

THESES OF THE DOCTORAL (PhD) DISSERTATION

IMPACT OF INFORMATION SYSTEMS ON COMPETITIVENESS IN THE FOOD SECTOR'S SUPPLY CHAIN IN JORDAN

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1. INTRODUCTION OF THE TOPICS AND OBJECTIVE

Background and Research Problem

Supply chain competitiveness has become a defining factor in firm performance, particularly within the food industry, where product perishability, traceability, and logistical complexity elevate supply chain management from a commercial concern to a matter of public trust and economic stability (GAMMELGAARD & NOWICKA, 2024). In emerging economies such as Jordan, these pressures are magnified by infrastructural variability, regulatory evolution, and constrained resource environments (LUTFI et al., 2022).

Digital transformation, driven by the adoption of information systems (IS), is widely regarded as foundational to modern supply chain management. Technologies such as enterprise resource planning systems (ERP), the Internet of Things (IoT), and advanced analytics platforms are understood to enable real-time visibility, coordination, and agility (BÜYÜKÖZKAN & GÖÇER, 2018). Yet while the operational benefits of such technologies are well documented, the precise mechanisms through which they translate into sustainable competitive advantage remain underexplored (GROVER & KOHLI, 2012). Moreover, sustainability has emerged as a non-negotiable dimension of supply chain strategy, where companies are increasingly responsible for the ethical and environmental footprint of their operations (GURZAWSKA, 2020). Nevertheless, its intersection with digitally enabled competitiveness is seldom examined in an integrated manner (WARNER & WÄGER, 2019).

This study addresses these gaps by investigating how information systems adoption (ISA) serves as a platform for developing both the dynamic capabilities required for market responsiveness and the measurable sustainability outcomes that modern markets demand. It does so within the empirical context of Jordan's food supply chain, a sector of strategic importance to national economic and food security, undergoing rapid modernization, and characterized by both urgent need for digital transformation and distinct implementation challenges (ORABI, 2016; FERROZ et al., 2021).

Jordan's policy environment increasingly prioritizes digitalization and sustainability, as reflected in the government's alignment with the United Nations Sustainable Development Goals into its national policy architecture (DoS, 2026; MoPIC, 2025; MoA, 2025). Recent

advances in national e-governance and digital infrastructure have positioned the country for continued digital transformation, with the Ministry of Digital Economy and Entrepreneurship reporting over 80% of government services digitalized under its 2021-2025 strategy (MoDEE, 2026). Nevertheless, evidence-based guidance on how firms in this context should prioritize digital investments to achieve both competitive and sustainability outcomes remains lacking (HANELT et al., 2021).

Rationale and Significance

Prior literature has tended to examine technological adoption, organizational agility, or sustainability in isolation, neglecting the synergistic interactions among them (WARNER & WÄGER, 2019). In particular, empirical evidence is scarce regarding the processes by which information system-enabled capabilities contribute to sustainable competitiveness in emerging economy settings (GROVER & KOHLI, 2012). Practitioners and policymakers in Jordan consequently lack a clear hierarchy of strategic priorities for digital investment, leading to fragmented resource allocation. Additionally, digital transformation discourse often emphasizes technological assets over the organizational capacities needed to leverage them, and implementation challenges are frequently treated as definitive barriers rather than as obstacles that resilient firms can overcome (HANELT et al., 2021).

Theoretically, the study contributes to refining the Dynamic Capabilities (DC) View within the domain of supply chain digitalization, offering evidence on the hierarchy of capabilities necessary for competitiveness and addressing a key debate in strategic management (LINDE et al., 2021). It also advances green information systems literature by quantitatively linking sustainability practices enabled by information systems directly to competitive performance. Therefore, this research investigates the junction of these three core elements: information systems, competitiveness, and sustainability. It posits that these elements are not separate goals but are intrinsically linked within a digitally transforming supply chain. The study seeks to unravel how IS adoption serves as a platform, enabling both the dynamic organizational capabilities for market responsiveness and the measurable sustainability outcomes that modern markets demand, and how this synergy determines competitive competitiveness in the context of Jordan's food supply chain. In this study, supply chain competitiveness is defined as the set of operational capabilities through which a firm

competes in its market – namely delivery reliability, cost efficiency, responsiveness to demand, order accuracy, and service flexibility. This conceptualization follows the way competitiveness is operationalized in the supply chain literature, where it is captured through measurable capabilities such as cost, delivery dependability, quality, and flexibility (LI et al., 2006).

Practically, the findings provide actionable intelligence for supply chain managers and executive, offering a prioritization framework for digital investment decisions. For national policymakers, the insights inform the design of support programs that emphasize capability development alongside technology procurement, contributing to a more resilient and competitive national logistics ecosystem.

This research addresses the theoretical and empirical voids by developing and empirically validating an integrated model that identifies and explains the influence of information system-enabled capabilities on supply chain competitiveness.

Research Aim and Questions

The objective of this research is to develop and empirically validate an integrated model that identifies and explains the influence of information system-enabled capabilities on supply chain competitiveness. Moving beyond the question of whether information systems impact competitiveness, the study investigates how and through which mechanisms this impact materializes.

The main research question is: ***What are the key determinants of supply chain competitiveness in the Jordanian food industry, and what is the role of information systems in shaping this competitiveness?***

This addressed through the following sub-questions:

- a. To what extent do technological factors, the adoption of information systems (ISA) and the development of IS-enabled dynamic capabilities, directly influence supply chain competitiveness?
- b. How does the strategic use of Information Systems (IS) for sustainability initiatives contribute to competitive advantage in the supply chain?

- c. What is the relative importance of possessing valuable resource versus measuring performance effectively when compared to these digital and adaptive factors?
- d. Do the challenges of implementation fundamentally mediate success, or can they be absorbed by resilient organizations?

2. MATERIAL AND METHODS

The present study follows post-positivism philosophy in order to develop and empirically validate an integrated model that identifies and explain the influence of IS-enabled capabilities on supply chain competitiveness. Where it employs a quantitative, hypothesis testing approach to examine casual relationships reflecting a pursuit of explaining phenomena. Quantitative research, which encompasses experimental, semi-experimental, correlational, or descriptive research designs, is generally characterized by the collection of numerical data (GHANAD, 2023). Therefore, this study employs a deductive research approach as it systematically derives hypotheses from established theory and tests them through quantitative data and statistical analysis. This approach supports the objective testing of causal relationships and enhances the generalizability of findings, consistent with a positivist research philosophy (SAUNDERS et al., 2019).

2.1. Data Collection Strategy

The data gathered specifically for this study was through a structured questionnaire distributed to professionals within Jordan's food supply chain sector. The questionnaire consisted of nine sections. (i) Section 1: Personal Questions, (ii) Section 2: Demographics and Firm Characteristics, (iii) Section 3: Information Systems Adoption (ISA) and Usage, (iv) Section 4: Supply Chain Competitiveness, (v) Section 5: IS and Sustainability, (vi) Section 6: Resource-Based View (RBV) Factors, (vii) Section 7: Dynamic Capabilities Theory (DCT) Factors, (viii) Section 8: Challenges & Moderating Factors, and (ix) Section 9: KPI Effectiveness. With a total of 62 questions. The sections reflect different theories relevant to the research aim and objectives. The time needed for participants to complete the questionnaire was roughly 15-20 minutes. Consistent with a cross-sectional research design, the questionnaire was administered for responses over a four-month period, spanning April-July 2025, with a total of 200 completed responses collected at a single point in time from each participant.

To evaluate the efficiency and effectiveness of the sampling frame, the frame must be comprehensive by including all of the target population. Hence, the actors in the food supply chain are purposively chosen, they are: Producers/Manufacturers, Distributors/Wholesalers

and Logistic Providers. The following criteria were applied for selecting the actors in the supply chain:

- Actors in the food supply chain;
- Actors have knowledge of information systems (IS);
- Actors have established or planning sustainable initiatives;
- Actors that have localized SC operations in Jordan;

This instrument was designed to measure the latent constructs of the theoretical model, including Information Systems Adoption, Dynamic Capabilities, and Supply Chain Competitiveness.

2.2. Data Analysis Methods

The resulting dataset from the questionnaire, formed the sole basis for the following statistical analyses, including confirmatory factor analysis, reliability tests, and structural equation modeling that validated the research hypotheses. No pre-existing datasets, archival records, or secondary sources were used in the empirical testing phase, ensuring that the findings directly reflect the viewpoints and realities of the targeted contemporary context.

2.2.1. Model Fitness Analysis

In this study, confirmatory factor analysis (CFA) is employed, where CFA serves as a theory-testing procedure. The primary function of this method is to provide a mechanism for interpreting the internal architecture of the covariance or correlation matrices that these variables produce, thereby revealing any layered information that may simplify and explain the data (LEDESMA et al., 2021). This process reduces the overall complexity of the data by taking advantage of the inherent interdependencies, meaning a small number of factors can account for approximately the same amount of information as the original observations (GORETZKO et al., 2021).

Before conducting the actual empirical analysis that evaluates the effects of the independent variables on the dependent variables, the study conducted a correlation analysis. The analysis showed that supply chain competitiveness (SCC) has an average moderate relationship with the independent variables; meaning that the SCC direction was influenced

by other variables significantly. After the correlation analysis, CFA was evaluated using multiple fit indices. Some of the indices are absolute fit (χ^2/df), PGFI, CFI, and RMSEA, which all were within acceptable range.

2.2.2. Reliability and Validity

In addition to the model fitness analysis, the study evaluated the reliability and validity of the study variables. Reliability refers to the consistence and stability of a measurement instrument over time, across different items, and among different observers (BRYMAN & BELL, 2015). A reliable instrument produces similar results under consistent conditions, minimizing random error. Reliability in quantitative research which utilizes questionnaires is frequently evaluated using internal consistency measures such as Cronbach's alpha (α) and Composite Reliability (CR) (CRESWELL & CRESWELL, 2017), which were implemented in this study.

Validity refers to the extent to which an instrument accurately measures what it is intended to measure (CRESWELL & CRESWELL, 2017). Hence, this study ensures validity by adapting measurement instruments that have been validated in previous research such as Average Variance Extracted (AVE) and standardized beta (CHEUNG et al., 2024; HAIR et al., 2011). Another test that justifies the move to SEM analysis is the discriminant validity that was following the Fornell-Lacker criterion, which were considered statistically robust and theoretically consistent (BECKER et al., 2023).

2.2.3. Structural Equation Modeling (SEM)

SEM is an advanced multivariate technique used to evaluate how well a proposed theoretical model is supported by empirical data (KLINE, 2023); in this study it was employed. It specifically tests complex relationships between observed variables and latent constructs, which are unobservable traits that can be concluded from those variables. Essentially, SEM improves our comprehension of complex multivariate relationships by employing hypothesis testing to verify how groups of variables define a construct and the relationships among constructs (CEPEDA-CARRION et al., 2019; LEI & WU, 2007). SEM is a versatile analytical technique that can be utilized in a wide range of professional and academic environments. For instance, it is frequently utilized in disciplines such as sociology, education, social policy, and family science. Importantly, SEM is also instrumental in

examining economic phenomena, particularly within economics and market research, as well as in psychology, demography, biology, genetics, and medical science. In summary, due to its broad utility, the SEM framework can be effectively employed across a wide array of research domain (TARKA, 2018). Covariance-based SEM was selected because the study's aim is to test and assess the overall fit of a theory-driven model built on established constructs, which is the setting CB-SEM is designed for; PLS-SEM, by contrast, is oriented toward prediction and toward formative or small-sample contexts and would not provide the model-fit assessment central to this confirmatory study. A regression-based approach was not adopted because it cannot simultaneously estimate the measurement and structural components, nor the mediation paths, which the integrated model requires. All analyses were conducted in IBM SPSS Statistics and IBM SPSS Amos, with model parameters estimated by maximum likelihood.

3. MAIN FINDINGS OF THE DISSERTATION

This chapter presents an analysis of the data gathered from Jordan's food supply chain sector, transitioning from the previously established methodological framework to the essential stage of empirical validation. Based on the principles of Structural Equation Modeling (SEM), the results presented provide the proposed conceptual framework, which integrates constructs from IS adoption to dynamic capabilities, to a thorough statistical analysis. The sequence of analysis begins with establishing the integrity of the measurement model through Confirmatory Factor Analysis (CFA), proceeds to test the hypothesized structural paths driving supply chain competitiveness, and concludes by investigating the potential mediating role of IS challenges (HAIR et al., 2021).

3.1. Descriptive Statistics of the Sample

The preliminary phase of the research involved a demographic analysis, employing descriptive statistics to characterize the study's participants across variables such as age, gender, and educational level, as shown in Table 1. This approach is methodologically standard for profiling a sample population and is grounded in the scientific study of human population structures (PALLANT, 2020). Accurately defining and measuring these participants' characteristics is a critical step for establishing the context and validity of research findings (SARDAK et al., 2018).

Table 1: Demographics and Professional Attributes of Participants

		Frequency	Percent
Demographics	Categories	(n)	(%)
Age	18 – 24 years	52	26
	25 – 34 years	95	47.5
	35 – 44 years	33	16.5
	45 – 54 years	15	7.5
	more than 55 years	5	2.5
	Total	200	100
Gender	Male	107	53.5
	Female	93	46.5

	Total	200	100
Education	High school	3	1.5
	Bachelors	146	73
	Masters	43	21.5
	Ph.D.	8	4
	Total	200	100
Company size	1 – 49 employees	43	21.5
	50 – 99 employees	27	13.5
	100 – 249 employees	31	15.5
	250 – 499 employees	32	16
	>500 employees	67	33.5
	Total	200	100
Nature of company	National	82	41
	International	118	59
	Total	200	100
Functional departments	Research and development	46	23
	Finance and accounting	18	9
	Distribution	9	4.5
	Sales	38	19
	Customer service	17	8.5
	Human resources	43	21.5
	Marketing	29	14.5
	Total	200	100
Hierarchy of position	Team leader	41	20.5
	First line manager	22	11
	Middle manager	24	12
	Top level manager	25	12.5
	Do not hold any leadership position	88	44
	Total	200	100
Using IS in SC	Less than 2 years	49	24.5
	Between 2-5 years	55	27.5

operations	More than 5 years	96	48
	Total	200	100
Hold a position	Rarely	93	46.5
or job related			
to	Occasionally	107	53.5
sustainability	Total	200	100

(Source: Developed by Author)

Common-method bias is therefore not a serious concern, although this preliminary test is complemented by the well-defined multi-factor structure confirmed in the CFA. Prior to model estimation, the distributional properties of the constructs were examined (Table 2). All item-level skewness values fell between -0.85 and -0.25 and kurtosis between -0.62 and $+0.80$, within the thresholds of $|\text{skewness}| < 2$ and $|\text{kurtosis}| < 7$ recommended for ML-based SEM (Curran, West & Finch, 1996), supporting the use of maximum-likelihood estimation. As a further safeguard against mild non-normality, the structural relationships were re-estimated with robust standard errors; the significance decisions were unchanged for all hypotheses except IS-enabled Sustainability, which became marginal ($p \approx 0.05$).

Table 2: Descriptive Statistics and Normality of Constructs

Construct	Mean	SD	Median	Skewness	Kurtosis
IS Adoption (ISA)	3.61	0.81	3.71	-0.64	0.35
Supply Chain Competitiveness (SCC)	3.70	0.83	3.88	-0.78	0.78
IS-enabled Sustainability (ISS)	3.54	0.83	3.67	-0.53	0.31
Resource Based View (RBV)	3.66	0.78	3.75	-0.32	-0.35
Dynamic Capabilities (DC)	3.60	0.80	3.71	-0.38	0.29
IS Challenges (ISC)	3.49	0.86	3.60	-0.69	0.40

KPI Effectiveness (KPIE)	3.49	0.78	3.54	-0.30	0.00
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(Source: Developed by Author)

3.1.1. Industry and System Context

Contextual data regarding the firms' primary roles and IS infrastructure provides critical insight into the operating environment. The respondent pool is heavily weighted towards core supply chain actors, with logistics providers (35%), product manufacturers (27.5%), and distributors/wholesalers (19.5%) constituting the vast majority (82% collectively). A clear technological hierarchy is evident in the systems used; while foundational ERP systems are the dominant platform, utilized by 33.5% of firms, there is a steep drop-off in the implementation of more sophisticated tools. Specifically, AI/ML for demand forecasting (4%) and blockchain for traceability (3.5%) see markedly low adoption. When asked to evaluate the level of information systems integration across their supply chain, 65% of respondents answered "often" or "repeatedly". Furthermore, the use of real-time data for decision -making is an established practice, with 64% of respondents using it "often" or "repeatedly". This operational reliance is reflected in the year-end performance outcomes. The assessment of Key Performance Indicators (KPIs) shows a strong positive trend, with the modal response for critical metrics like On-time delivery (58%), customer retention (55%), and product/service quality (54%) being a "slight increase". This quantitative backdrop establishes that the industry is not only technologically equipped but is also actively converting that capability into measurable performance gains. This suggests the Jordanian food supply chain sector currently prioritizes operational integration over predictive or transformative digital capabilities.

3.2. Assessment of the Measurement Model

3.2.1. Confirmatory Factor Analysis and Model Fit

Confirmatory factor analysis is a hypothesis-testing approach, its primary objective is to statistically evaluate the model's "goodness of fit" by determining how well this hypothesized structure replicates the observed data (KLINE, 2023). The primary objectives of structural equation modeling are evaluating a hypothesized model's goodness of fit and

estimating its parameters. This assessment is most commonly conducted using two complementary approaches: χ^2 goodness-of-fit test or a suite of practical fit indices. One of the main differences between them is that the χ^2 goodness-of-fit is a test of exact fit, where the null hypothesis (H_0) is that “the model fits the data perfectly”. In practice, this test is often supplemented by descriptive fit indices, which provide a more flexible evaluation of “close fit” and are generally less sensitive to sample size (MCNEISH & WOLF, 2023).

The absolute fit measures provide a basic indication of how well the hypothesized model reproduces the observed data. The chi-squared/degree of freedom (χ^2/df) value was 1.771 as shown below in Table 3, which is well below the conservative threshold of 2.0, indicating a good model fit (KANG & AHN, 2021). Furthermore, the Root Mean Square Residual (RMR) was 0.05, falling below the 0.08 cut-off for a close fit (Xia & Yang, 2019). However, the Goodness-of-Fit (GFI) was 0.706. While below the ideal level of 0.9, contemporary guidelines note that GFI values above 0.7 can be considered acceptable in complex models, particularly in social sciences where perfect fit is rare (KANG & AHN, 2021).

Table 3: Model Fitness Analysis

Fit Index	Recommended Threshold	Model Values	Interpretation	Reference
Absolute Fit Measures				
CMIN/DF (χ^2/df)	<2(Good); <5(Acceptable)	1.771	Good Fit	Kang & Ahn, (2021)
RMR	<0.08(Acceptable)	0.05	Good Fit	Xia & Yang, (2019)
GFI	≥ 0.9 (Good); .0.7 (Acceptable)	0.706	Acceptable	Kang & Ahn, (2021)
Incremental Fit Measures				
CFI	≥ 0.9 (Good); >0.85(Acceptable)	0.873	Acceptable	Shi & Maydeu-

				Olivares, 2020)
IFI	≥ 0.9 (Good); > 0.85 (Acceptable)	0.874	Acceptable	Shi & Maydeu- Olivares, 2020)
TLI	≥ 0.9 (Good); > 0.85 (Acceptable)	0.866	Acceptable	Shi & Maydeu- Olivares, 2020)
Parsimony-Adjusted Measures				
PNFI	> 0.5 (Acceptable)	0.71	Acceptable	Pek & Hoyle, (2022)
PCFI	> 0.5 (Acceptable)	0.825	Acceptable	Pek & Hoyle, (2022)
Error of Approximation				
RMSEA	< 0.06 (Good); < 0.08 (Acceptable)	0.062	Acceptable	Sokolov, (2019)

(Source: Developed by Author)

The incremental fit indices, which measure the improvement in fit over a baseline null model, all fall within the acceptable range. The Comparative Fit Index (CFI=0.873), Incremental Fit Index (IFI=0.874), and Tucker-Lewis Index (TLI=0.866) each meet or exceed the value of 0.85, a benchmark recognized in contemporary methodological reviews as indicative of adequate model fit in practical research contexts (SHI & MAYDEU-OLIVARES, 2020). While not indicating a “great” fit, these values are widely considered to represent an “acceptable” or “adequate” fit (HAIR et al., 2019). This suggests the model represents a significant improvement over a null model. Crucially, the parsimony-adjusted indices, which reward simpler models, are strong. The Parsimony Normed Fit Index (PNFI=0.71) and Parsimony Comparative Fit Index (PCFI=0.825) substantially exceed the

0.5 benchmark commonly used in contemporary research to indicate a well specified model that achieves good fit without unnecessary complexity (PEK & HOYLE, 2022). Finally, the Root Mean Square Error of Approximation (RMSEA) of 0.062 provide strong evidence for a reasonable fit. This value is below the 0.08 threshold for acceptable fit, and in addition the RMSEA's 90% confidence interval falls entirely within acceptable bounds, a key criterion for model adequacy (SOKOLOV, 2019). The complete measurement model, illustrating the constructs and their respective indicators as validated by the CFA is presented below in Figure 1, where it provides a visual summary of the assessed theoretical framework.

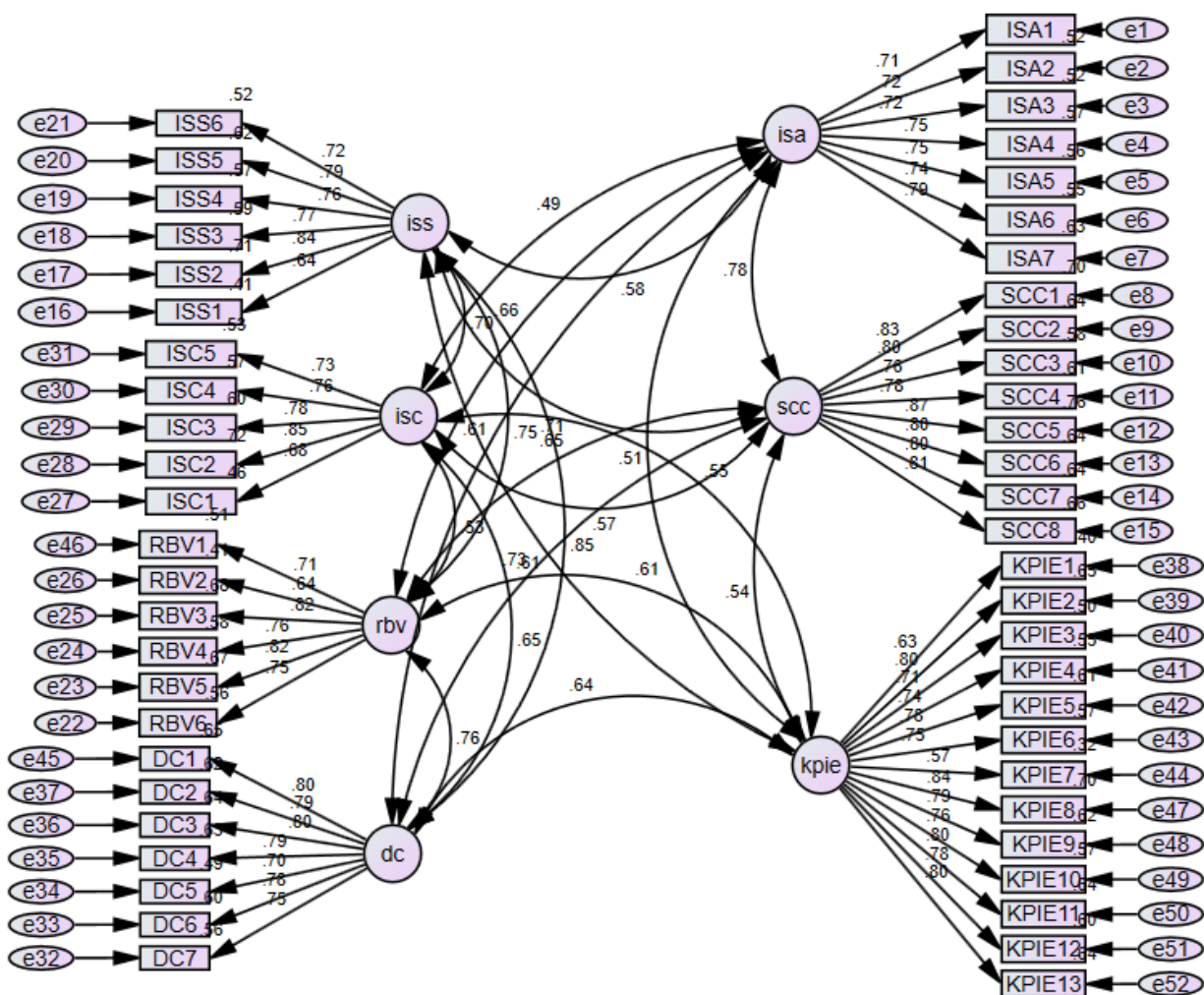


Figure 1: Model Fitness Analysis

(Source: Developed by Author)

The assessment of the model fit indices presents mixed but ultimately positive acceptable evidence. While the GFI and incremental fit indices (CFI, IFI, TLI) suggest a minor weakness, this is common in complex models and does not invalidate the overall strong fit. Whereas key indices of χ^2/df , RMR, RMSEA, and the parsimony-adjusted measures (PNFI, PCFI) all meet their respective criteria for a satisfactory model. Given that the primary goal

of CFA is to determine if the model is plausible and adequate for proceeding with structural analysis, the collective evidence from these indices supports the conclusion that the measurement model exhibits a reasonably good fit to the data (WEST et al., 2012). Therefore, the model is deemed sufficient to proceed with an evaluation of the reliability, validity, and subsequent testing of the structural relationships.

3.2.2. Reliability and Validity Analysis

Following the confirmatory factor analysis, the measurement model was subjected to tests for reliability and validity (HAIR et al., 2021). Reliability, which reflects the internal consistency of the measurement scales, was assessed using Cronbach's alpha and Composite Reliability (CR). As shown in Table 4, the Cronbach's alpha values for all constructs ranged from 0.88 to 0.949, significantly exceeding the conservative threshold of 0.7, thus demonstrating excellent reliability (CHO & KANG, 2024). Composite Reliability, a measure often considered more appropriate for SEM as it is less sensitive to the number of items, was also employed (RÖNKKÖ & CHO, 2022). All CR values, which spanned from 0.871 to 0.944, were well above the 0.7 benchmark, providing strong evidence of the scales' internal consistency (SARSTEDT et al., 2020).

Validity was observed through convergent and discriminant test (CHEUNG et al., 2024). Convergent validity, indicating that a set of items effectively converges to represent the same underlying construct, was evaluated using the Average Variance Extracted (AVE) and the statistical significance of the factor loadings (AB HAMID et al., 2017). The AVE for every construct surpassed the critical value of 0.5, with results ranging from 0.552 to 0.652. This confirms that each latent variable captures a sufficient amount of variance from its indicators relative to measurement error (VOORHEES et al., 2016).

Table 4: Reliability and Validity Analysis of Constructs

Construct	Indicator Loadings (range)	Composite Reliability (CR)	Average Variance Extracted (AVE)	Cronbach's Alpha (α)

Dynamic Capabilities (DC)	DC1 - DC7 (0.703 - 0.803)	0.912	0.598	0.914
IS Adoption (ISA)	ISA1 – ISA7 (0.712 – 0.794)	0.896	0.552	0.898
IS Challenges (ISC)	ISC1 – ISC5 (0.678 – 0.846)	0.871	0.575	0.880
IS Sustainability (ISS)	ISS1 – ISS6 (0.639 – 0.844)	0.888	0.571	0.897
KPI Effectiveness (KPIE)	KPIE1 – KPIE13 (0.565 – 0.837)	0.944	0.566	0.949
Resource-Based View (RBV)	RBV1 – RBV6 (0.638 – 0.824)	0.887	0.568	0.895
Supply Chain Competitiveness (SCC)	SCC1 – SCC8 (0.759 – 0.869)	0.937	0.652	0.940

(Source: Developed by Author)

Discriminant validity, which verifies that constructs are conceptually distinct, was tested using the Fornell-Larcker criterion. This method requires that the root of the AVE for any given construct is greater than its correlation with any other construct (AB HAMID et al., 2017), displayed diagonally in Table 5. Inspection of the full matrix shows the criterion is satisfied for most, but not all, construct pairs. The AVE square root for ISS (0.755) is exceeded by its correlation with Dynamic Capabilities (0.846), and a similar pattern arises

for the ISA–SCC and RBV–DC pairs, indicating borderline discriminant validity for these conceptually adjacent constructs. Assessed with the more sensitive HETEROTRAIT–MONOTRAIT ratio (HTMT; HENSELER, RINGLE & SARSTEDT, 2015), all values fall below 0.90 and all but one (ISS–DC = 0.851) below the stricter 0.85 threshold (Table 6), supporting discriminant validity across the model while transparently noting the marginal ISS–DC pair (VOORHEES et al., 2016). To summarize, the measurement model provides strong evidence of reliability, convergent validity and discriminant validity. These adequate behavioral measures show that the constructs are adequate and different, providing a firm basis for model evaluation and hypothesized relationships.

Table 5: Fornell-Larcker Criterion Validity Analysis

Construct	1	2	3	4	5	6	7
1. RBV	0.753						
2. SCC	0.653	0.808					
3. ISC	0.530	0.574	0.758				
4. KPIE	0.610	0.542	0.555	0.753			
5. ISS	0.752	0.713	0.698	0.612	0.755		
6. DC	0.756	0.726	0.649	0.638	0.846	0.774	
7. ISA	0.663	0.778	0.493	0.508	0.581	0.615	0.743

(Source: Developed by Author)

Note: Diagonal elements (in bold) are the square root of the AVE. Off-diagonal elements are the correlations between constructs. For discriminant validity, the diagonal value should be greater than the correlations in its row and column (Shrestha, 2021).

Table 6: HETEROTRAIT–MONOTRAIT (HTMT) Ratios

Construct	1	2	3	4	5	6	7
ISA	1.000						
SCC	0.778	1.000					

ISS	0.584	0.716	1.000				
RBV	0.668	0.654	0.759	1.000			
DC	0.609	0.727	0.851	0.747	1.000		
ISC	0.496	0.575	0.710	0.548	0.651	1.000	
KPIE	0.501	0.534	0.615	0.600	0.636	0.575	1.000

(Source: Developed by Author)

3.3. Structural Model and Hypothesis Testing

3.3.1. Structural Model Fit and Correlation Analysis

A correlation matrix was generated to evaluate the bivariate relationships between the latent constructs, providing an initial diagnostic of the proposed model linkages. The coefficients reported are Pearson correlations, supported by the distributional diagnostics in Section 3.1. As a robustness check, Spearman rank-order correlations were computed and were near-identical (maximum absolute difference 0.05; see Table 7), confirming the results are not sensitive to the ordinal nature of the Likert data.

Table 7: Spearman vs Pearson with Supply Chain Competitiveness (SCC)

Construct Pairs with SCC	Spearman	Pearson	Difference
SCC-ISA	0.709	0.713	0.004
SCC-ISS	0.658	0.652	0.006
SCC-RBV	0.621	0.597	0.024
SCC-DC	0.630	0.672	0.042
SCC-ISC	0.513	0.519	0.007
SCC-KPIE	0.491	0.501	0.010

(Source: Developed by Author)

The analysis reveals that supply chain competitiveness (SCC) shares significant positive relationships with all independent constructs. The strongest bivariate relationship exists between SCC and ISA ($r^* = 0.713$) as depicted in Table 8. This powerful correlation

underscores that technological integration is a fundamental driver of competitive advantage, enabling superior operational visibility, process automation, and responsiveness in complex supply chains. The results align with the established view that digital transformation is critical to building resilient and efficient supply chain operations (IVANOV & DOLGUI, 2021). Furthermore, SCC demonstrates strong correlation with DC ($r^* = 0.672$) and ISS ($r^* = 0.652$). This pattern indicates that a firm's ability to sense, seize, and reconfigure its resources is essentially linked to its market performance (TEECE, 2018). It also aligns with the view that competitiveness is less about static resource ownership and more about the capacity for continuous reconfiguration and adaption (FAINSHMIDT et al., 2019). The significant link with ISS indicates that leveraging IS for environmental and social governance is no longer a preference but is integrated into core competitive strategy, a trend accelerated by global sustainability pressures (DUBEY et al., 2021; BEN-DAYA et al., 2023). The findings suggest that in the Jordanian context, competitiveness is increasingly tied to agile and responsible business practices.

Table 8: Correlation Analysis Results

Construct	SCC	ISA	ISS	RBV	DC	ISC	KPIE
SCC	1.0						
ISA	0.713**	1.0					
ISS	0.652**	0.521**	1.0				
RBV	0.597**	0.596**	0.671**	1.0			
DC	0.672**	0.552**	0.765**	0.672**	1.0		
ISC	0.519**	0.437**	0.621**	0.481**	0.579**	1.0	
KPIE	0.501**	0.457**	0.563**	0.547**	0.59**	0.52**	1.0

(Source: Developed by Author)

Note: ** $p < 0.01$ (two-tailed)

The moderate correlation of SCC with RBV ($r^* = 0.597$) and KPIE ($r^* = 0.501$) suggest that while tangible resources and performance measurement are important, their standalone relationship with competitiveness is less pronounced than dynamic and adaptive

capabilities. This implies that only having valuable resources is insufficient to result in competitive outcomes, rather more importantly is the capacity to measure and dynamically reconfigure them (WILDEN & GUDERGAN, 2017; FAINSHMIDT et al., 2019). A particularly intriguing finding is the positive correlation between SCC and ISC ($r^* = 0.519$). This may reflect a "performance paradox," in which more advanced and competitive organizations are more aware of and prepared to report systemic challenges resulting from their more complex operations (WAMBA & QUEIROZ, 2022). Conversely, less mature organizations may lack the expertise to even recognize these complexities (AL-KHATIB, 2023).

On the other hand, the high correlation between ISS and DC ($r^* = 0.765$) is theoretically coherent. Designing sustainable supply chains is a dynamic process that requires firms to continuously learn, innovate, and transform their processes in response to stakeholder demands and legislative changes (GÖLGEÇI & KUIVALAINEN, 2020). However, this significant inter-construct correlation indicates a potential for multicollinearity in the structural model, which needs to be carefully examined to guarantee the stability of path coefficient estimates, even in the face of reported discriminant validity (HAIR, 2014).

3.3.2. Direct Hypothesis Testing Results

In this section, the direct casual paths between the latent constructs that were hypothesized are tested after the foundational relationships were established by bivariate correlation (SARSTEDT et al., 2023; HAIR et al., 2021). SEM moves beyond simple correlations by assessing each independent variable's distinct prediction ability on the dependent variable, while also accounting for the impact of every other construct in the model. This multivariate approach is critical for understanding the distinct role each factor plays in driving Supply Chain Competitiveness (SCC). Providing a more subtle and accurate picture than correlation analysis alone, as it helps rule out false associations and provides a clearer interpretation of direct relationships (SARSTEDT et al., 2021). The results of the direct hypothesis tests are presented in Table 9.

Table 9: Relationship between studied variables

Hypothesis	Path Relationship	Std. Estimate (β)	p-value	Supported?
H1	ISA $\rightarrow$ SCC	0.604	< 0.001	YES
H2	DC $\rightarrow$ SCC	0.261	< 0.001	YES
H3	ISS $\rightarrow$ SCC	0.282	< 0.001	YES
H4	RBV $\rightarrow$ SCC	0.009	0.868	NO
H5	KPIE $\rightarrow$ SCC	0.044	0.476	NO

(Source: Developed by Author)

Hypothesis 1 proposed that the adoption of information systems (ISA) would directly enhance SCC. The analysis provides strong support for this hypothesis ($\beta = 0.604$, $p < 0.001$), this path coefficient is the largest in the model, indicating that ISA is the most powerful direct driver of competitiveness. This finding means that for companies in Jordan's food supply chain, investing in core information technologies directly translates into superior competitive performance. These systems enable the visibility, coordination, and efficiency required to compete in a fast-paced market (BELHADI et al., 2024). Hypothesis 2 suggests that a firm's dynamic capabilities (DC) would positively affect competitiveness. This hypothesis was also supported ($\beta = 0.261$, $p < 0.001$). While the effect is smaller than that of ISA, it is highly significant, which indicates that technology alone is not sufficient. This finding underscores that competitiveness stems from a combination of technological tools and managerial agility, and that DC are essential for translating digital investments into tangible competitive outcomes (VIAL, 2021). Hypothesis 3 predicted that leveraging information systems for sustainability (ISS) would boost competitiveness, by which the results confirm this ($\beta = 0.282$, $p < 0.001$), as shown in figure 2. Practically, this means that using IS to track and reduce carbon emissions in logistics, minimize food waste through better forecasting, or ensure ethical sourcing through traceability systems directly contributes to a stronger market position. Supply chain transparency and sustainability initiatives are integrally linked to improved performance, where consumers and business partners are increasingly valuing sustainable practices and are gaining a competitive edge (DUBEY et al., 2019).

Hypothesis 4 proposed that possessing valuable and rare resources (RBV), would directly enhance competitiveness. However, the analysis found no significant support for this path ($\beta = 0.009$, $p = 0.868$). This is a critical finding which suggests that in the dynamic context of Jordan's food supply chain, merely owning resources is not enough to guarantee a competitive advantage. The lack of a significant effect implies that static resources can be commoditized or made obsolete if not actively managed and reconfigured. This result provides empirical weight to the theoretical critique that the traditional RBV may be insufficient in highly volatile environments, where the ability to change and adapt is more critical than the resource portfolio itself (ELLSTRÖM et al., 2022). Hypothesis 5 argued that the effectiveness of key performance indicators (KPIE) would directly improve competitiveness. However, the results do not support this ($\beta = 0.044$, $p = 0.476$), which indicates, that while tracking performance metrics is a fundamental management activity, it does not, by itself, directly drive competitiveness. KPIs are often diagnostic tools that measure outcomes, but they are not a strategic capability that creates an advantage. The non-significant finding suggests that KPIE may act as a supporting mechanism that enables other capabilities rather than being a direct driver. This aligns with the view that performance measurement systems provide the data for decision-making, but the competitive advantage comes from the actions taken based on that data (GUNASEKARAN et al., 2015).

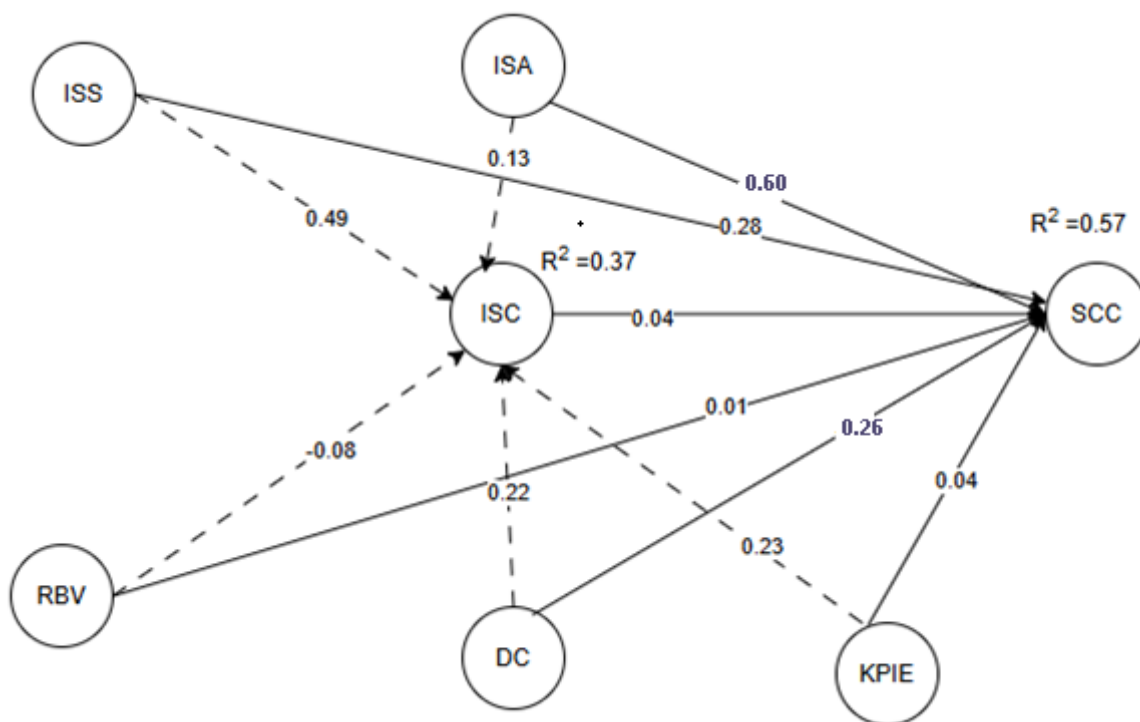


Figure 2: Structural Model with path coefficients and R-squared values

(Source: Developed by Author)

In summary, the model explains 57% of the variance in Supply Chain Competitiveness ($R^2 = 0.57$), which is considered a substantial level of explanatory power in this field of research (GÖLGEÇİ & KUIVALAINEN, 2020). The results clearly show that competitiveness is driven by a combination of digital infrastructure (ISA), organizational agility (DC), and sustainable business practices (ISS), while the static possession of resources (RBV) and measurement systems (KPIE) do not exert a significant direct influence.

3.3.3. Mediation Analysis Results

This section examines the proposed mediating role of Information System Challenges (ISC) as outlined in Hypothesis H6. A mediation analysis tests whether the effect of an independent variable on a dependent variable (SCC) is transmitted through a third, mediating variable (ISC). In this study, it's investigated whether the various IS constructs influence supply chain competitiveness indirectly by first increasing or decreasing the perceived level of IS challenges. For assessing indirect effects, the bootstrapping procedure has been conducted as recommended by HAYES (2017), where this method is preferred as it does not rely on the assumption of normal sampling distributions, providing more robust confidence intervals for the indirect effect. The results of this analysis are presented in Table 10.

Table 10: Results of Mediation Analysis Bootstrapping

Indirect Path	Total Effect	Direct Effect	Indirect Effect	95% CI (Lower)	95% CI (Upper)	Result
ISA → ISC → SCC	0.609**	0.604**	0.005	-0.021	0.032	No Mediation
DC → ISC → SCC	0.269**	0.261**	0.008	-0.015	0.034	No Mediation
ISS → ISC → SCC	0.301**	0.282**	0.019	-0.008	0.051	No Mediation

RBV → ISC → SCC	0.006	0.009	-0.003	-0.033	0.019	No Mediation
KPIE → ISC → SCC	0.053	0.044	0.009	-0.021	0.041	No Mediation

(Source: Developed by Author)

The results consistently show that for all hypothesized paths, the indirect effects are non-significant. This conclusion is drawn from the fact that the bootstrap confidence intervals (CI) for every indirect effect include zero (PREACHER & HAYES, 2004). Since these intervals cross zero, it cannot be concluded that the indirect effect is different from zero, and thus, mediation is not established. Therefore, hypothesis 6 (H6) is not supported. The findings indicate that ISC do not act as a significant mediating mechanism through which the other constructs influence SCC. This means that the powerful direct effects of ISA, DC, and ISS on SCC, reported in the previous section, are not meaningfully explained or channeled through the level of IS challenges faced by an organization.

This finding suggests that in the context of Jordan's food supply chain, the relationship between key IS-driven capabilities and competitiveness is robust. The positive impact of adopting new technologies, developing dynamic capabilities, and pursuing sustainability initiatives is not significantly diminished or facilitated by the challenges encountered during implementation. Organizations appear to be achieving competitiveness despite these challenges, implying a level of resilience or effective challenge management that decouples the experience of obstacles from the ultimate performance outcome. In other words, digital transformation is considered as manageable barriers to overcome rather than deterministic factors that dictate success or failure (WONG et al., 2020).

The assessment of the measurement model confirmed the reliability, convergent validity, and discriminant validity of all constructs, with the overall model demonstrating acceptable fit indices. The structural model analysis provided strong evidence supporting the significant direct effects of Information Systems Adoption, Dynamic Capabilities, and IS-enabled Sustainability on Supply Chain Competitiveness. Conversely, the hypotheses concerning the direct effects of the Resource-Based View and Key Performance Indicator Effectiveness were not supported. Finally, the mediation analysis established that Information System

Challenges do not act as a significant mediating mechanism between the other constructs and competitiveness. Collectively, these results lay a solid empirical foundation for discussing their practical and theoretical applicability's in the upcoming chapter.

4. NEW AND NOVEL RESULTS OF THE DISSERTATION

This study set out to investigate the determinants of supply chain competitiveness within Jordan's food industry, with a specific focus on the role of information systems in shaping this competitiveness. The research was centered on structural equation modeling (SEM), to construct and validate a model that tested the influence of key factors including Information Systems Adoption (ISA), Dynamic Capabilities (DC), IS-enabled Sustainability (ISS), Resource-based View (RBV), and KPI effectiveness (KPIE), while also evaluating the potential mediating role of IS challenges (ISC). The findings of this research offer insights that contribute to both academic research and managerial practice.

Information systems adoption has been shown to have the most effective on supply chain competitiveness (SCC) among the identified group of drivers. This finding highlights an important change in strategic thinking, as ERP and WMS are now viewed as the fundamental bases of competitive supply chain rather than just as operational improvements. This digital infrastructure offers the necessary visibility, coordination, and data driven control required to compete on efficiency, cost, and reliability in the Jordanian food sector, which is distinguished by its logistical complexities and perishable goods. In addition, the study established Dynamic Capabilities as another strategic driver. The significant positive effect of DC demonstrates that technology alone is not enough. Where its competitiveness is derived from a firm's organizational and managerial capacity to take advantage of its digital tools, by sensing market shifts through data analytics or seize opportunities through agile decision making. It also confirms the most important competitive differentiator in the dynamic Jordanian food supply chain is not the software's static resource but rather the organizational ability to strategically transform data into a competitive advantage.

Furthermore, the significant positive effect of IS sustainability demonstrates that employing digital tools for environmental and social governance is a direct driver of competitiveness. Firms that use systems to track carbon footprints ensure traceability and minimizes wastes, which simultaneously cuts costs, mitigates risks, and builds the trust required to access global markets. In today's global economy, sustainability when powered by IS, is a source of tangible competitive value.

The lack of a significant direct effect from the resource-based view (RBV), suggests that in the dynamic reality of today's market solely owning valuable resources is not enough. These resources are powerless without the dynamic capabilities to constantly equip and reconfigure them effectively. The advantage lies not in what you own, but in how intelligently it is used. Similarly, the finding of KPI Effectiveness (KPIE) shows that it does not directly drive competitiveness. It shows that performance measurement systems are diagnostic and not generative. They are measurements that shed light to problems and opportunities, but they are not what creates improvement. Competitiveness is driven by the managerial actions and strategic decisions influenced by that specific data set, also emphasizing the important role of DC. Another interesting result was the complete lack of mediation by ISC. This indicates that challenges such as high costs, technical problems, and lack of skill do not have to determine a project's ultimate success. For firms with strong direct capabilities and strategic commitment, these challenges become manageable obstacles rather than barriers. This concept teaches managers a critical lesson, where implementation should not be about avoiding risks but about proving your organization's resilience.

The research employed a methodological approach centered on Structural Equation Modelling (SEM) to test the proposed theoretical framework. The analysis began with Confirmatory Factor Analysis (CFA) to first establish the validity and reliability of the measurement model, making sure that the constructs are accurately defined within the intended model. Following this validation, SEM was used to examine the structural relationships within the model, providing a powerful and comprehensive assessment of the interconnections between ISA, DC, ISS, and their collective impact on SCC. The focus on firms within Jordan's food supply chain, may not be fully generalizable to other nation economies or industrial sectors with different characteristics. Furthermore, the cross-sectional nature of the data, cannot definitely account for changes over time nor establish casual links. These limitations, provide a clear path for future research, while keeping the validity of the findings within this project's context.

Finally, this study demonstrates that achieving supply chain competitiveness in a market like Jordan's, requires a focus on digital infrastructure, organizational agility and strategic sustainability. It provides managers with a clear, evidence-based mandate to invest not only

in technology but in the human and strategic capacities. For policymakers, the findings underscore the importance of fostering an ecosystem that supports both digital adoption and sustainable business practices. By supporting these relationships, this research contributes an actionable framework for building supply chains that are not only efficient and competitive, but also resilient and prepared to meet the complex demands of globalized economy.

5. PRACTICAL APPLICABILITY OF THE RESULTS

The findings of this study offer actionable insights for various stakeholders within the Jordanian food supply chain. By translating the empirical results into strategic guidance, this research provides a clear roadmap for enhancing competitiveness through policymakers, industry leaders and other stakeholders.

For Supply Chain Managers and Logistics Professional:

The findings mandate a shift in operational priorities. First, the organization must invest in and successfully implement integrated information systems, such as ERP and WMS, as core strategic investments rather than merely IT projects. These systems are no longer optional for achieving competitiveness. Second, to move beyond a passive role of system operation and actively manage dynamic capabilities. This involves forming cross functional teams capable of utilizing IS data to sense market changes, seize opportunities through rapid logistical reconfiguration, and transform challenges into opportunities. Finally, leveraging these systems to drive sustainability initiatives that affect the bottom-line, like food waste through data analytics.

For Senior Executives and Strategic Decision Makers:

At the strategic level, this research provides guidance for resource allocation and strategic planning. The organization's investment strategy must be redesigned to focus on growing the digital and human capital which enhance organizational agility rather than just acquiring physical assets. Budgeting must prioritize not only the owning of new technologies but also the investment in training and change management programs that develop the effective use of dynamic capabilities. Furthermore, the organization should reframe corporate sustainability from public relations to a core competitive strategy. Recognizing the importance of traceability and carbon footprint monitoring systems in gaining access to premium markets and establishing long-term value and reputation. The lack of mediation by IS challenges should empower the organization to pursue digital transformation with the confidence that strong leadership and strategic commitment can overcome any implementation obstacles.

For Policymakers and Government Agencies:

To enhance the national competitiveness of the food supply chain, policy interferences must adapt. Rather than only investing in hardware or software purchases, investing in design programs help encourage the development of dynamic capabilities and implementation resilience. This includes funding for managerial training in digital supply chain management, creating platforms for knowledge sharing, and developing industry specific standards for digital integration that reduce technical integration challenges. Acknowledging the strategic significance of ISS, policymakers should accelerate the creation of a national digital traceability infrastructure and offer incentives to companies that can demonstrate their use of IS to reduce their environmental footprint. This creates an ecosystem where sustainability and digitally advanced firms can thrive by balancing regulatory goals with competitive demands. Policymakers can help in securing the performance of the national economy from the inevitable disruptions of international trade by concentrating on building a resilient and agile supply chain ecosystem.

5.1. Theoretical Contribution

This research makes several contributions to the intersecting theoretical domains of Information System, Supply Chain Management and Competitiveness, and Strategic Management. The empirical findings from the Jordanian food supply chain context challenge established paradigms and offer subtle refinements, as detailed below.

The Dominance of Information Systems in Emerging Markets

This research redefines the strategic role of information systems from a supportive infrastructure to a primary strategic driver of supply chain competitiveness within an emerging market. In developing economies, the direct effect of IS Adoption (ISA) is the implementation of digital technology as a foundation block for modern competitive supply chains, as well as a tool for efficiency. Using integrated systems like ERP and WMS provides firms a transformative competitive advantage in a country like Jordan, where outdated technology may still be in use and the potential for technological bypassing is high. These technologies are not only tools for optimizing current processes, rather they establish the base upon which modern, transparent, and efficient supply chain operations are built.

Integrating Sustainability as a Core Strategic Driver

The research achieves a deep integration of Green IS literature into mainstream supply chain strategy. The significant and positive influence of ISS demonstrates that applying digital tools for environmental and social governance is not a secondary activity but a direct source of market advantage. In practical terms, this means that investments in systems for traceability, carbon footprint monitoring, and waste reduction are no longer just about risk management or corporate requirements. They are strategic investments that simultaneously enhance operational efficiency, build brand reputation, and secure access to premium markets with demanding sustainability standards. This finding establishes that when sustainability is achieved through information technology, it is naturally linked to competitiveness and is a key component of a modern, resilient business model. It integrates the principles of Green IS into the core of strategic supply chain theory.

Redefining the Strategic Hierarchy of Capabilities

This study provides an empirical purpose concerning the relative importance of having resources versus deploying them effectively. The findings demonstrate that Dynamic Capabilities (DC) function as a critical meta-capability that governs the effectiveness of the Resource-Based View within the volatile context of an emerging market supply chain. While RBV posits that valuable, rare, and inimitable resources are the primary source of sustained advantage, the results reveal a more complex hierarchy. The significant positive influence of DC on supply chain competitiveness, compared with the nonsignificant negligible effect of RBV, indicates that the static possession of resources is an insufficient condition for competitive success in a dynamic environment. Instead, the firm's fundamental ability to continuously detect changes in the market, seize opportunities through agile decision making, and most importantly to redesign its existing resource base to maintain alignment with a dynamic market is where competitive advantage is primarily located. This does not portray the RBV to be fruitless, rather it includes it within a more dynamic framework. It suggests that resources are the necessary raw materials, but DC are the essential engines that transform these materials into a sustained competitive output. This strategic hierarchy recalibration offers a more powerful lens which to see the performance drivers in the fast paced, digitally driven world of modern global supply chains.

The Core Triad of Digital Supply Chain Competitiveness

This research synthesizes its empirical findings to propose a different, integrative model that identifies a core triad of capabilities essential for competitiveness in emerging market supply chains. This triad consists of Digital Infrastructure (Information System Adoption) as the foundational layer, Organizations Agility (Dynamic capabilities) as the critical mediating capability, and Strategic Sustainability (Information System Sustainability) as the vital strategic orientation. The model demonstrates that competitiveness originates from the effective interaction between these elements rather than being the result of any single factor alone. Technology provides the data and connectivity, agility allows for strategic reconfiguration in response to this data, and sustainability focus ensures this reconfiguration aligns with long term value creation and market access. This framework offers managers and scholars a clear roadmap for prioritizing strategic investments in this digital era, offering a more practical alternative for complex, resource heavy models.

The Concept of Challenge Absorption in IS Implementation

This research introduces a theoretical refinement to technology adoption theory by revealing that Information System Challenges (ISC) do not necessarily mediate competitive performance. The results of the nonsignificant mediation suggest a decoupling effect, meaning that the strategic success or failure of digital initiatives is not always determined by the presence of implementational challenges. This indicates that with strong direct capabilities determined strategic execution, organizations can build the capacity to absorb, minimize, or eliminate obstacles. This finding provides new theoretical paths for comprehending how organizations effectively manage the inevitable friction of digital transformation while maintaining their competitiveness in the market.

The Diagnostic Nature of Performance Measurement

This research clarifies a critical theoretical differentiation in performance management by demonstrating that the efficacy of Key Performance Indicators (KPIs) serves as an advanced diagnostic tool rather than a source of competitive advantage. Competitiveness is not an automatic output of measurements, but is instead produced by the organizational dynamics that the measurements inform. As a result, whereas KPI efficacy is a required but

insufficient prerequisite for competitiveness, it is the quality of the managerial response to that data that ultimately determines competitive outcomes.

6. LIST OF PUBLICATIONS RELATED TO THE DISSERTATION

Articles, studies

1. Hattar, I. Z., & Felföldi, J. (2024). IMPACT OF INFORMATION SYSTEMS IN THE SUPPLY CHAIN: A SYSTEMATIC LITERATURE REVIEW. *Applied Studies in Agribusiness and Commerce*, 18(1). <https://doi.org/10.19041/APSTRACT/2024/1/3>
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Conference, presentations

1. Annual Doctoral School of Management and Business Doctoral Student Conference, February 11-12th 2025, University of Debrecen
2. Annual Doctoral School of Management and Business Doctoral Student Conference, May 2023, University of Debrecen
3. 6th International European Congress on Interdisciplinary Scientific Research conference August 26–27, 2022, Bucharest, Romania

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