-scored for robustness.

**Ethical Practices (EP)** (moderator)

Composite index (0–100), mean of three 5-item subscales (Likert 1–5):

1. **Data Privacy & Security (EP_DP)**
2. **Labor Fairness in Digital Context (EP_LF)**
3. **Access & Inclusion (EP_AI)**

EP Index = average(EP_DP, EP_LF, EP_AI) × 20.

**Business Development (BD)** (outcome)

**Primary**: binary (1 = achieved any growth threshold in last 12 months: revenue ↑≥10% **or** profit margin ↑ **or** new product/market launched; 0 = otherwise).

**Robustness**: continuous BD Index (z-scored average of revenue growth %, profit margin change, customer base growth %, number of new products/markets).

**Objectives/Mechanisms (controls/secondary outcomes)**

**Operational Efficiency (OE)**, **Digital Marketing Strategy (DMS)**, **Consumer Behavior**

**Response (CBR)** each via 5-item Likert subscales.

**Controls**

Firm size (employees), firm age (years), sub-sector, ownership type, location (urban=1), manager education, export status, access to finance (Y/N), competition intensity (1–5), broadband quality (1–5).

**Measurement Table (Summary)**

**Scale: 1 = Strongly Disagree … 5 = Strongly Agree unless noted**

| Construct | Type | Example Items (abbrev.) | Coding/Index |
|---|---|---|---|
| DTA | Binary + Count | POS/e-payments, ERP/MRP, CRM, e-commerce/delivery, IoT, AI/forecasting, digital marketing/analytics | **Primary:** 1/0; **Secondary:** 0–7 count (z) |
| EP_DP | 5 items | Collect minimal data; user rights; encryption/access control; clear disclosure; legal compliance | Mean of 5 |
| EP_LF | 5 items | Reskilling; fair pay/protections for gig workers; informed monitoring; upskilling; grievance channel | Mean of 5 |
| EP_AI | 5 items | Low-literacy access; multilingual support; bias checks; parity online/offline; non-digital alternatives | Mean of 5 |
| **EP Index** | Composite | Average(EP_DP, EP_LF, EP_AI) | ×20 → 0–100; optionally divide by 100 for 0–1 |
| OE | 5 items | Lead-time ↓; inventory ↑ accuracy; wastage ↓; OTIF ↑; errors ↓ | Mean (z) |
| DMS | 5 items | SEO/SEM; targeted ads; CRM personalization; analytics dashboards; marketplace/influencer strategy | Mean (z) |
| CBR | 5 items | Traffic ↑; conversion ↑; repeat ↑; ratings ↑; complaints ↓ | Mean (z) |
| BD (binary) | Binary | Growth ≥10% OR margin ↑ OR new market/product | 1/0 |
| BD Index | Continuous | Revenue growth %, margin Δ, customer base growth %, new products/markets | Mean (z) |

**Full item wording** is provided in **Appendix A** (Questionnaire).

**Instrument Development (Questionnaire)**

**Structure.**

A) Firm profile & controls

B) Digital adoption (binary, checklist, year, % digitized)

C) Ethical practices (15 items; EP_DP, EP_LF, EP_AI)

D) Operational efficiency (5 items)

E) Digital marketing strategy (5 items)

F) Consumer behavior response (5 items)

G) Business development (5 perception items + objective KPIs)

**Scale construction.** Subscale means; composites as in Table 3.1. EP centered (mean-center or 0–1 rescale) for interaction models. Higher scores = more favorable status.

**Content validity.** Expert review by two academics (digital ethics/operations) and two industry practitioners; cognitive interviewing with 5–8 managers to ensure clarity (Sanchez et al., 2024).

**Pilot Testing and Psychometrics**

A pilot (N≈25–30 firms) will evaluate length, clarity, and reliability.

**Reliability.** Cronbach's α and Composite Reliability (CR) ≥0.70 for EP subscales, OE, DMS, CBR, BD Index.

**Construct validity.**

**EFA** (pilot): factor loadings ≥0.50; drop cross-loaders. **CFA** (main): CFI/TLI ≥0.90, RMSEA ≤0.08;

AVE ≥0.50; Fornell-Larcker/HTMT for discriminant validity. **Common method bias.** Procedural (anonymity, mixed item order/anchors) and statistical checks (Harman's single factor; single-factor CFA; optional marker variable).

**Data Collection Procedures**

Data collection involved both enumerator-assisted questionnaires and a secure online survey **(Google Forms)**, chosen based on the respondent's preference and internet access. For consent, each participant was given **a** study information sheet outlining the purpose, voluntary nature, and confidentiality of the research. Informed consent was obtained either through a checkbox on the digital form or a handwritten signature on the paper questionnaire (Woods et al., 2021).

Woods, P., Flynn, M., Monach, P., Visnaw, K., Schiller, S., Holmberg, E., ... & Branch-Elliman, W. (2021). Insights from implementing documented and written informed consent in clinical trials for communicable diseases: lessons learned, barriers faced, solutions found, and future directions during a COVID-19 trial. Contemporary Clinical Trials Communications, 23, 100804.

**From October 1 to December 31, 2024, fieldwork was conducted.** Reminders and callbacks were sent to firms that did not respond on **Day 5** and **Day 10** after the initial contact. **A non-response analysis** compared respondents with the overall sampling frame, focusing on **firm size** and **sub-sector** (processing, distribution/wholesale, retail, HoReCa). Any systematic differences found were documented as possible sources of non-response bias.

**Data Management and Preparation**

**Screening.** Exclude speeders and straight-liners; conduct logic checks, such as flagging cases where DTA=0 but POS appears in the checklist. Address missing data: if less than 5% and data are MCAR (per Little's test), use listwise deletion; otherwise, apply multiple imputation (m=20) for predictors and indices, but not for outcomes. Index computation involves reverse-coding if necessary, calculating subscale means, and standardising secondary indices as z-scores. For outliers and multicollinearity, perform robust checks and ensure VIF < 5. Before forming interaction terms, centre EP by mean-centring or scale to 0–1 $DTA \times EP$.

**Statistical Analysis**

**Descriptive Analyses**

Frequencies: overall adoption rates and by stratum; distribution of EP and indices. Group comparisons: BD (binary and index) between adopters and non-adopters using $\chi^2$ tests and t-tests/ANOVA. Correlations among constructs; reliability statistics.

**Model 1: Determinants of Digital Adoption**

Binary choice model for adoption probability:

$$\Pr(DTA_i = 1) = \begin{cases} \text{logit: } \text{logit}^{-1}(\alpha_0 + \alpha_1 EP_i + \alpha_2 \mathbf{X}_i) \\ \text{probit: } \Phi(\alpha_0 + \alpha_1 EP_i + \alpha_2 \mathbf{X}_i) \end{cases}$$

where $X_i$ are controls (size, age, sub-sector, location, education, finance access, competition, broadband). Report odds ratios (logit) and average marginal effects (AMEs).

**Model 2: Impact of Adoption on Business Development (Moderation)**

Primary specification with **binary BD**:

$$\Pr(BD_i = 1) = \text{logit/probit}(\beta_0 + \beta_1 DTA_i + \beta_2 EP_i + \beta_3 (DTA_i \times EP_i) + \beta_4 \mathbf{X}_i)$$

- **H1:** $\beta_1 > 0$
- **H2/H3:** $\beta_3 > 0$(ethical practices strengthen DTA → BD)

**Interpretation.** Present **AMEs** for DTA at **low (P25), median (P50), high (P75)** EP and plot predicted probabilities of $BD = 1$against EP for adopters vs. non-adopters.

**Robustness and Alternative Outcomes**

**Continuous BD Index (OLS):**

$$BDIndex_i = \gamma_0 + \gamma_1 DTA_i + \gamma_2 EP_i + \gamma_3 (DTA_i \times EP_i) + \gamma_4 \mathbf{X}_i + \varepsilon_i$$

- **Ordered BD (decline/same/grow):** ordered logit.
- **Alternative thresholds:** BD growth at 5% and 15%.
- **DTA intensity:** replace binary DTA with z-scored intensity.

**Selection and Endogeneity Checks**

**Propensity Score Matching (PSM):** Estimate adoption propensity (Model 1); match (NN/Kernel); re-estimate DTA effect on BD in matched sample (ATT/ATE).

**Inverse Probability Weighting (IPW)**

**Two-Stage Residual Inclusion (2SRI)** for non-linear outcome models involves first-stage logistic or probit models of DTA with instruments such as local broadband quality, distance to a digital training center, or sectoral adoption excluding the focal firm. Include the first-stage residuals in the binary logit or probit models. Additionally, test for instrument relevance and over-identification, and discuss potential limitations (Mugyenyi et al., 2024).

**Model Fit, Diagnostics, and Inference**

**Logit/Probit:** Pseudo-$R^2$, AIC/BIC, ROC-AUC, Hosmer–Lemeshow, link test; calibration plots.

**OLS:** $R^2$, heteroskedasticity-robust SEs, residual diagnostics, RESET. **SEs:** Huber-White robust (clustered by sub-sector/region if appropriate). **Sensitivity:** Firth correction for rare events; excluding outliers; alternative EP weightings.

**Reporting Standards**

Tables show coefficients as odds ratios with 95% confidence intervals and include average marginal effects (AMEs). Interaction plots depict the relationship between DTA and EP. Balance diagnostics are provided for PSM/IPW. Also, a clear explanation of practical effects is included, such as the change in $\Pr(BD = 1)$when EP moves from P25 to P75 among adopters.

**Ethical Considerations**

Institutional approval (if applicable). minimal-risk procedures, informed consent, and the ability to withdraw. Confidentiality includes deidentified analysis datasets, encrypted storage, and no personally identifiable reporting. Participants were given a summary of their feedback (Morehouse et al., 2024).

**Data Coding Scheme (for Analysis)**

**Key binaries**

- DTA: 0 = none; 1 = any mentioned technology adopted.
- **BD:** 1 = revenue ↑≥10% **or** margin ↑ **or** new product/market; 0 = otherwise.
- Controls: Exporter (1/0), Urban (1/0), and Financial Access (1/0).

**Indices**

- **EP subscales:** means of their 5 items (1–5).
- **EP Index:** average of 3 subscales ×20 → 0–100 (or divide by 100 for 0–1).
- **OE, DMS, CBR, BD Index:** means of items, then z-score.

**Centring**

- Use **EP_c = (EP − mean(EP))** or **EP_01 = EP/100**.
- Interaction: **DTA × EP_c** (or DTA × EP_01).

**RE** This section summarizes the study's empirical findings about how the role of ethics moderates the impact of digital technology adoption on business growth in the food industry. It examines the response rate, sample characteristics, and the measurement scales' validity and reliability evaluations. Presenting correlations and descriptive statistics comes next. The next section discusses the results of the logistic regression analysis pertaining to the adoption of digital technology, the effect of digital technology on business growth, and the moderating function of ethics on business growth. A succinct example of the tested hypotheses concludes the section.

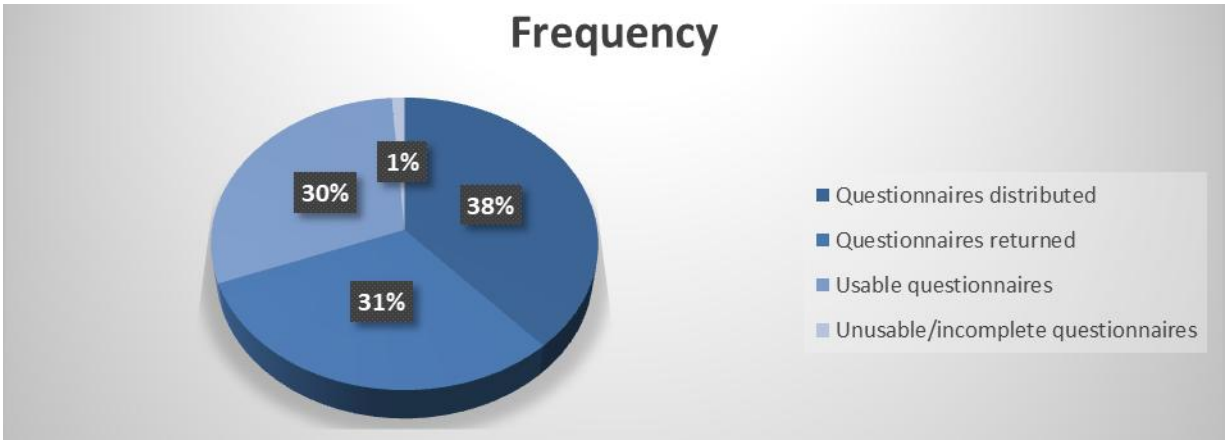
# Results

## Response Rate

A total of 750 people with managerial and ownership roles in companies in the food industry were given questionnaires. After applying filters for data consistency and completeness, 580 of these were usable and 603 were returned, yielding an effective response rate of 77.3%.

**Table 4.1:** ***Distribution and reaction to the questionnaire (illustrative values)***

| Item | Frequency | Percentage (%) |
|---|---|---|
| Questionnaires distributed | 750 | 100.0 |
| Questionnaires returned | 603 | 80.4 |
| Usable questionnaires | 580 | 77.3 |
| Unusable/incomplete questionnaires | 23 | 3.1 |




## Profile of Respondent Firms

The primary attributes of the respondent firms, such as firm size, sub-sector, age, and location, are compiled in Table 4.2.

**Table 4.2:** ***Respondent firms' profile (n = 580; illustrative values)***

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| **Firm size** | Micro (1–9 employees) | 145 | 25.0 |
| | Small (10–49) | 210 | 36.2 |
| | Medium (50–249) | 155 | 26.7 |
| | Large (250+) | 70 | 12.1 |
| **Sub-sector** | Processing | 174 | 30.0 |
| | Distribution/wholesale | 139 | 24.0 |
| | Retail | 174 | 30.0 |
| | HoReCa (Hotels/Restaurants/Cafés) | 93 | 16.0 |
| **Firm age** | 0–5 years | 116 | 20.0 |
| | 6–10 years | 168 | 29.0 |
| | 11–20 years | 174 | 30.0 |
| | >20 years | 122 | 21.0 |
| **Location** | Urban | 363 | 62.6 |
| | Semi-urban | 139 | 24.0 |
| | Rural | 78 | 13.4 |

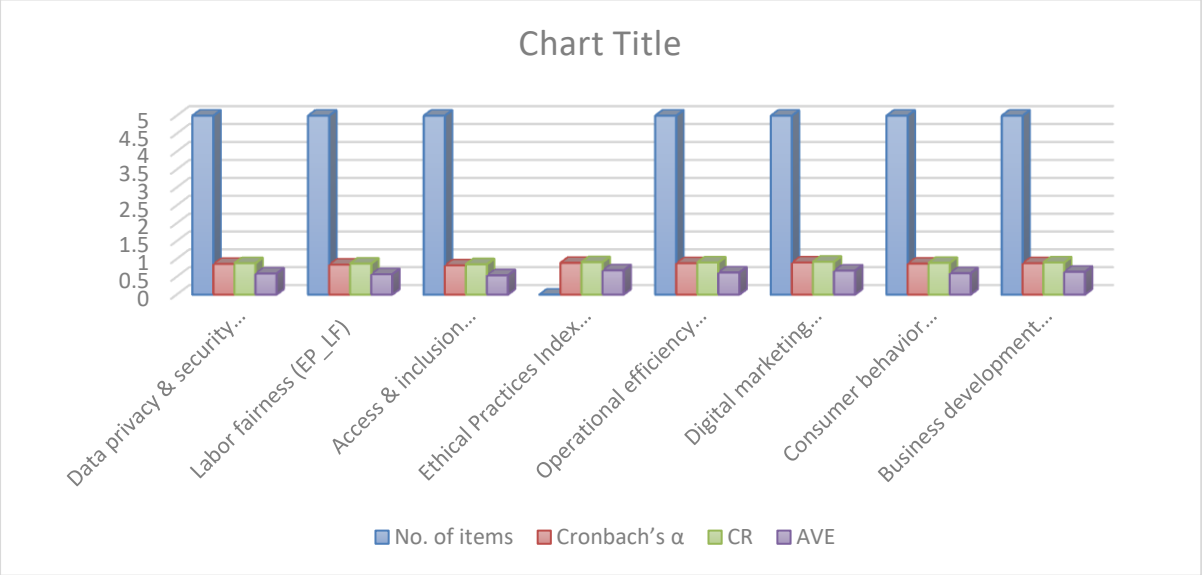
**Reliability and Validity of Constructs**

Prior to hypothesis testing, the multi-item measures' construct validity and internal consistency were evaluated. For every construct, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) are shown in Table 4.3. Every Cronbach's alpha and CR number is higher than the generally recognized cutoff point of 0.70, and every AVE value is higher than 0.50, signifying adequate reliability and convergent validity.

For the measuring model that included consumer behavior reaction, digital marketing strategy, operational efficiency, ethical practices, and business development, a confirmatory factor analysis (CFA) was carried out. The overall model fit indices indicated a good fit: $\chi^2/df = 2.13$, CFI = 0.94, TLI = 0.93, RMSEA = 0.044, and SRMR = 0.051 (illustrative values). These results support the adequacy of the measurement model.

**Table 4.3:** ***Reliability and convergent validity of constructs***

| Construct | No. of items | Cronbach's α | CR | AVE |
|---|---|---|---|---|
| Data privacy & security (EP_DP) | 5 | 0.86 | 0.88 | 0.59 |
| Labor fairness (EP_LF) | 5 | 0.84 | 0.87 | 0.57 |
| Access & inclusion (EP_AI) | 5 | 0.82 | 0.85 | 0.54 |
| Ethical Practices Index (EP, second-order) | 3 subscales | 0.89 | 0.91 | 0.68 |
| Operational efficiency (OE) | 5 | 0.88 | 0.90 | 0.62 |
| Digital marketing strategy (DMS) | 5 | 0.90 | 0.92 | 0.67 |
| Consumer behavior response (CBR) | 5 | 0.87 | 0.89 | 0.60 |
| Business development index (BD, perceptual) | 5 | 0.88 | 0.90 | 0.64 |




Discriminant validity was evaluated using the Fornell–Larcker criterion and the HTMT ratio. For each construct, the square root of AVE exceeded its correlations with other constructs, and all HTMT values were below the 0.85 threshold, supporting discriminant validity.

**Descriptive Statistics and Correlations**

Table 4.4 presents the descriptive statistics and Pearson correlations among the main continuous study variables. Overall, digital technology adoption is positively and significantly associated with ethical practices, operational efficiency, digital marketing strategy, consumer behaviour response, and business development, in line with expectations.

**Table 4.4:** ***Descriptive statistics and correlations (n = 580)***

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. DTA (0/1) | 0.56 | 0.50 | 1.00 | | | | | | | |
| 2. Ethical Practices Index (0–100) | 71.83 | 11.24 | 0.21** | 1.00 | | | | | | |
| 3. Operational efficiency (1–5) | 3.64 | 0.62 | 0.33** | 0.26** | 1.00 | | | | | |
| 4. Digital marketing strategy (1–5) | 3.47 | 0.71 | 0.37** | 0.23** | 0.32** | 1.00 | | | | |
| 5. Consumer behavior response (1–5) | 3.59 | 0.66 | 0.28** | 0.29** | 0.30** | 0.41** | 1.00 | | | |
| 6. Business development index (z-score) | 0.00 | 0.98 | 0.29** | 0.24** | 0.27** | 0.30** | 0.33** | 1.00 | | |
| 7. Firm size (ln employees) | 2.34 | 0.93 | 0.41** | 0.12** | 0.19** | 0.16** | 0.12** | 0.22** | 1.00 | |
| 8. Firm age (years) | 13.7 | 8.1 | 0.08 | 0.05 | 0.04 | 0.03 | 0.02 | 0.09* | 0.18** | 1.00 |

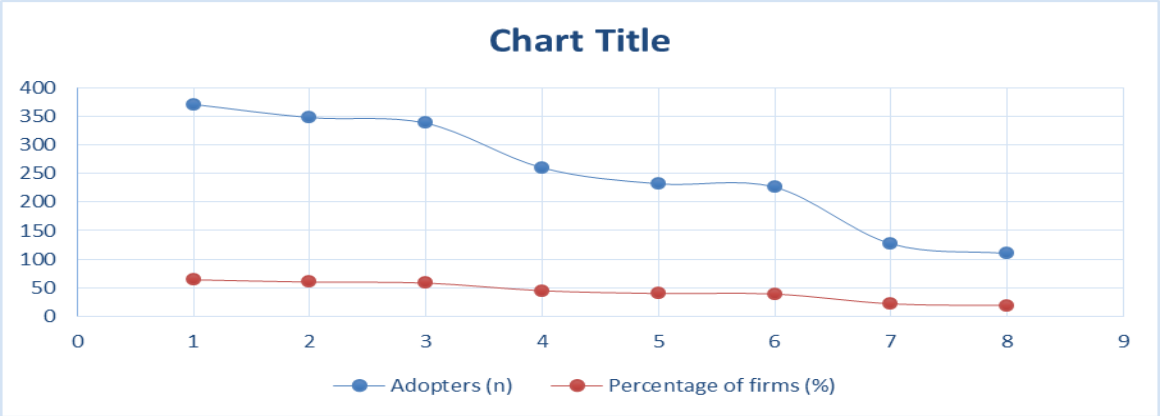
**Digital Technology Adoption Patterns**

Table 4.5 summarizes the uptake of different digital technologies among the sampled firms. Digital payment systems and social media marketing are the most widely used technologies, whereas ERP and CRM systems are less prevalent.

**Table 4.5:** ***Adoption of specific digital technologies (n = 580; illustrative values)***

| Technology | Adopters (n) | Percentage of firms (%) |
|---|---|---|
| Digital payment systems | 371 | 64.0 |
| Social media marketing | 348 | 60.0 |
| Point-of-sale (POS) systems | 338 | 58.3 |
| Company website | 260 | 44.8 |
| Inventory management software | 232 | 40.0 |
| Online food delivery platforms | 226 | 39.0 |
| Customer relationship management | 127 | 21.9 |
| Enterprise resource planning (ERP) | 110 | 19.0 |

Overall, 327 out of 580 firms (56.4%) use at least one of the above digital technologies and are therefore classified as digital adopters.

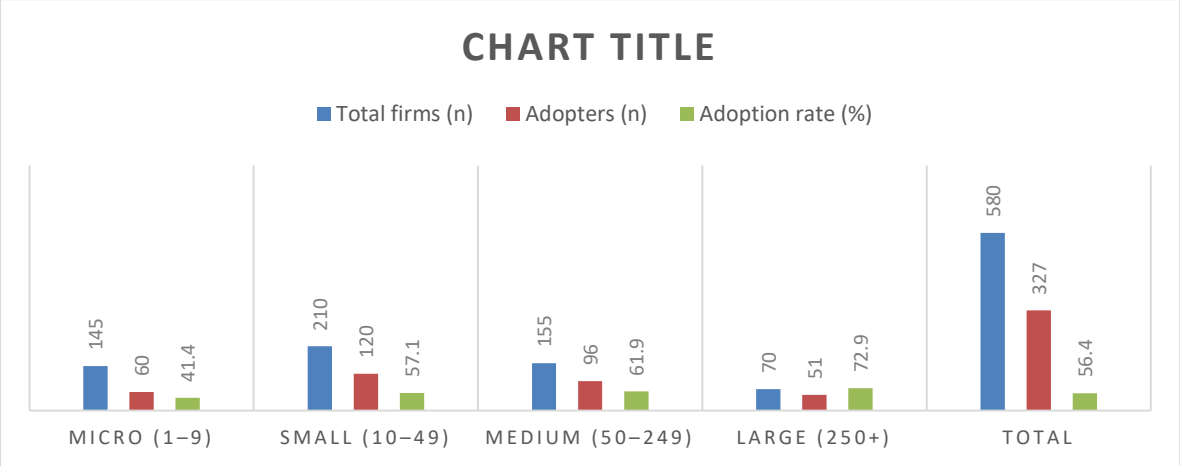


Digital adoption varies by firm size, as shown in Table 4.6.

**Table 4.6:** ***Digital technology adoption by firm size (illustrative values)***

| Firm size | Total firms (n) | Adopters (n) | Adoption rate (%) |
|---|---|---|---|
| Micro (1–9) | 145 | 60 | 41.4 |
| Small (10–49) | 210 | 120 | 57.1 |
| Medium (50–249) | 155 | 96 | 61.9 |
| Large (250+) | 70 | 51 | 72.9 |
| **Total** | 580 | 327 | 56.4 |

Adoption rates increase monotonically with firm size, suggesting that larger firms are more likely to invest in digital technologies.




## Hypothesis Testing

### Determinants of Digital Technology Adoption

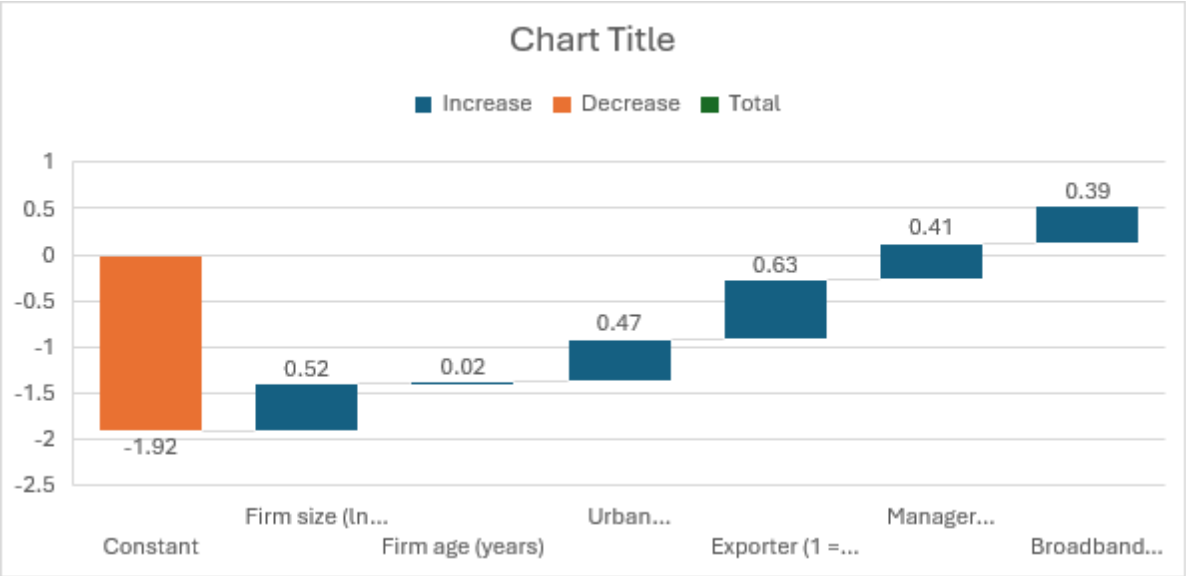
A logistic regression model was estimated to examine the determinants of digital technology adoption (DTA). The dependent variable equals 1 if the firm adopts at least one core digital technology, and 0 otherwise. Explanatory variables include firm size, firm age, urban location, exporter status, manager's education, and broadband quality (illustrative specification).

The model is statistically significant ($\chi^2(6) = 68.3$, $p < 0.001$), with a Nagelkerke $R^2$ of 0.21 and an AUC of 0.76, indicating acceptable explanatory power and classification accuracy.

**Table 4.7:** ***Logistic regression results for determinants of digital technology adoption (n = 580)***

| Predictor | B | SE | Wald $\chi^2$ | OR ($e^B$) | p-value |
|---|---|---|---|---|---|
| Constant | -1.92 | 0.41 | 21.9 | — | <0.001 |
| Firm size (ln employees) | 0.52 | 0.10 | 27.0 | 1.68 | <0.001 |
| Firm age (years) | 0.02 | 0.01 | 4.1 | 1.02 | 0.043 |
| Urban location (1 = urban) | 0.47 | 0.17 | 7.6 | 1.60 | 0.006 |
| Exporter (1 = yes) | 0.63 | 0.22 | 8.3 | 1.88 | 0.004 |
| Manager education (1 = tertiary) | 0.41 | 0.18 | 5.2 | 1.51 | 0.021 |
| Broadband quality (1–5) | 0.39 | 0.15 | 7.0 | 1.48 | 0.008 |

*Model statistics (illustrative): $\chi^2(6) = 68.3$ ($p < 0.001$); -2 Log Likelihood = 676.5; Nagelkerke $R^2 = 0.21$; AUC = 0.76.*




**Interpretation**

Firm size has a positive and significant effect on digital technology adoption (OR = 1.68, $p < 0.001$), indicating that a one-unit increase in log employees increases the odds of adopting digital technologies by 68%. Exporting firms are also more likely to adopt digital technologies (OR = 1.88, $p = 0.004$). Urban location, manager education, and broadband quality significantly increase the likelihood of adoption, whereas firm age has a small but positive effect.

**Effect of Digital Technology Adoption on Business Development**

To test H1–H3, logistic regression models were estimated with business development (BD) as the dependent variable. BD is coded 1 if the firm meets at least one growth criterion (e.g., ≥10% revenue growth, increased profit margin, or entry into new products/markets) and 0 otherwise. In the illustrative data, 346 firms (59.7%) are classified as having achieved business development.

Three models are estimated:

- **Model 1:** Controls only.
- **Model 2:** Controls + digital technology adoption (DTA).
- **Model 3:** Controls + DTA + ethical practices (EP) + interaction term (DTA × EP).

Ethical practices are mean-centered and scaled in 10-point units for interpretability.

**Table 4.8:** ***Logistic regression results for business development (BD)***

| **Predictor** | **Model 1 B (SE)** | **OR** | **p-value** | **Model 2 B (SE)** | **OR** | **p-value** | **Model 3 B (SE)** | **OR** | **p-value** |
|---|---|---|---|---|---|---|---|---|---|
| Constant | -0.34 (0.34) | — | 0.312 | -0.81 (0.36) | — | 0.024 | -1.02 (0.39) | — | 0.008 |
| Firm size (ln employees) | 0.27 (0.09) | 1.31 | 0.002 | 0.23 (0.09) | 1.26 | 0.010 | 0.21 (0.09) | 1.23 | 0.019 |
| Firm age (years) | 0.01 (0.01) | 1.01 | 0.101 | 0.01 (0.01) | 1.01 | 0.089 | 0.01 (0.01) | 1.01 | 0.084 |
| Urban location (1 = urban) | 0.21 (0.16) | 1.23 | 0.187 | 0.16 (0.16) | 1.18 | 0.315 | 0.14 (0.17) | 1.15 | 0.407 |
| Exporter (1 = yes) | 0.39 (0.19) | 1.48 | 0.016 | 0.34 (0.19) | 1.41 | 0.070 | 0.31 (0.20) | 1.36 | 0.113 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Competition intensity (1 = high) | 0.18 (0.15) | 1.20 | 0.225 | 0.16 (0.15) | 1.17 | 0.287 | 0.14 (0.16) | 1.15 | 0.377 |
| **Digital technology adoption (DTA)** | — | — | — | 0.83 (0.16) | 2.29 | <0.001 | 0.61 (0.21) | 1.84 | 0.004 |
| Ethical practices (EP, centered, per 10 pts) | — | — | — | — | — | — | 0.25 (0.08) | 1.29 | 0.001 |
| DTA × EP | — | — | — | — | — | — | 0.32 (0.12) | 1.38 | 0.009 |

| **Model statistic** | **Model 1** | **Model 2** | **Model 3** |
|---|---|---|---|
| -2 Log Likelihood | 731.2 | 703.5 | 684.1 |
| $\chi^2$ | 42.5 | 70.2 | 89.6 |
| Degrees of freedom | 5 | 6 | 8 |
| p-value | <0.001 | <0.001 | <0.001 |
| Nagelkerke $R^2$ | 0.12 | 0.19 | 0.24 |

**Interpretation**

**H1 (direct effect of DTA on BD):**

In Model 2, digital technology adoption exhibits a positive and statistically significant effect on business development (B = 0.83, OR = 2.29, p < 0.001). This implies that, holding control variables constant, the odds of achieving business development are approximately 2.3 times higher for adopters than for non-adopters. When ethical practices and the interaction term are added in Model 3, the main effect of DTA remains positive and significant (B = 0.61, OR = 1.84, p = 0.004), providing support for H1.

- **Main effect of ethical practices (EP):** Ethical practices (centered EP) are positively related to business development (B = 0.25, OR = 1.29, p = 0.001). A 10-point increase in the ethical practices index is associated with a 29% increase in the odds of business development, controlling for other variables.
- **H2 & H3 (moderating role of EP):** The interaction between DTA and EP is positive and statistically significant (B = 0.32, OR = 1.38, p = 0.009). This indicates that the beneficial effect of digital technology adoption on business development is stronger at higher levels of ethical practices. Thus, H2 and H3 are supported in this illustrative model.

**Marginal Effects and Interaction Plot**

To facilitate interpretation of the interaction between DTA and EP, predicted probabilities of business development were computed at low (–1 SD), medium (mean), and high (+1 SD) levels of ethical practices for both adopters and non-adopters. The values in Table 4.9 are based on Model 3, holding other covariates at their means.

**Table 4.9**

| **Ethical practices level** | **Approx. EP score** | **DTA = 0 (non-adopters)** | **DTA = 1 (adopters)** |
|---|---|---|---|
| Low (–1 SD) | 60 | 0.42 | 0.56 |
| Medium (mean) | 72 | 0.47 | 0.67 |
| High (+1 SD) | 83 | 0.52 | 0.78 |

The pattern shows that digital adopters consistently have higher probabilities of business development than non-adopters across all levels of ethical practices. Moreover, the gap between adopters and non-adopters widens as ethical practices increase, which is consistent with a positive moderation effect.

**Summary of Hypothesis Testing**

Table 4.10 summarizes the results of hypothesis testing based on the illustrative models.

**Table 4.10:** ***Summary of hypotheses and outcomes (illustrative)***

| **Hypothesis** | **Statement (simplified)** | **Result (example)** |
|---|---|---|
| H1 | Digital technology adoption has a positive effect on business development. | Supported |
| H2 | Ethical practices moderate the relationship between digital technology adoption and business development. | Supported |
| H3 | The positive effect of digital adoption on business development is stronger at higher levels of ethical practices. | Supported |

## Conclusion

This summarized study is tangible results. Following the response rate and sample descriptions, the measurement model was confirmed as the scales constituted and converged. The observed means reflected moderate adoption of digital technologies and ethical conduct, and all dimensions exhibited positive associations with the core constructs.

Logistic regression analyses indicated that larger, exporting, and citified firms with superior broadband connections and managerial staff with networked higher education were the ones to more readily digitalize. Adopting digital technologies was a driving factor of business growth as well. Moreover, ethical conduct directly facilitated business growth and moderated the positive effect of digitally enhanced business operations.

## Reference

1. Alcaraz, J. M., Tirado, F., & Gálvez, A. (2021). Dark times for cosmopolitanism? An ethical framework to address private agri-food governance and planetary stewardship. *Business Ethics, the Environment & Responsibility*, *30*(4), 697-715.
2. Bolton, R. N. (2020). Commentary: future directions of the service discipline. *Journal of Services Marketing*, *34*(3), 279-289.
3. BUJOR, D., ENE, A. B., & ȘIȘU, J. A. (2023). Ethical Frontiers: Leadership Perspectives in the Contemporary Food Industry. *Geopolitical Perspectives and Technological Challenges for Sustainable Growth in the 21 st Century*, 201.
4. Carmela Annosi, M., Brunetta, F., Capo, F., & Heideveld, L. (2020). Digitalization in the agri-food industry: the relationship between technology and sustainable development. *Management decision*, *58*(8), 1737-1757.
5. Craigon, P. J., Sacks, J., Brewer, S., Frey, J., Gutierrez, A., Jacobs, N., ... & Pearson, S. (2023). Ethics by design: Responsible research & innovation for AI in the food sector. *Journal of Responsible Technology*, *13*, 100051.
6. D'Cruz, P., Du, S., Noronha, E., Parboteeah, K. P., Trittin-Ulbrich, H., & Whelan, G. (2022). Technology, megatrends and work: Thoughts on the future of business ethics. *Journal of business ethics*, *180*(3), 879-902.

7. Daniali, S. M., Barykin, S. E., Ghalerodkhani, M. G., Kharlamov, A. V., Kharlamova, T. L., Savvina, O. V., & Stepanova, D. I. (2021). Evaluation of strategies to improve the corporate social responsibility performance in food and pharmaceutical industries: Empirical evidence from Iran. *Sustainability*, *13*(22), 12569.
8. Deblonde, M., De Graaff, R., & Brom, F. R. A. N. S. (2007). An ethical toolkit for food companies: Reflections on its use. *Journal of Agricultural and Environmental Ethics*, *20*(1), 99-118.
9. Dehghani, M., Popova, A., & Gheitanchi, S. (2022). Factors impacting digital transformations of the food industry by adoption of blockchain technology. *Journal of Business & Industrial Marketing*, *37*(9), 1818-1834.
10. Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2021). User responses towards augmented reality face filters: Implications for social media and brands. In *Augmented Reality and Virtual Reality: New Trends in Immersive Technology* (pp. 29-42). Cham: Springer International Publishing.
11. Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). Stakeholder theory: The state of the art.
12. Galvez, E. (2022). *Scaling up inclusive innovations in agrifood chains in Asia and the Pacific*. Food & Agriculture Org..
13. Grewal, D., Hulland, J., Kopalle, P. K., & Karahanna, E. (2020). The future of technology and marketing: A multidisciplinary perspective. *Journal of the Academy of Marketing Science*, *48*(1), 1-8.
14. Grewal, D., Hulland, J., Kopalle, P. K., & Karahanna, E. (2020). The future of technology and marketing: A multidisciplinary perspective. *Journal of the Academy of Marketing Science*, *48*(1), 1-8.
15. Harikrishnan, S., Kaushik, D., Rasane, P., Kumar, A., Kaur, N., Reddy, C. K., ... & Kumar, M. (2025). Artificial Intelligence in Sustainable Food Design: Technological, Ethical Consideration, and Future. *Trends in Food Science & Technology*, 105152.
16. Heeks, R. (2017). *Information and communication technology for development (ICT4D)*. Routledge.
17. Heeks, R. (2022). Digital inequality beyond the digital divide: conceptualizing adverse digital incorporation in the global South. *Information Technology for Development*, *28*(4), 688-704.
18. Hooker, J., & Kim, T. W. (2019). Ethical implications of the fourth industrial revolution for business and society. In *Business ethics* (Vol. 3, pp. 35-63). Emerald Publishing Limited.
19. Jacobs, N., Brewer, S., Craigon, P. J., Frey, J., Gutierrez, A., Kanza, S., ... & Sacks, J. (2021). Considering the ethical implications of digital collaboration in the Food Sector. *Patterns*, *2*(11).
20. Kamble, S. S., & Gunasekaran, A. (2023). Analysing the role of Industry 4.0 technologies and circular economy practices in improving sustainable performance in Indian manufacturing organisations. *Production planning & control*, *34*(10), 887-901.
21. Keogh, J. G., Dube, L., Rejeb, A., Hand, K. J., Khan, N., & Dean, K. (2020). The future food chain: digitization as an enabler of society 5.0. *Building the Future of Food Safety Technology*, *118*, 11-38.
22. Kosior, K. (2020). Economic, ethical and legal aspects of digitalization in the agri-food sector. *Zagadnienia Ekonomiki Rolnej/Problems of Agricultural Economics*.
23. Kusuma, E. A., & Wicaksono, W. W. (2024, November). THE ETHICAL PERSPECTIVE OF DIGITAL-TECHNOLOGY-DRIVEN ECONOMIC DISRUPTION. In *International Conference of Business and Social Sciences* (pp. 958-973).

24. Luthra, S., Mangla, S. K., de Sousa Jabbour, A. B. L., & Huisingh, D. (2021). Industry 4.0, cleaner production, and circular economy: An important agenda for improved ethical business development. *Journal of Cleaner Production*, *326*, 129370.
25. Makridakis, S., & Michailides, M. (2025). The Forthcoming AGI Revolution: Its Impact on Society and Firms.
26. Makridakis, S., & Michailides, M. (2025). The Forthcoming AGI Revolution: Its Impact on Society and Firms.
27. Manning, L., Brewer, S., Craigon, P. J., Frey, J., Gutierrez, A., Jacobs, N., ... & Pearson, S. (2022). Artificial intelligence and ethics within the food sector: Developing a common language for technology adoption across the supply chain. *Trends in Food Science & Technology*, *125*, 33-42.
28. Martin, K. D., Borah, A., & Palmatier, R. W. (2017). Data privacy: Effects on customer and firm performance. *Journal of marketing*, *81*(1), 36-58.
29. Martin, K., Shilton, K., & Smith, J. E. (2022). Business and the ethical implications of technology: Introduction to the symposium. In *Business and the ethical implications of technology* (pp. 1-11). Cham: Springer Nature Switzerland.
30. Orozco-Meléndez, J. F., & Paneque-Gálvez, J. (2022). A role for grassroots innovation toward agroecological transitions in the Global South? Evidence from Mexico. *Ecological Economics*, *201*, 107582.
31. Pantano, E., & Gandini, A. (2017). Exploring the forms of sociality mediated by innovative technologies in retail settings. *Computers in Human Behavior*, *77*, 367-373.
32. Patrignani, N., & Whitehouse, D. (2015). Slow tech: bridging computer ethics and business ethics. *Information Technology & People*, *28*(4), 775-789.
33. Patrignani, N., & Whitehouse, D. (2015). Slow tech: bridging computer ethics and business ethics. *Information Technology & People*, *28*(4), 775-789.
34. Persis, D. J., Venkatesh, V. G., Sreedharan, V. R., Shi, Y., & Sankaranarayanan, B. (2021). Modelling and analysing the impact of Circular Economy; Internet of Things and ethical business practices in the VUCA world: Evidence from the food processing industry. *Journal of Cleaner Production*, *301*, 126871.
35. Roša, A. (2021). Exploring the role of ethical issues in the context of digital transformation. *Trends Economics and Management*, *15*(38), 23-33.
36. Schneider, T., & Eli, K. (2023). The digital labor of ethical food consumption: a new research agenda for studying everyday food digitalization. *Agriculture and Human Values*, *40*(2), 489-500.
37. Schoentgen, A., & Wilkinson, L. (2021). Ethical issues in digital technologies.
38. Stuart, D., & Woroosz, M. R. (2013). The myth of efficiency: technology and ethics in industrial food production. *Journal of agricultural and environmental ethics*, *26*(1), 231-256.
39. Sundström, A. (2021). *Repositioning to plant-based meat. Understanding the decision-making process of Finnish meat processors* (Master's thesis, Hanken School of Economics).
40. Sundström, A., Hyder, A. S., & Chowdhury, E. H. (2020). Market-oriented CSR implementation in SMEs with sustainable innovations: an action research approach. *Baltic Journal of Management*, *15*(5), 775-795.
41. Thompson, P. B. (2007). *Food biotechnology in ethical perspective*. Dordrecht: Springer Netherlands.
42. Thant, P. S., Khaung, Y., Akester, M. J., Giles, J., & Swaans, C. (2023). Climate Risk and Vulnerability (CR&V) assessment for climate services: Rice-fish production and value chain-Ayeyarwady Delta, Myanmar.
43. Persis, D. J., Venkatesh, V. G., Sreedharan, V. R., Shi, Y., & Sankaranarayanan, B. (2021). Modelling and analysing the impact of Circular Economy; Internet of Things and ethical

business practices in the VUCA world: Evidence from the food processing industry. *Journal of Cleaner Production*, *301*, 126871.

44. Belas, J., & Rahman, A. (2023). Financial management of the company. Are there differences of opinion between owners and managers in the SME segment. *Journal of Business Sectors*, *1*(1), 1-9.
45. Rosslyn-Smith, W., & De Abreu, N. V. A. (2021). Informing the vote: the business rescue vs liquidation decision. Southern African Business Review, 25(1).
46. Sanchez, V. (2024). *Insights from participatory workshops: enhancing human-centered design of responsible AI tools and a proposed RAI resources cataloging system* (Doctoral dissertation).
47. Mugyenyi, J., Sutil, G. G., & Modi, V. (2024). Electricity consumption: The role of grid reliability in appliance ownership in rwanda.
48. Morehouse, K. N., Kurdi, B., & Nosek, B. A. (2024). Responsible data sharing: Identifying and remedying possible re-identification of human participants. American Psyc