ABAC ODI JOURNAL Vision. Action. Outcome

ISSN: 2351-0617 (print), ISSN: 2408-2058 (electronic)

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ABAC ODI JOURNAL Vision. Action. Outcome Vol 13(2) pp. 120-146

https://assumptionjournal.au.edu/index.php/odijournal

Published by the
Organization Development Institute
Graduate School of Business and Advanced Technology Management
Assumption University Thailand

ABAC ODI JOURNAL Vision. Action. Outcome
is indexed by the Thai Citation Index and ASEAN Citation Index

The Influence of Socioemotional Wealth on Business Intelligence Adoption Intention of Thai Family SMEs in Agricultural Machinery Business

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Received: 16 March 2025. Revised: 10 May 2025. Accepted: 05 June 2025

Abstract

The modern business environment demands rapid and effective decision-making, facilitated by tools that can process and analyze data from multiple sources. Business Intelligence (BI), as an effective tool, has been adopted, aiding organizations of all sizes in making fact-based decisions across tactical and strategic levels. Small and medium-sized enterprises (SMEs) encounter limitations in various facets ranging from management, resources and including information technology adoption. Family firms possess unique characteristics, Socioemotional Wealth (SEW). This term is described as the collection of non-financial characteristics inherent to family businesses that satisfy the emotional needs and preferences of members of the family firms. Socioemotional wealth influences decision making of family firms. This empirical study focuses to determine the factors which influence business intelligence adoption intention of Thai family SMEs in agricultural machinery business. The study investigates direct effects of factors and moderating effects of age as moderator on business intelligence adoption intention. The foundation of the theoretical model was constituted from Technology-Organization-Environment (TOE) framework combined with factors from Diffusion of Innovation (DOI) theory, Manager's innovativeness factor and socioemotional wealth dimensions. The final samples comprise of 384 respondents who are managers and members of Family SMEs in agricultural machinery business in Thailand. This empirical research found that BI adoption intention was significantly affected by a number of variables. These variables, ordered by highest to smallest effect sizes, encompass organization readiness, top management support, relative advantages, renewal of family bonds, emotional attachment, competitive pressure, manager's innovativeness and perceived cost. The empirical evidence suggests that age does not function as a significant moderator in this study.

Keywords: business intelligence, adoption intention, technology-organization-environment framework, diffusion of innovation theory, socioemotional wealth, family firms, small and medium-sized enterprise

Introduction

Background

Businesses are battling in a fast-paced market landscape. The capacity to make swift and well-informed decisions is crucial for success. Businesses demand rapid and effective decision-making, facilitated by tools that process and analyze data from multiple sources. Business Intelligence (BI) has been adopted as an effective tool, aiding organizations of all sizes in making decisions across tactical to strategic levels (Ragazou et al., 2023; Tutunea & Rus, 2012). Family SMEs are important business entities that build the large foundation of worldwide economies. Gómez-Mejía et al. (2007) found that socioemotional wealth, considered as a unique aspect of family firms, influenced the decision making of family firms. Family firms made decisions to preserve socioemotional wealth and accepted risk of losing financial gains. Their survival and longevity should be of exceptional concern. Negash (2004) identified that BI offered transformative benefits for businesses by converting data, structured and semi-structured, from multiple sources into meaningful insights, enabling accurate decision-making and supporting optimization of operations. BI tools complement experience-based decisions with data-driven approaches, providing a "single source of truth" that aligns organizational objectives and reduces conflicts (Boonsiritomachai et al., 2016). Operationally, BI identifies inefficiencies and improves processes such as inventory management by preparing goods to match the demands. It enhances customer relationships by segmenting clients based on behavior and loyalty metrics, enabling personalized marketing and service delivery. Financially, BI tools improve cash flow forecasting and profitability analysis, revealing hidden opportunities across products and channels (Elbashir et al., 2008). For strategic planning in family SMEs, BI supports succession management by providing objective performance metrics that facilitate leadership transitions while reducing emotional tensions. BI supports long-term plan which is built on fact-based projections (Lönnqvist et al., 2006). BI empowers family SMEs to combine traditional strengths with advanced analytics to thrive in competitive markets (Caseiro & Coelho, 2018; Papachristodoulou et al., 2017). Empirically testing factors influencing BI adoption intention of family SMEs in agricultural machinery in Thailand is the focus of this research.

Problem Statement

Despite the prior discussion on the advantages of Business Intelligence, the factors influencing its adoption by SMEs, particularly family SMEs, remain insufficiently explored. Prior research mainly focused on BI adoption in the general SME context, such as those studied by Boonsiritomachai et al. (2016) and Bhatiasevi and Naglis (2020) which focused on SMEs in Thailand. Filser et al. (2018) confirmed the influence of socioemotional wealth dimensions on family firms' innovativeness. However, none of those research works specifically addressed BI adoption within family SME context, leaving a significant gap in understanding how unique family SME's characteristics influence the adoption process. Family firms possess unique characteristics, referred to as socioemotional wealth, which Gómez-Mejía et al. (2007) defined as a collection of non-financial attributes that satisfy the emotional needs and preferences of

family members and found that socioemotional wealth had impact of family firms' decisions. These attributes can significantly impact decision-making processes, including technology adoption. To address this gap, this research aims to investigate how socioemotional wealth dimensions affect the intention of family SMEs to adopt BI. The various functions within family SMEs are managed and decision making is made by manager. The manager's innovativeness, as a specific manager's characteristic, is empirically tested in this research as a factor influencing BI adoption among family SMEs.

Applying the Technology-Organization-Environment (TOE) framework and incorporating variables from Diffusion of Innovation (DOI) theory, this study theoretically constitutes a research model that further incorporates additional factors of socioemotional wealth dimensions and manager's innovativeness. By bridging the fields of family business management and information technology adoption as a response to recommendations in prior research (Basly & Hammouda, 2020; Tirdasari et al., 2022), this research aims to provide deeper understanding of BI adoption among family SMEs in agricultural machinery business in Thailand and offers valuable guidance for improving technology adoption strategies tailored to family SMEs.

Research Objectives

1. To identify the factors influencing BI adoption intention of family SMEs in agricultural machinery business in Thailand.
2. To explore the relationships between these factors.
3. To determine the significant causal factors affecting BI adoption intention of family SMEs in agricultural machinery business in Thailand.
4. To assess the theoretical and practical implications derived from the research outcomes.

Research Questions

1. What are the factors influencing BI adoption intention of family SMEs in agricultural machinery business in Thailand?
2. Do the factors in question 1 have relationships among them?
3. Which factors in the research model show significant causal effects on BI adoption intention of family SMEs in agricultural machinery business in Thailand?
4. What are the theoretical and practical contributions of research's findings?

Significance of the Study

The outcomes of this empirical investigation are projected to provide a meaningful contribution to the study of BI adoption in Thai family SMEs in the agricultural machinery business. This research study identifies and fills the existing insufficiencies in limited studies on business intelligence adoption among family SMEs which possess unique characteristics distinct from other forms of business firms (Basly & Hammouda, 2020; Boonsiritomachai et al., 2016; Tirdasari et al., 2022). This research integrates studies on information technology adoption frameworks, business intelligence as a specific information technology, and family SME. It is anticipated that the research's findings will offer a more comprehensive view of the

factors that influence the BI adoption intention of Thai family SMEs in the agricultural machinery business and will lead to valuable theoretical and practical implications.

Literature Review

Related Literature

Business Intelligence

Business Intelligence (BI) refers to a comprehensive system that integrated data, query, analytical tools, and reporting mechanisms to support decision-makers in making competitive, fact-based decisions (Elbashir et al., 2008; Negash, 2004). Business Intelligence was used to understand the capabilities of the businesses (Heredia-Vizcaíno & Nieto, 2019). Adoptions of business intelligence created significant impacts in organizations. It helped organizations to operate in line with key objectives. It delivered fact-based and fast decision making by gathering and processing data from multiple sources for supporting decision-making. BI efficiently collected and distributed vital data and statistics (Boonsiritomachai et al., 2016). BI demonstrated significant effects on the firm performance as evidenced by existing empirical studies (Pancić et al., 2023; Richards et al., 2014). BI was confirmed that it played a significant role in boosting innovation, supporting knowledge management, enhancing marketing capabilities and eventually shaping competitiveness of the firm (Jiménez-Partearroyo & Medina-López, 2024). Business intelligence adoption was confirmed that it positively affected organizational performance (Bhatiasevi & Naglis, 2020). Through these capabilities, BI has become an indispensable tool for organizations striving to maintain a competitive edge in dynamic business environments.

Information Technology Adoption Models.

The Technology-Organization-Environment (TOE) framework, introduced by Tornatzky and Fleischer in 1990, served as a theoretical model to explain the adoption and implementation of technological innovations within organizations. This framework identified three critical dimensions, technological, organizational, and environmental contexts, that influence the innovation adoption process. These contexts collectively influenced the process of technology adoption. *Technological* context referred to the relevance of the external and internal technologies being adopted to the organization. *Organizational* context referred to the properties and characteristics of the adopting organization such as size, scope of work and structure of management. *Environmental* context concerned the environment where the organization conducted its operation such as business sector, competitors, and policies issued by government. Rogers (1995) introduced the Diffusion of Innovation Theory (DOI) which defined the decision-making process on innovation by acquiring and evaluating information, driven by an individual's desire to decrease uncertainty regarding the benefits and drawbacks of an innovation. Variables from DOI, relative advantage, compatibility, complexity, trialability, and observability, were often adopted as factors in TOE model. TOE and DOI were integrated to form theoretical models of BI adoption in the prior empirical research works (Bhatiasevi & Naglis, 2020; Boonsiritomachai et al., 2016; Mavutha et al., 2023).

Characteristics of Family SME

Definitions of SMEs varied in different countries. SME classification was usually considered by the number of employees, annual revenue and/or total asset value (Storey, 2004). SMEs contributed as the foundation of the economies of several countries in generating large part of gross domestic product (GDP) value. Their survival and sustainability were crucial (Ahmad et al., 2020). A firm was designated as a family firm when a family or individual maintained ownership exceeding 50% of the shares and family members played a direct role in the firm's management (Azizi et al., 2021; Nunes et al., 2014). Socioemotional wealth was studied and defined by Gómez-Mejía et al. (2007) as non-financial attributes of a family firm that satisfy the family's emotional preferences. Socioemotional wealth was identified in five dimensions by Berrone et al. (2012) comprising F for family control and influence, I for identification of family members with the firm, B for binding social ties, E for emotional attachment of family members and R for renewal of family bonds through dynastic succession. Research studies uncovered the effects of socioemotional wealth on family firms' decision making and innovativeness (Berrone et al., 2012; Filser et al., 2018; Gómez-Mejía et al., 2007; Hu et al., 2023). Prior studies confirmed that Socioemotional wealth exhibited significant influences on decision making of family firm (Gómez-Mejía et al., 2007) and on family firm's innovativeness (Filser et al., 2018; Hu et al., 2023). Family SMEs deserved to be studied across various facets including information technology adoption (Basly & Hammouda, 2020; Tirdasari et al., 2022).

Manager's Innovativeness

The manager's innovativeness was integrated into prior research models as a direct antecedent of their intentions to adopt and utilize information technologies. The characteristics of manager influenced SMEs' decisions about the use of information technology (Boonsiritomachai et al., 2016; Hasani et al., 2023). For small businesses, the managers exhibited great impact on the decision making in various functions of the small firms (Thong, 1999). The impact of the manager's innovativeness in the context of SME were studied in likelihood of information system adoption (Thong, 1999) and on BI adoption level (Boonsiritomachai et al., 2016). Manager's innovativeness demonstrated significant influence in those empirical studies. The influence of the manager's innovativeness is further examined in this research.

Business Intelligence Adoption in Family SME

Deeper investigations into the factors that influences BI adoption intention among Thai family SMEs in the agricultural machinery business are conducted in this study, responding to the need for more research in this field (Tirdasari et al., 2022). While BI adoption was mainly studied in larger organizations, research focusing on SMEs and family SMEs, remained limited (Basly & Hammouda, 2020; Boonsiritomachai et al., 2016). In fact, SMEs also required BI for effective decision-making and competitiveness (Cheung & Li, 2012). Zamani (2022) observed a lack of in-depth studies on technology adoption among SMEs. Basly and Hammouda (2020) indicated a lack of information technology adoption framework for family firms. To respond to those calls for more studies in information technology adoption by SMEs and family firms, this study fills the critical gap in the limited understanding on BI adoption among family SMEs

and enhances the literature by incorporating information technology adoption frameworks, focusing on BI as an essential tool for family SMEs, and the unique characteristics, socioemotional wealth of family SMEs. Factors which influenced BI adoption among SMEs were empirically tested in SME context (Bhatiasevi & Naglis, 2020; Boonsiritomachai et al., 2016; Mavutha et al. ,2023) but no empirical study of factors influencing BI adoption among family SMEs has been conducted. This research aims to fill the gap in insufficient studies in BI adoption among family SMEs.

Theoretical Model Variables

Throughout the extensive literature review, various variables were studied in the prior research works where they showed significant effects on BI adoption, information technologies or innovation. Business intelligence adoption intention within the context of this study referred to the quantified degree of commitment exhibited by family SMEs toward the implementation and utilization of business intelligence. Behavioral intention referred to the magnitude to which a person is determined to engage in a specific behavior. (Ajzen, 1991). A group of variables which were empirically tested and demonstrated significant effects were retrieved and employed in this research. Relative advantage refers to the expected benefits that business intelligence will bring to a Thai family SME in agricultural machinery business when there is a need for adoption. Complexity pertains to the complication or degree of difficulty in comprehending business intelligence for application in Thai SMEs in the agricultural machinery business. Relative advantage and complexity, factors in technological context, were confirmed as significant factors in BI adoption (Boonsiritomachai et al., 2016; Hmoud et al., 2023; Mavutha et al., 2023; Shahadat et al., 2023; Ullah et al., 2023). Compatibility refers to the extent to which business intelligence aligns with established value, requirements, and prior experiences of Thai family SME in agricultural machinery business, showed significance in BI adoption (Bhatiasevi & Naglis, 2020; Hmoud et al., 2023; Stjepić et al., 2021). Perceived cost, defined as the level of financial investment perceived by the manager of Thai family SME in agricultural machinery business in adopting business intelligence, was significant in BI adoption (Mavutha et al., 2023). Top management support refers to the inherent enthusiasm displayed by managers of Thai family SMEs in the agricultural machinery business for embracing innovation when adopting new information technology to accomplish specific objectives. Organization readiness refers to the availability of organizational resources necessary to support the preparation for adopting business intelligence by Thai family SME in agricultural machinery business. Top management support and organization readiness were significant on BI adoption (Bhatiasevi & Naglis, 2020; Boonsiritomachai et al., 2016; Hmoud et al., 2023). Competitive pressure, defined as the need of Thai family SME in agricultural machinery business to minimize ambiguity in business environment and gain a competitive edge by gathering insightful business intelligence, was significant on BI adoption (Stjepić et al., 2021). Manager's innovativeness referred to a tendency exists in the manager of Thai family SME in agricultural machinery business for inherent enthusiasm in embracing innovation while experimenting with new information technology to accomplish specific objectives, was significant in BI adoption (Boonsiritomachai et al., 2016).

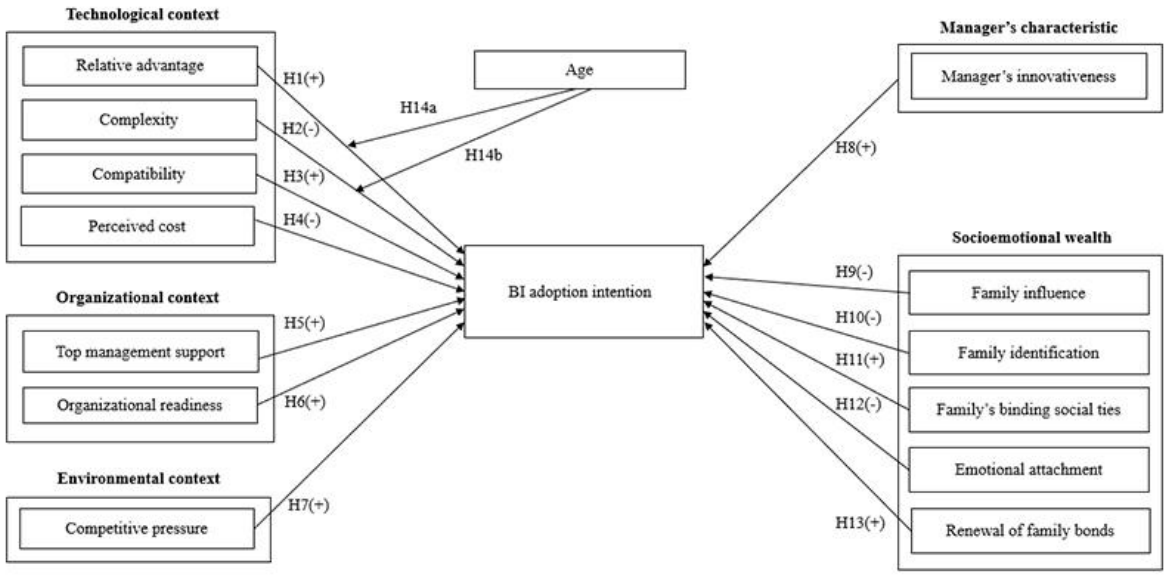
Family influence was defined as control of comprehensive strategic planning and operational management in Thai family SME in agricultural machinery business. Family identity referred to the connection and sense of belonging shared among family members of Thai family SME in agricultural machinery business. Family's binding social ties established a sustainable and mutually beneficial relationship between society and Thai family SME in agricultural machinery business. Emotional attachment was characterized as the psychological embodiment of family members within Thai family SMEs in the agricultural machinery business, reflecting family ties rooted in longstanding traditions and heritage. Renewal of family bonds referred to the continuation of the Thai family SME in agricultural machinery business through the family dynasty. Filser et al. (2018) found that socioemotional wealth factors; family influence, family identification, family's binding social ties, emotional attachment and renewal of family bonds were uncovered that they showed significant influences on family firm's innovativeness. Alsswey and Al-Samarraie (2020) found that age moderated the relationships between relative advantage and complexity on intention to use mHealth UI design-based culture. Age was highlighted as a moderating factor in new technology adoption frameworks such as UTAUT model (Venkatesh et al., 2003). The discussed significant variables are integrated into the theoretical model of this research.

Hypotheses

The development of the theoretical model was grounded in a thorough examination of prior studies that aligned with the objectives of the research: BI adoption, TOE, DOI, manager's characteristics and socioemotional wealth dimensions. Figure 1 illustrates the theoretical model, including hypotheses H1-H13 for direct effects and hypotheses H14a-H14b for moderating effects.

Figure 1

The Theoretical Model



H1: Relative advantage positively affects BI adoption intention.
H2: Complexity negatively affects BI adoption intention.
H3: Compatibility positively affects BI adoption intention.
H4: Perceived cost negatively affects BI adoption intention.
H5: Top management support positively affects BI adoption intention.
H6: Organization readiness positively affects BI adoption intention.
H7: Competitive pressure positively affects BI adoption intention.
H8: Manager's innovativeness positively affects BI adoption intention.
H9: Family influence negatively affects BI adoption intention.
H10: Family identification positively affects BI adoption intention.
H11: Family's binding social ties positively affects BI adoption intention.
H12: Emotional attachment negatively affects BI adoption intention.
H13: Renewal of family bonds positively affects BI adoption intention.
H14a: Age moderates the relationship between relative advantage and BI adoption intention.
H14b: Age moderates the relationship between complexity and BI adoption intention

Research Methodology

This section details and discusses the complete research methodology, encompassing research design, sampling population, research measurements, data collection and data analyses.

Research Design

The design of this research was founded on employing a quantitative research approach, alongside the adoption of a cross-sectional study. Self-administered questionnaires in both English and Thai languages were prepared and elaborately tested. The Thai-version questionnaire was used in the field study. To ensure measurement validity and reliability, this study employed previously validated instruments used in prior literature. As shown in Table 1, five-point Likert-type scale was used to assess all latent variables with options of response ranging from 1 to 5, 1 indicating "strongly disagree" and 5 indicating "strongly agree". For analytical purposes, age groups were categorized into two distinct cohorts: 40 years or younger and above 40 years of age.

Table 1

Measurements of Latent Variables

Variable	Indicator	Item	Existing Measurements
Relative advantage (RA)	RA1	Business intelligence enables your family SME to reduce the cost of operations.	Boonsiritomachai (2014)
	RA2	Business intelligence provides competitive information and improves decision-support to your family SME.	

Variable	Indicator	Item	Existing Measurements
	RA3	Business intelligence accomplishes tasks that allow us to enhance business strategies of your family SME.	
	RA4	Business intelligence monitors problems and provides solutions in real-time to your family SME.	
Complexity (CX)	CX1	The process of introducing business intelligence was complicated for your family SME.	Boonsiritomachai (2014)
	CX2	The operation of business intelligence was considerably complicated to implement and use within your family SME.	
	CX3	Business intelligence was difficult to learn in your family SME.	
	CX4	Considerable resistance existed within your family SME towards the use of business intelligence.	
Compatibility (CM)	CM1	Using business intelligence fits well with how your family SME functions.	Boonsiritomachai (2014)
	CM2	Using business intelligence is consistent with your family SME's values and beliefs	
	CM3	Business intelligence is compatible with your family SME's IT infrastructure.	
	CM4	The changes introduced by business intelligence are compatible with your family SME's existing operating practices.	
Perceived Cost (PC)	PC2	Your family SME thinks the cost of business intelligence infrastructure is high.	Shahadat et al. (2023)
	PC3	The amount of money and time of training for business intelligence applications is high for your family SME.	
	PC4	The costs of integration of business intelligence system with existing information systems infrastructure is high for your family SME.	
	PC5	The maintenance and support cost for business intelligence applications are high for your family SME.	
Top management support (TMS)	TMS1	Your family SME's top management supports to adopt new business trend.	Shahadat et al. (2023)
	TMS2	Your family SME's top management is likely to consider business intelligence adoption as strategically important.	
	TMS3	Your family SME's management is willing to take risks involved in the adoption of business intelligence.	
Organization readiness (OR)	OR1	The business intelligence procedure is easily understandable to your family SME.	Shahadat et al. (2023)
	OR2	Your family SME has all the readiness resources for business intelligence-based operation.	

Variable	Indicator	Item	Existing Measurements
	OR3	Your family SME has different ways (virtual, in person, etc.).	
Competitive pressure (CP)	CP1	The degree of competition in our industry placed pressure on your family SME's decision to adopt business intelligence.	Boonsiritomachai (2014)
	CP2	Your family SME knew that our competing rivals were already using business intelligence.	
	CP3	Your family SME needed to utilize business intelligence to maintain its competitiveness in the market.	
	CP4	It was a strategic necessity to use business intelligence in your family SME.	
Manager's innovativeness (IN)	IN1	I always introduce new and original ideas.	Boonsiritomachai (2014)
	IN2	I always look for something new rather than improving something existing	
	IN3	I would sooner create something new than improve something existing.	
	IN4	I often have a fresh perspective on old problems.	
Family influence (IF)	IF1	The majority of shares of your family SME are owned by family members.	Filser et al. (2018)
	IF2	In your family SME, most executive positions are occupied by family members.	
	IF3	The board of directors of your family SME is mainly composed of family members.	
Family identification (ID)	ID1	Family members have a strong sense of belonging to your family SME.	Filser et al. (2018)
	ID2	Family members feel that your family SME's success is their own success.	
	ID3	Being a family member of your family SME helps define who you are.	
	ID4	Family members are proud to tell others that we are part of your family SME.	
Family's binding social ties (ST)	ST1	Nonfamily employees are treated as part of your family SME.	Filser et al. (2018)
	ST2	In your family SME, contractual relationships are mainly based on trust and norms of reciprocity.	
	ST3	Building strong relationships with other institutions (i.e., other companies, professional associations, government agents, etc.) is important for your family SME.	
Emotional attachment (EA)	EA1	Emotions and sentiments often affect decision-making processes in your family SME.	Filser et al. (2018)
	EA2	Protecting the welfare of family members is critical to your family SME.	
	EA3	In your family SME, affective considerations are often as important as economic considerations.	
	EA4	Strong emotional ties among your family members help us maintain a positive self-concept.	

Variable	Indicator	Item	Existing Measurements
Renewal of family bonds (RB)	RB1	Continuing the family legacy and tradition is an important goal for your family SME.	Filser et al. (2018)
	RB2	Family members would be unlikely to consider selling your family SME.	
	RB3	Successful business transfer to the next generation is an important goal for your family members.	
	RB4	Preservation of family control and independence are important goals for your family SME.	
BI Adoption Intention (BIA)	BIA1	Your family SME intends to adopt business intelligence to create competitive advantage.	Hasani et al. (2023)
	BIA2	Your family SME intends to adopt business intelligence to improve customer relations.	
	BIA3	Your family SME intends to adopt business intelligence to improve management data.	
	BIA4	Your family SME intends to adopt business intelligence to improve data accuracy.	

Sampling Population

Purposive sampling was employed in this field study. Purposive sampling is a nonrandom technique where researchers employ various strategies to identify every possible instance of a rare or hard-to-access population. This approach ensures that the participants meet specific criteria (Neuman, 2014). Questionnaires were distributed to participants who met the criteria of this research. Participants were managers of family SMEs dealing in agricultural machinery business in Thailand. Those participants were family members whose families maintained majority ownership with a minimum shareholding threshold of 50 percent. This research considered that population of family SMEs in agricultural machinery business in Thailand was equal to 4,007 firms. According to Adam (2020), at 95 percent confidence level and target population of 4,007, a sample size of minimum 357 samples was required. The printed questionnaires were personally distributed and online questionnaires were distributed on Google Form to the selected participants. The questionnaires contained filtering sections to ensure that the participants met the criteria of being proper respondents.

Data Analysis Methods

Data preparation including respondent criteria checks, checking missing values, identifying outliners, Principal Component Factor Analysis, descriptive statistics, T-test, independent samples T-test and correlation analysis were conducted. Subsequently, Structural Equation Modeling (SEM) was employed to develop final model and analyze causal effects among variables according to the research's hypotheses.

Results and Discussion

Data Preparation

A total of 396 questionnaires were collected through online Google Form and printed copies. Twelve questionnaires were removed because the respondents did not meet the criteria or contained missing values. Finally, 384 samples were entered to the statistical analysis using IBM SPSS Statistics V24.

Demographic Characteristics and Economic Indicators

The total respondents comprised of 285 males (74.2%) and 99 females (25.8%). Ages of participants varied between 25 and 67. The youngest was 25 whereas oldest was 67 years. The average age of respondent was 39.37 years. The respondents were classified into 2 groups based on age. Age Group 1 was for the respondents whose ages were less than or equal to 40 years (62.76%) and Age Group 2 was for the respondents whose ages were over 40 years (37.24%). Education levels of respondents comprised of bachelor's degree 68.75%, master's degree 19.53%, vocational or diploma 8.85% and high school or equivalent 2.86%. In the business sector perspective, 96.88% of respondents operated in trading or service sector and 3.13% operated in manufacturing sector. Considering business lines which the respondents conducted businesses, 75.26% of respondents dealt in tractor parts, 17.45% in tillage and planting equipment and parts, 2.08% in crop protection equipment and parts, 3.91% in harvesting equipment and parts and 1.30% in other agricultural machinery. About employment, 96.35% of respondents employed 1-30 employees, 2.08% employed 31 employees to 50 employees, 0.78% employed 51 employees to 100 employees and 0.78% employed 101 employees to 200 employees. Considering revenue of respondents, 89.06% earned revenue not more than THB 50 million, 5.73% earned more than THB 50 million but not more than THB100 million, 3.65% earned more than THB 100 million but not more than THB 300 million and 1.56% earned more than THB 300 million but not more than THB 500 million. 89.32% of the respondents were small-sized family SMEs and 10.68% were medium-sized family SMEs. The respondent sample comprised of 62.76% of respondents whose ages were less than or equal to 40 years and 37.24% of respondents whose ages were over 40 years.

Principal Component Factor Analysis

Principal Component Factor Analysis was employed to evaluate the construct validity of the latent variables. The first execution indicated cross loading of indicators CX4 and indicator ID3 on the other components. To resolve the cross-loading of indicators for complexity (CX1-4) and indicators for family identification (ID1-4), complexity (CX) family identification (ID) and their indictors were removed. The second execution yielded a result of cross-loading among indicators BIA1, BIA2, BIA3, BIA4 for BI Adoption Intention and ST1, ST2, ST3 for family's binding social ties. family's binding social ties and its indicators were removed from the theoretical model. The final execution of Principal Component Factor Analysis demonstrated satisfactory construct validity for all other latent variables. Indicators exhibiting loadings of 0.5 or greater, while having associated eigenvalues of at least 1,

presented satisfactory loadings on their respective latent variables (Straub et al., 2004). The result of final Principal Component Factor Analysis is presented in Table 2.

Table 2 presents Cronbach's alpha coefficients, Average Variance Extracted (AVE) and Composite Reliability (CR) of the variables. Cronbach's alpha coefficients were used to evaluate the equivalence reliability of the indicators. According to the interpretation suggested by George and Mallery (2003), each coefficient presented in Table 2 exceeded the acceptable value of 0.7. To reinforce the validity of the construct, Average Variance Extracted (AVE) and Composite Reliability (CR) analyses were conducted. Table 2 reports that the AVE and CR of all latent variables are above 0.5 and 0.7 respectively. The square root of the AVE for each latent variable shows the value greater than the correlation coefficients among that variable and other variables. These results confirmed the validity of the constructs (Fornell & Larcker, 1981; Haji-Othman & Yusuff, 2022).

Table 2

Principal Component Factor Analysis, Cronbach's Alpha, AVE and CR

Variable/Indicator	Factor Loading	Cronbach's Alpha	AVE	CR
Relative Advantage (RA)		0.929	0.808	0.944
RA1	0.915			
RA2	0.869			
RA3	0.917			
RA4	0.894			
Compatibility (CM)		0.868	0.713	0.908
CM1	0.834			
CM2	0.822			
CM3	0.874			
CM4	0.843			
Perceived Cost (PC)		0.835	0.646	0.879
PC1	0.786			
PC2	0.801			
PC3	0.842			
PC4	0.779			
Top Management Support (TMS)		0.814	0.698	0.874
TMS1	0.812			
TMS2	0.855			
TMS3	0.839			
Organization Readiness (OR)		0.806	0.638	0.841
OR1	0.798			
OR2	0.793			
OR3	0.807			
Competitive Pressure (CP)		0.867	0.687	0.898
CP1	0.781			
CP2	0.822			
CP3	0.855			
CP4	0.854			

Variable/Indicator	Factor Loading	Cronbach's Alpha	AVE	CR
Manager Innovativeness (IN)		0.882	0.724	0.913
IN1	0.818			
IN2	0.836			
IN3	0.878			
IN4	0.869			
Family Influence (IF)		0.855	0.766	0.908
IF1	0.874			
IF2	0.892			
IF3	0.858			
Emotional Attachment (EA)		0.865	0.703	0.904
EA1	0.783			
EA2	0.871			
EA3	0.86			
EA4	0.836			
Renewal of Family Bonds (RB)		0.888	0.719	0.911
RB1	0.829			
RB2	0.838			
RB3	0.88			
RB4	0.842			
BI Adoption Intention (BIA)		0.938	0.688	0.898
BIA1	0.827			
BIA2	0.876			
BIA3	0.804			
BIA4	0.809			

Descriptive Analysis

Descriptive statistical analyses were conducted for all variables and their corresponding indicators within the modified theoretical model. The analysis of data distributions revealed acceptable skewness and kurtosis values, which were within the recommended range of less than 3 and 7 respectively, for maximum likelihood estimation in structural equation modeling, as prescribed by Kline (2016). Table 3 presents a comprehensive summary of the descriptive statistical findings.

Table 3

Descriptive Statistics

Descriptive Statistics						
	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
RA: Relative advantage	**4.179**	**0.811**	**-1.01**	**0.125**	**0.002**	**0.248**
RA1	4.466	0.833	-1.27	0.125	0.294	0.248
RA2	4.133	0.861	-0.801	0.125	0.003	0.248
RA3	4.117	0.961	-0.751	0.125	-0.546	0.248
RA4	4.068	0.912	-0.779	0.125	-0.073	0.248

Descriptive Statistics						
	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
CM: Compatibility	**3.405**	**0.654**	**-0.081**	**0.125**	**0.326**	**0.248**
CM1	3.568	0.719	0.142	0.125	-0.32	0.248
CM2	3.456	0.774	-0.242	0.125	-0.087	0.248
CM3	3.281	0.784	-0.018	0.125	0.084	0.248
CM4	3.331	0.806	-0.1	0.125	-0.053	0.248
PC: Perceived cost	**3.678**	**0.537**	**-0.155**	**0.125**	**0.645**	**0.248**
PC1	3.656	0.635	-0.358	0.125	0.116	0.248
PC2	3.656	0.679	-0.404	0.125	0.132	0.248
PC3	3.693	0.662	-0.545	0.125	0.399	0.248
PC4	3.706	0.65	-0.195	0.125	0.011	0.248
TMS: Top management support	**3.947**	**0.556**	**-0.327**	**0.125**	**0.739**	**0.248**
TMS1	3.932	0.639	-0.304	0.125	0.443	0.248
TMS2	3.984	0.638	-0.351	0.125	0.587	0.248
TMS3	3.927	0.678	-0.315	0.125	0.212	0.248
OR: Organization readiness	**3.421**	**0.603**	**0.036**	**0.125**	**-0.121**	**0.248**
OR1	3.438	0.631	0.394	0.125	-0.099	0.248
OR2	3.424	0.708	-0.153	0.125	-0.315	0.248
OR3	3.404	0.769	0.136	0.125	-0.327	0.248
CP: Competitive pressure	**3.851**	**0.553**	**-0.567**	**0.125**	**0.795**	**0.248**
CP1	3.833	0.684	-0.414	0.125	0.389	0.248
CP2	3.862	0.65	-0.316	0.125	0.372	0.248
CP3	3.799	0.669	-0.321	0.125	0.249	0.248
CP4	3.914	0.609	-0.373	0.125	0.819	0.248
IN: Manager's innovativeness	**3.711**	**0.581**	**-0.575**	**0.125**	**0.868**	**0.248**
IN1	3.706	0.666	-0.546	0.125	0.429	0.248
IN2	3.716	0.686	-0.545	0.125	0.402	0.248
IN3	3.667	0.688	-0.568	0.125	0.294	0.248
IN4	3.755	0.664	-0.378	0.125	0.307	0.248
IF: Family influence	**4.155**	**0.589**	**-0.274**	**0.125**	**-0.375**	**0.248**
IF1	4.182	0.676	-0.442	0.125	0	0.248
IF2	4.089	0.684	-0.212	0.125	-0.514	0.248
IF3	4.198	0.644	-0.21	0.125	-0.669	0.248
EA: Emotional attachment	**3.724**	**0.575**	**-0.657**	**0.125**	**1.392**	**0.248**
EA1	3.708	0.661	-0.582	0.125	0.493	0.248
EA2	3.695	0.684	-0.706	0.125	0.541	0.248
EA3	3.677	0.723	-0.469	0.125	0.126	0.248
EA4	3.823	0.65	-0.495	0.125	0.691	0.248
RB: Renewal of family bonds	**3.795**	**0.582**	**-0.764**	**0.125**	**0.719**	**0.248**
RB1	3.771	0.693	-0.608	0.125	0.596	0.248
RB2	3.826	0.657	-0.522	0.125	0.721	0.248

Descriptive Statistics						
	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
RB3	3.76	0.693	-0.635	0.125	0.612	0.248
RB4	3.826	0.649	-0.447	0.125	0.605	0.248
BIA: BI adoption intention	**4.253**	**0.688**	**-0.613**	**0.125**	**-0.657**	**0.248**
BIA1	4.273	0.818	-0.859	0.125	-0.087	0.248
BIA2	4.299	0.745	-0.548	0.125	-1.018	0.248
BIA3	4.195	0.716	-0.307	0.125	-1.015	0.248
BIA4	4.237	0.703	-0.368	0.125	-0.94	0.248

T-test

Statistical analysis, a one-sample t-test, was employed to examine whether the averages of measured characteristics differed substantially from a baseline value of 3. The findings, presented in Table 4 revealed that for each variable tested, the mean was demonstrably greater than 3. This observation was statistically significant at a significance level of 0.05 or less. In practical terms, respondents consistently expressed positive attitudes or opinions for relative advantage, compatibility, top management support, organization readiness, competitive pressure, manager's innovativeness, renewal of family bonds and BI adoption intention. Since their responses were significantly higher than the neutral midpoint of the scale, it suggested a general favorable disposition toward BI adoption among your respondent population. However, the variables hypothesized to have negative effects on BI adoption intention also showed the mean value above baseline value of 3. The results suggested that the respondents considered perceived cost of BI adoption was high for their family SMEs. The means of family influence and emotional attachment were also higher than the baseline value of 3. The participants acknowledged that family influence and emotions of family members involved in BI adoption decision of their family SMEs.

Table 4

T-tests Comparing Means of Model variables and Indicators with the Neutral Value of 3

One-Sample Test					
Test Value = 3					
	Mean	**t**	**df**	**Sig. (2-tailed)**	**Mean-3**
Relative advantage (RA)	4.179	28.475	383.000	0.000	1.179
Compatibility (CM)	3.405	12.114	383.000	0.000	0.405
Perceived cost (PC)	3.678	24.687	383.000	0.000	0.678
Top management support (TMS)	3.947	33.343	383.000	0.000	0.947
Organization readiness (OR)	3.421	13.664	383.000	0.000	0.421
Competitive pressure (CP)	3.851	30.094	383.000	0.000	0.851
Manager's innovativeness (IN)	3.711	23.943	383.000	0.000	0.711
Family influence (IF)	4.155	38.430	383.000	0.000	1.155
Emotional attachment (EA)	3.724	24.678	383.000	0.000	0.724

One-Sample Test					
Test Value = 3					
	Mean	**t**	**df**	**Sig. (2-tailed)**	**Mean-3**
Renewal of family bonds (RB)	3.795	26.718	383.000	0.000	0.795
BI adoption intention (BIA)	4.253	35.673	383.000	0.000	1.253

Correlation Analysis

Table 5 presents the correlations among latent variables. The shaded row represents the correlations among latent variables as defined in the modified theoretical model. Relative advantage (RA), top management support (TMS), organization readiness (OR), competitive pressure (PC), manager's innovativeness (IN), and renewal of family bonds (RB) demonstrated significant positive correlations whereas perceived cost (PC) and emotional attachment (EA) showed significant negative correlations to BI adoption intention (BIA) at significant level 0.01. However, compatibility (CM) and family influence did not exhibit significant correlations to BI Adoption Intention (BIA) at a significant level 0.05 or less.

Table 5

Correlations among Model Variables

CORRELATIONS											
	RA	**CM**	**PC**	**TMS**	**OR**	**CP**	**IN**	**IF**	**EA**	**RB**	**BIA**
RA	1										
CM	-0.059	1									
PC	0.018	**-.110***	1								
TMS	-0.010	0.072	**-.105***	1							
OR	**.130***	0.026	**-.205****	0.076	1						
CP	-0.002	0.086	**-.227****	**.102***	**.196****	1					
IN	0.059	-0.002	**-.152****	0.072	**.160****	0.044	1				
IF	**.101***	-0.039	-0.009	-0.052	-0.035	-0.037	0.080	1			
EA	-0.045	-0.044	0.077	-0.036	**-.112***	-0.014	-0.088	0.012	1		
RB	**.116***	0.041	-0.068	**.204****	**.120***	**.231****	0.066	-0.098	-0.029	1	
BIA	**.241****	0.081	**-.267****	**.315****	**.532****	**.255****	**.242****	-0.046	**-.214****	**.306****	1

Note: *. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

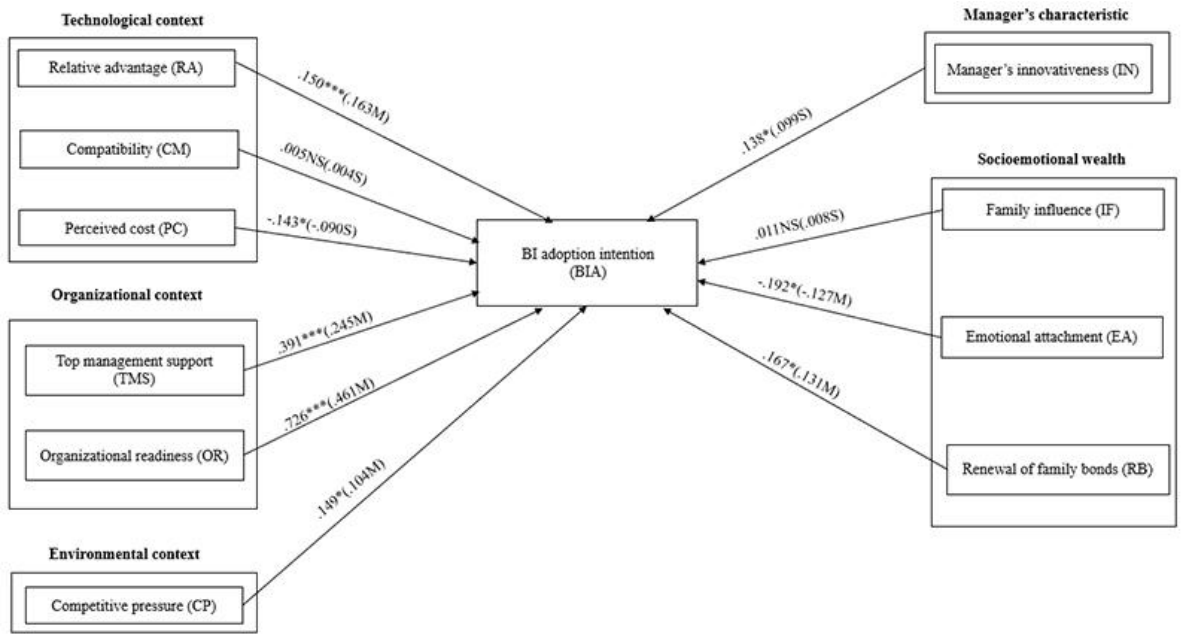
Model Analysis

To examine the causal interrelationships between the model's variables, Structural Equation Modeling (SEM) was applied. Figure 2 presents the modified theoretical model which was derived after performing Principal Component Factor Analysis. The analysis, presented in Figure 2, indicated the unstandardized and standardized direct effects of the modified theoretical model. Six direct effects on BI adoption intention demonstrated statistical significance at a level of 0.05 or less while having medium magnitude: relative advantage, top management support, organizational readiness, competitive pressure, emotional attachment,

and renewal of family bond. Perceived cost and manager's innovativeness demonstrated direct effects on BI adoption intention that were statistically significant at a level of 0.05 but had small magnitude. Lastly, compatibility and family influence did not demonstrate statistically significant direct effects on BI adoption intention at a level of 0.05 or less and had small magnitude.

Figure 2

The Modified Theoretical Model



Note: Symbol *, **, or *** indicate statistical significance at a level of 0.05, 0.01, or 0.001 respectively. NS indicates no statistical significance at a level of 0.05 or less.

Fit statistics of the modified theoretical model were analyzed as presented in Table 6. All other fit statistics were satisfactory according to Kline (2016) except AGFI which should be greater than 0.9. Presenting in Figure 2, there were some variables showing small magnitude of standardized direct effects including CM→ BIA, PC→BIA, IF→ BIA and IN→BIA. Those small-magnitude relationships were marked as options in the Specification Search function of AMOS and it returned sixteen possible models. The model suggested by AMOS's Specification Search which showed lowest value of Normed Chi-square (χ^2/df) was taken to develop the final model. As consequence, compatibility (CM) and family influence (IF) were removed. Table 6 presents the fit statistics of the final model, compared to the fit statistics of the modified theoretical. The fit statistics became satisfactory according to the acceptance criteria suggested by Kline (2016) as presented in Table 7. The Figure 3 presents direct effects within the final model.

Table 6

Measuring Model Fit of Modified Theoretical Model and Final Model

Model	N	NC (χ^2/df)	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
Modified Theoretical Model	384	796.56/724 = 1.10	0.018	0.91	0.893	0.917	0.992	0.992	0.016
		R^2: BI Adoption Intention (0.562)							
Final model	384	796.203/726 = 1.097	0.018	0.922	0.905	0.93	0.992	0.989	0.016
		R^2: BI Adoption Intention (0.562)							

Note: R^2 represents the proportion of the variance in each endogenous variable that is accounted for by the variables directly influencing it.

Table 7

Acceptance Criteria of Model Fit Statistics

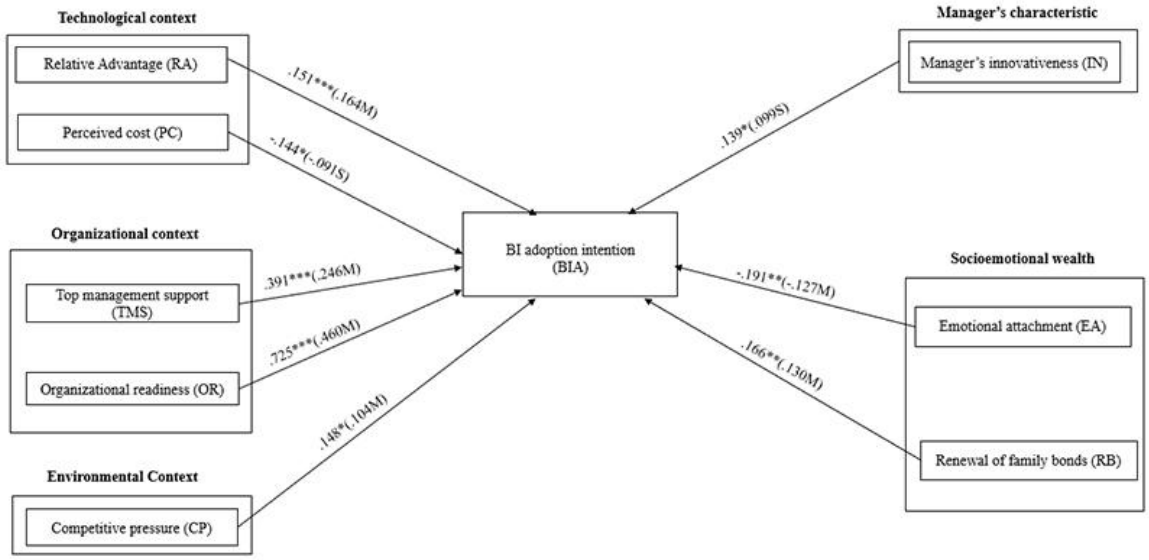
Model Fit Statistics	Interpretations
χ^2/df (Normed Chi-square, NC) where df is the degrees of freedom	Values of 1 < NC < 5 are considered to indicate at least a reasonable model fit.
RMR (Root Mean Square Residual)	RMR values close to 0 indicate a good model fit. The fit gets worse as the value of RMR increases.
GFI (Goodness of Fit Index)	GFI = 1 means a perfect fit, GFI > 0.9 means a good fit, GFI = 0 indicates a poor fit. AGFI corrects GFI downward based on model complexity.
AGFI (Adjusted GFI)	
NFI (Normed Fit Index)	NFI, IFI, CFI should have values > 0.9 to indicate a good model fit.
IFI (Incremental Fit Index)	
CFI (Comparative Fit Index)	
RMSEA (Root Mean Square Error of Approximation)	RMSEA less than or equal to 0.05 means a close fit; between 0.05 and 0.08 means a reasonable fit, 0.1 or more indicates a poor fit.

Hypothesis Testing

Figure 3 presents the final model which achieved acceptable model fit statistics. The final model was examined using AMOS software and Figure 3 illustrates the outcomes of the direct effects among the latent variables within the final model.

Figure 3

Direct Effects among Latent Variables in The Final Model



Note: Symbol *, **, or *** indicate statistical significance at a level of 0.05, 0.01, or 0.001 respectively.
NS indicates no statistical significance at a level of 0.05 or less.

Moderating Effect

To evaluate the moderating influence of two age groups, younger participants (40 years or younger) and older participants (over 40 years), on the relationship between relative advantage (RA) and BI adoption intention (BIA), the critical ratio for the difference was calculated along with the unstandardized effects and standardized effects of two age groups. The results are presented in Table 8. The analysis revealed that age did not significantly demonstrate moderating effect on the direct relationship between relative advantage (RA) and BI adoption intention (BIA).

Table 8

Differences in The Magnitude of Direct Effects between The Two Age Groups

Effects	Age				Difference between the Unstandardized Effects for Group 1 and Group 2	Magnitude of the Critical Ratio for the Difference between the Unstandardized Effects for Group 1 and Group 2
	Group 1: <=40 (N=241)		Group 2: >40 (N=143)			
	Unstandardized Effect	Standardized Effect and Magnitude	Unstandardized Effect	Standardized Effect and Magnitude		
RA → BIA	.194***	.210M	.101NS	.107M	0.093	1.185NS

Note: Symbol *, **, or *** indicate statistical significance at a level of 0.05, 0.01, or 0.001 respectively.
NS indicates no statistical significance at a level of 0.05 or less.

Hypothesis Testing Results

Table 9 presents the direct effects among latent variables in the final model. Table 10 provides a summary of the hypothesis testing outcomes, indicating supports of hypotheses H1, H4, H5, H6, H7, H8, H12, and H13, while hypothesis H3, H9, H14a were rejected. H3 and H9 were rejected due to the insignificant direct effect and small magnitude while H14a was rejected because age did not exhibit moderating effect. The other hypotheses which were not tested due to the removals of variables from Principal Component Factor Analysis were H2, H10, H11 and H14b.

Table 9

Direct Effects among Latent Variables in The Final Model

	Unstandardized Effect	S.E.	C.R.	P	Standardized Effect	Magnitude
BIA ← RA	0.151	0.038	4.010	***	0.164	M
BIA ← PC	-0.144	0.072	-2.008	*	-0.091	S
BIA ← TMS	0.391	0.073	5.323	***	0.246	M
BIA ← OR	0.725	0.085	8.527	***	0.460	M
BIA ← EA	-0.191	0.063	-3.025	**	-0.127	M
BIA ← RB	0.166	0.057	2.930	**	0.130	M
BIA ← IN	0.139	0.059	2.364	*	0.099	S
BIA ← CP	0.148	0.064	2.319	*	0.104	M

Note: S.E. = Standard Error, C.R. = Critical Ratio

Table 10

Hypothesis Testing Results

Hypothesis		Result
H1	Relative advantage positively affects BI adoption intention	Supported
H2	Complexity negatively affects BI adoption intention	Not tested
H3	Compatibility positively affects BI adoption intention	Rejected
H4	Perceived cost negatively affects BI adoption intention	Supported
H5	Top management support positively affects BI adoption intention	Supported
H6	Organizational readiness positively affects BI adoption intention	Supported
H7	Competitive pressure positively affects BI adoption intention	Supported
H8	Manager innovativeness positively affects BI adoption intention	Supported
H9	Family influence negatively affects BI adoption intention	Rejected
H10	Family identification negatively affects BI adoption intention	Not tested
H11	Family's binding social ties positively affects BI adoption intention	Not tested
H12	Emotional attachment negatively affects BI adoption intention	Supported
H13	Renewal of family bonds positively affects BI adoption intention	Supported
H14a	Age moderates the relationship between relative advantage and BI adoption intention	Rejected

Hypothesis		Result
H14b	Age moderates the relationship between complexity and BI adoption intention	Not tested

Discussion and Recommendation

Conclusion

Figure 3 provides an overview of all the direct effects within the final model. The most important exogenous variable that exhibited significant causal effect on BI adoption intention was organizational readiness (.460M) followed by top management support (.246M) then relative advantage (.164M). These results highlighted the importance of factors in organizational context. Among socioemotional wealth dimensions, renewal of family bonds (.130M) showed a positive effect while emotional attachment (-.127M) showed a negative direct effect on BI adoption intention respectively. The results confirmed that socioemotional factors influenced BI adoption intention. The other significant variables were competitive pressure (.104M), manager's innovativeness (.099S), and perceived cost (-.091S). Competitive pressure from environmental context demonstrated a significant influence on BI adoption intention. Manager's innovativeness and perceived cost were statistically important, and they influenced BI adoption intention, but their magnitudes were small. Regarding the moderating effect of age on relative advantage and BI adoption intention, the result confirmed that age did not significantly demonstrate moderating effect. Both age groups, 40 years or younger and over 40 years, presented the similar attitudes toward the intention to adopt BI.

Recommendations

This section presents the practical implications on how to increase BI adoption intention among family SMEs in agricultural machinery business in Thailand based on the casual effects among variables uncovered in this research. The causal effect with higher effect size should be prioritized first. The recommended actions are proposed in order of high to low effect sizes. To improve organizational readiness for BI adoption, consistent training programs should be organized to enhance employees' computing skills and foster ongoing learning about BI tools. Providing necessary resource availabilities, such as technical assistance and ready IT infrastructure, are also critical. Gaining top management support requires demonstrating how BI can help achieve organizations' goals and objectives. Emphasizing measurable advantages, like enhanced decision-making, operational efficiency, and competitive advantage, can further secure their commitment. To highlight the relative advantage of BI adoption, specific organizational challenges should be identified and addressed. For instance, BI can resolve issues like data inaccuracy by providing reliable insights to support decision making of the organizations. In the context of family SMEs, socioemotional wealth factors must also be considered. Emotional concerns stemming from family members' attachment to traditional practices should be addressed by emphasizing how BI adoption benefits all members and aligns with the family's shared vision and values. Highlighting how BI can preserve and grow the family's legacy can help shading light on the successful transgenerational succession. Given the competitive pressures faced by businesses, conducting a thorough market analysis is

essential. Understanding how competitors leverage BI and the advantages they gain can underscore the necessity of adoption. Additionally, appointing an innovative manager who can creatively address challenges during BI adoption is vital for success. To mitigate concerns about perceived costs, a detailed cost-benefit analysis should be conducted and presented to stakeholders to demonstrate how long-term benefits such as increased profitability and efficiency outweigh initial investments.

Future Research

The future research should retest the effects of the variables which were removed from the theoretical model: complexity, family identification and family's binding social ties. The future research should retest the moderating effect of age on complexity which was not tested in this research. This research is an exploratory study which integrates socioemotional wealth dimensions to business intelligence adoption intention. This research empirically tested the causal effects of socioemotional wealth dimension on business intelligence adoption intention of family SMEs in agricultural machinery businesses in Thailand. The analyses uncovered that socioemotional wealth dimensions, renewal of family bonds and emotional attachment, showed significant direct effects on business intelligence adoption intention among family SMEs in agricultural machinery business in Thailand. Other variables in socioemotional wealth context which were not tested including family identification and family's binding social ties should be retested.

There are other characteristics which family SMEs possess, and those may affect their decision-making process, including information technology adoption. The future research should study these characteristics and theoretically integrate them to the BI adoption research models. This research did not hypothesize any moderating effects on any relationships between socioemotional wealth variables and BI adoption intention. Future research should test moderating effects of moderators on the relationships between socioemotional wealth variables and BI adoption intention.

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