BUSINESS INTELLIGENCE SYSTEM ADOPTION MODEL FOR TEXTILE AND APPAREL INDUSTRY IN PAKISTAN

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DEDICATION

This thesis is dedicated to my dearest husband Dr Ahmad Bilal Awan who has been the source of enthusiasm and patience. I thank you for your tremendous support; no number of words can equal the support and sacrifices you have committed to this noble cause. It is also dedicated to my lovely mother, who taught me that even the largest task can be accomplished with hard work and dedication.

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ABSTRACT

Industry 4.0 concept has put pressure on industries to integrate business intelligence systems (BIS) to process large data sets for intelligent decision-making. Despite its potential, the success of this credible innovation still has a big question mark with 70-80% failure rate. Thus, many scholars have put efforts to find the influential determinants for the BIS implementation in many sectors but neglected the Textile and Apparel (T&A) industry. Although, the T&A industry has great contribution in the development of many developed nations and has become the gate of choice for developing countries to gain the status of developed nations, however, Pakistan is still lagging in this perspective. Therefore, it is imperative to investigate this complex issue and address the lack of any potential framework for examining the current status of the BIS adoption and exploration of the significant determinants that influence its adoption in the T&A industry. To fill this gap, a hybrid Technology-Organization-Environment (TOE) model was proposed to investigate and evaluate the optimal determinants in the individual, technological, organizational, and environmental contexts. This study used a mixed method approach. First, data was collected by conducting twenty-two semi-structured in-depth interviews with industry experts from the T&A industry in Pakistan. Ten determinants emerged after thematic analysis of interview data which were users' traits, interpersonal communications, compatibility, technology maturity, leadership commitment and support, satisfaction with existing systems, sustainable data quality and integrity, sustainability, competitive pressure, and market trends. Further, the Best-Worst method was used to calculate the weights for evaluation and ranking the determinants according to their significance. A BIS model was developed based on TOE with ten determinants which were earlier explored using qualitative approach. The proposed BIS model was validated by using a quantitative approach. Quantitative data was collected by conducting a survey with self-administered questionnaires from the T&A industry in Pakistan. Then, the model was evaluated by using Decision-Making Trial and Evaluation Laboratory (DEMATEL) to determine the cause-effect relationships among the determinants. The results of this study would persuade not only the industrial policy makers in the T&A industry but also from other industries to holistically comprehend the significant determinants. It would contribute to the success of BIS adoption and encourage the key stakeholders to invest for BIS projects with minor threat of failure and secure their sustainability in global markets.

ABSTRAK

Konsep Industri 4.0 telah memberi tekanan kepada industri untuk mengintegrasikan sistem kepintaran perniagaan (BIS) untuk memproses set data besar bagi membuat keputusan yang bijak. Walaupun berpotensi, kejayaan inovasi yang dipercayai ini masih lagi menjadi persoalan besar dengan kadar kegagalan 70-80%. Oleh itu, banyak sarjana telah berusaha untuk mencari faktor penentu yang mempengaruhi pelaksanaan BIS di banyak sektor tetapi mengabaikan industri Tekstil dan Pakaian (T&A). Walaupun industri T&A mempunyai sumbangan besar dalam pembangunan di kebanyakan negara maju dan menjadi pintu gerbang pilihan bagi negara-negara membangun untuk memperoleh status negara maju. Bagaimanapun, Pakistan ketinggalan dalam perspektif ini. Oleh itu, amat penting untuk menyelidiki masalah yang kompleks ini dan mengatasi kekurangan rangka kerja yang berpotensi untuk meneliti keadaan terkini penggunaan BIS dan meneroka faktor penentu penting yang mempengaruhi penerimaan BIS dalam industri T&A. Untuk mengisi jurang ini, model hibrid Teknologi-Organisasi- Persekitaran (TOE) dicadangkan untuk mengkaji dan menilai faktor penentu yang optimum dalam konteks individu, teknologi, organisasi dan persekitaran. Kajian ini menggunakan pendekatan kaedah campuran. Pertama, data dikumpulkan dengan mengadakan dua puluh dua temubual semi-struktur secara mendalam dengan pakar dari industri T&A di Pakistan. Sepuluh penentu muncul setelah data temubual dianalisis secara tematik iaitu sifat pengguna, komunikasi interpersonal, kesesuaian, kematangan teknologi, komitmen dan sokongan kepemimpinan, kepuasan dengan sistem yang ada, kualiti dan integriti data yang lestari, keberlanjutan, tekanan persaingan, dan trend pasaran. Selanjutnya, kaedah Best-Worst digunakan untuk mengira pemberat untuk menilai dan menentukan penentu mengikut kepentingannya. Model BIS dibangunkan berdasarkan TOE dengan sepuluh penentu yang sebelumnya diterokai menggunakan pendekatan kualitatif. Model BIS yang dicadangkan disahkan dengan menggunakan pendekatan kuantitatif. Data kuantitatif dikumpulkan dengan melakukan tinjauan dengan soalan soal selidik yang dikendalikan sendiri dari industri T&A di Pakistan. Kemudian, model dtersebut dinilai dengan menggunakan Makmal Percubaan dan Penilaian Pembuatan Keputusan (DEMATEL) untuk menentukan hubungan sebab-akibat di antara faktor penentu. Hasil kajian ini tidak hanya akan menyakinkan para pembuat dasar dalam industri T&A tetapi juga dari industri lain untuk memahami fackor penentu penting secara menyeluruh. Ini akan menyumbang kepada kejayaan penerimaan BIS dan mendorong pihak berkepentingan utama untuk menetapkan pelaburan besar untuk projek BIS dengan ancaman kegagalan yang minimum dan menjamin kelestarian mereka di pasaran global.

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LIST OF ABBREVIATIONS

AHP	-	Analytic Hierarchy Process
ANP	-	Analytic Network Process
APTMA	-	All Pakistan Textile Mills Association
BIS	-	Business Intelligence System
BWM	-	Best-West Method
CEO	-	Chief Executive Officer
CIO	-	Chief Information Officer
CRM	-	Customer Relationship Management
CS	-	Case Study
DEMATEL	-	Decision making trial and evaluation laboratory
DOI	-	Diffusion of Innovation
DSS	-	Decision Support System
DW	-	Data Warehouse
EIS	-	Enterprise Information System
ERGM	-	Exponential Random Graph Model
ERP	-	Enterprise Resource Planning
ETL	-	Extract-Transform-Load
GDP	-	Gross domestic product
HRM	-	Human Resource Management
IoT	-	Internet of Things
IMDB		In-Memory Database
IS	-	Information System
IT	-	Information Technology
MCDM	-	Multiple-criteria decision-making
MIS	-	Management Information System
OLAP	-	Online analytical Processing
QA	-	Quality Assessment
R&D	-	Research and Development
RFID	-	Radio-Frequency Identification
ROI	-	Return of Investment

RQ	-	Research Question
SLR	-	Systematic Literature Review
SME	-	Small and Medium Enterprises
T&A	-	Textile and Apparel
TAM	-	Technology Acceptance Model
TOE	-	Technology-Organization-Environment
TPB	-	Theory of Planned Behavior
UTAUT	-	Unified Theory of Acceptance and Use of Technology

LIST OF SYMBOLS

ξ	-	Consistency ratio
W_j	-	Weight of j_{th} determinant
W_W	-	Weight of worst determinant
W_B	-	Weight of best determinant
a_{Bj}	-	Best-to-others determinants
a_{jW}	-	Others-to-worst determinants
a_{ij}	-	Impact of determinant *i* on determinant *j*
S	-	Direct influence matrix
A	-	Initial direct relation matrix
I	-	Identity matrix
R_i	-	Sum of the rows of the total-influence matrix
D_j	-	Sum of the columns of the total-influence matrix

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CHAPTER 1

INTRODUCTION

1.1 Overview

This study investigates the current adoption status of Business Intelligence System (BIS) and significant determinants that influence the BIS adoption in the textile and apparel (T&A) industry in Pakistan. The ultimate objective is to develop and validate a theoretical BIS adoption model for the T&A industry in Pakistan. First, the research background including the aim of the study (section 1.2) is presented in this chapter. Further, it explains the research problem (section 1.3) based on identified research gaps and followed by research questions and research objectives (section 1.3.1&1.3.2) that are tackled from the perspective of practice and academia. Followed by the scope of study (section 1.4) and the significance of study which are presented from three contexts: theoretical, practical, and methodological (section 1.5). Finally, this chapter ends with the organization of thesis (Section 1.6) and chapter summary (1.7).

1.2 Background of the Study

Business environments are becoming complex in the era of Industry 4.0. Enterprises including the T&A industry need advanced innovations and technologies for quick response to the dynamic markets [1], [2]. One of the oldest and mature industries in the world is the T&A industry and has great importance in terms of employment, revenue, investment and trade that contribute to the world economy with significant percentage [3]. Moreover, this important industry has great contribution in the development of many countries such as Taiwan, Singapore, Hong

Kong and Korea (four countries are identified as “Asian Tigers”) with high growth rate. These countries have become developed countries due to high-income economies with a major role of their T& A industry [4]. Therefore, the T&A industry has become the gate of choice for developing countries to gain the status of developed nations through industrializations [5]. China, India, Turkey, Vietnam, and Bangladesh are striving hard to win this race; however, Pakistan is lagging in this competition despite of having complete value chain of the T&A industry. In addition, fast fashion is another characteristic of the T&A industry that influences the consumers’ choices on a frequent basis, because most of the T&A products are seasonal in nature and fashion trends change rapidly [6]–[8].

As a result, the T&A industry comprises shorter product life cycles and unexpected customer demands. The fashion market would be observed as one of the ficklest and unpredictable markets due to high uncertainty of the T&A business. Due to these complexities, Pakistani T&A industry is facing challenges of intensive competitive pressure. The challenges are increasing market share, entering in new markets, improving supply chains, reducing energy and material costs per unit, and improving the quality of goods. Therefore, now time-to-market is a pertinent determinant for the T&A industry in Pakistan to compete in the international markets. Thus, the industry is intensified with international competition for a long period; time-based competition has been a strategic policy direction for this industry. Hence, the acceleration of competitive advantage forced the T&A companies to equip with advanced technologies such as big data, cloud technology, robotics, radio-frequency identification (RFID), additive manufacturing, augmented reality, and internet of things (IoT) [9], [10]. Despite investing in advanced and high-cost technologies, industry is unable to harness the true sustainability [11], [12].

The high level of automation, connectivity, and digitization in industry produces large volumes of unstructured and structured data sets on daily basis and it is impossible to obtain real value and sustainability without converting these large data sets into useful information. It is essential to analyze and access such huge amounts of data for designing the T&A manufacturing/production plans, forecasting sales and demands, Supply Chain Management (SCM), fast merchandising, and

inventory management, to cope with international sustainability challenges in the global market [13]. One innovation that has the capability to integrate and analyze the structured and unstructured data to support all industrial stakeholders with valuable information for decision-making is the Business Intelligence System (BIS) [14]. The emergence of BIS is led by the rapid growth of technology and diffusion of the internet in the mid-90s [15], [16]. The BIS is an umbrella term that includes technologies' techniques, tools strategies, and software systems which are integrated by companies to extract information and relevant knowledge to support a broad array of strategic, tactical, and operational business decisions [17]. The BIS is also considered as an Information System (IS) that facilitates decision-making by i) management, aggregation, and integration of unstructured and structured data, ii) handling with large datasets such as big data, iii) offering ad hoc queries, reporting, forecasting and analysis solutions, iv) end-users support with advanced processing abilities to explore new knowledge [15], [18].

With the adoption of BIS, entrepreneurs can easily interpret and understand ongoing challenges, opportunities, strengths, and weaknesses of their businesses by reviewing regional and international trade markets [19]. In previous studies, the positive influence of information on decision-making is recognized by the adoption of BIS, especially when organizations are operating in a highly competitive environment [17], [20]. Additionally, the BIS has the capability to boost the internationalization process of organization by sorting, summarizing, filtering and integrating data from multiple channels such as competitors, host markets and local government, then converting the collected data into unified information [9], [21]. In contemporary trade, due to hyper-competition policy makers, Chief Executive Officers (CEOs), professionals and managers need to make best decisions in real and shorter time span, as "time is money" [22]. As a result, organizations are inclined to use big data and the BIS [6], [23].

In spite of emerging big data techniques, the BIS technology is still positioned among the best technological priorities of several decision-making authorities such as business managers, owners, CEOs and Chief Information Officers (CIOs) [14], [15], [24].It is also depicted by the drastic increase of the worldwide

BIS market with 7.3% growth rate and projected revenues up to $18.3 in 2017. It is expected to reach $26.78 billion by the end of 2020 and predicted to grow 11.2% until 2022 [15], [25]. To compete in the traditional markets or online business, the BIS solutions have attracted great attention from various industries to improve their products and services with improved processes and managerial practices [26]. The adoption of BIS revolutionized the worldwide economies such as 95% in Finland, 96% in Germany, 97% enterprises in Switzerland, total of 89% in Mexico, Brazil, and Asian territory, 73% in Norway 79% in Canada, 76% in the Netherlands, and 87% organizations across the world [27], [28]. According to Gartner's Magic Quadrant 2020, 90% of the world's top 500 companies will take analytics governance initiatives to converge analytics into broader data analytics till 2023 [29]. An international study shows; by 2020, the number of users of modern business intelligence and analytics will grow at the rate of twice and also deliver the business value at the rate of twice of those organizations or users that are not using the BIS [30].

Despite its extreme importance, great market expansion, and growing investments in BIS projects, it is evident by the previous studies that enterprises are failing to leverage the true value of BIS adoption in organization [14], [15], [31]. Enterprises are struggling hard to find the best determinants to make their BIS integration successful by yielding the maximum value from BIS [32], [33]. In recent decades, the academic research related to big data and BIS has thrived [34], [35]. In a large number of published studies, the practitioners and scholars are still discussing the tactical, management, and strategic approaches to the successful adoption of BIS [6], [36]. However, the existing body of knowledge is insufficient in this perspective due to limited studies relevant to the significant determinants for the BIS adoption [14], [37].Hence, it is necessary to focus on different aspects, drivers and issues, that organizations are considering in the adoption of BIS [38]. In addition, it is very necessary for organizations to follow appropriate guidelines to adopt the BIS.

It is revealed by literature that an extensive stream of literature has been published in the perspective of implementation, acceptance, utilization and success of the BIS with various theories and models for various industries at individual level

or organizational levels [20]. However, to date, no study is available that investigated the adoption of BIS in the T&A industry. It is also suggested in literature that adoption decisions regarding the BIS adoption are influenced deeply by considering the most significant determinants [14], [39]. Enterprises also require to focus technological, organizational, and environmental challenges to enhance the success of BIS projects [15].

The Qlik-Gartner-2019 report predicted that by 2020, the number of data and analytics experts in enterprises would increase at three times than the rate of IT experts, which would put pressure on organizations to rethink their organizational skills, expertise and models [29]. The market for BI technologies is projected to grow at a rapid pace in the coming years but still lingering in terms of success. The literature reveals that researchers have focused more on investigating the critical success factors (CSFs) for the BIS implementation [39]–[46] but have neglected the BIS adoption context. This happens because many researchers believed that both terminologies are the same in meaning, but in practice, they are two different stages. The assessment and identification of significant determinants is crucial before adoption of the BIS in companies [14], [47].

Thus, this study aims to fill the existing gaps regarding the identification of potential determinants with the lens of individual, technological, organizational, and environmental contexts which can impede or drive the adoption of BIS in the T&A industry. It is revealed from the past research, that TOE is proven to be fairly effective to integrate any theory or context in accordance with study requirements because TOE has no specific determinants in any contexts [83]. Therefore, it always integrates different theories and determinants to investigate the innovation adoption [60]. Thus, in this study TOE is used as a base, and individual context is added, resulting in an individual, technological, organizational, and environmental (ITOE) framework for this study. The major contribution of TOE integration is to provoke and encourage the practitioners and researchers to adopt the innovation at firm level.

This study contributes a rich overview of BIS research from 2011 to 2020, presenting the recent development of theories/framework/models and significant

determinants relevant to the BIS research which led to the substantive guidelines for a novel theory. This theory is labelled as "Conceptual model and Theoretical framework of BIS adoption" with significant determinants for the T&A industry in Pakistan. The study results with a BIS adoption model would enrich the scholars and practitioner's knowledge pertaining to the BIS adoption. It would also guide them to consider what kind of determinants; organizations require taking into consideration with highest priority to leverage the true value of BIS which contribute to the success of this costly complex system.

1.3 Problem Statement

The T&A industry in Pakistan has good repute across the world with ample experience and long tradition since the 19th century. Pakistan is one of the top ten exporters of textiles & apparels in the world [5]. The industry is not only progressing positively, but also facing the intensive competitive pressure because of their regional players. In addition, the abolition of multi-fibre arrangement (MFA) in 2005, competitive pressure has increased many folds [48]. Vietnam, China, and Bangladesh capture the international markets successfully while Mexico and Philippines are struggling to compete this challenge, but Pakistan is lagging despite having a complete value chain of the T&A industry. A constant stream of innovations is required to secure its due share in quota free international trade of textiles [123].

The arrival of fast fashion is continuously pressurizing the T&A industry to harmonize its procedures with manufacturing, production plans, supply chain, inventories of outlets, and logistics warehouses [6]. This is because most T&A products are seasonal in nature and consumers' tastes are changing frequently [49], [50]. Along these lines, the T&A companies can bear notable loss in revenues because of outdated apparel stocks due to rapid and seasonal changes [51].Therefore, a large amount of money can be lost by textile and fashion companies due to extravagant outdated stocks [51]. In addition, the industry is considered generally to have a great environmental sustainability impact as well as causing concern

regarding human rights due to hazardous chemical usage in order to grow cotton, dyeing textile products, and other value chain processes. It is added to the ecosystem impact of this globalized consumption of water, energy, and land; it is polluting the rivers and atmosphere largely. Increasing textile wastes from low-quality frequent clothing replacement for short-term use is a critical issue of the T&A industry [7], [52].

As a result, some high-end T&A companies have integrated advanced technologies with intention to resolve the sustainability issues and to attain competitive edge across the world [6] but they are facing the challenges of data integration, solutions, processes, and resources from end-to-end. Only 10% of available data is used for analytics and decision-making processes and rest of 90% generated data is not fully utilized [53]. Thus, a precise and authentic information system is required for decision-making in contemporary business scenarios. The BIS has the ability to provide intelligent information for decision-making by analysing large data sets [14]. Despite contemporary remarkable investments in advanced technologies, Pakistani T&A industry is still lagging for the BIS adoption.

In addition, researchers are mainly focused on the financial and telecommunication industries in terms of the BIS adoption in Pakistan [38], but neglected the T&A industry that is considered the backbone of Pakistani economy. Subsequently, the current adoption status of BIS is vital to be revealed with a legitimate research literature. It is important to note that across the world, some high-end T&A companies are using advanced BIS, not yet broadly investigated by the researchers [6], [54], [55]. However, by integrating the BIS, a broad array of benefits can be obtained in different departments of the T&A industry such as SCM, Customer Relationship Management (CRM), inventory control/management, manufacturing, production, distribution, marketing, and sales with well-informed decision-making [6].

Despite the immense benefits of BIS, the cost is a major obstacle in the adoption of BIS in developing countries [56]. The BIS requires not only millions of dollars for integration but also requires pertinent personnel and hardware investments

[57]. Further, it is demonstrated by literature that the success of this credible innovation has still a big question mark with 70-80% failure rate [14], [58], [59]. The reasons for this failure are still unknown [15]. Several researchers believed that the exploration of significant determinants is a pertinent aspect that attributes the success of BIS adoption [14], [39], [60]. According to Yeoh et al. [14], organizations should be aware of and learn about important determinants in order to recognize the potential actions and areas, which can guide them in the right direction as well as removing the obstacles in achieving desired targets. It would lead to the ultimate success of complex BIS projects. Some researchers claimed that the same determinants do not necessarily fit with the same contexts for all business types [31], [42], [61].

Therefore, it is very important to identify and select the determinants that fit for a specific industry with the context of investigation. Thus, in the light of the above discussion, there is ample space for investigation of the current BIS adoption phenomenon, especially in the T&A industry. However, until now, no study was found on the significant determinants for the BIS adoption in the T&A industry [6], [54], [55]. Moreover, conventional determinants that are often claimed to ensure the successful adoption of BIS are starting to lose their influence in the presence of a high failure rate of BIS projects. It is challenging to persuade the administration and industrial stakeholders for the adoption of BIS from developing countries like Pakistan. Therefore, it becomes inevitable to explore and prioritize the new determinants that facilitate or hinder the process of BIS adoption in industries.

A good quality theory/model has great importance to add the knowledge of practitioners and scholars within the theoretical domain [62], [63]. Despite its great importance within IS discipline, the development of new theoretical framework and refinement of existing theories/ models generally in the IS field and particularly for the BIS is scarce [60], [63], [64]. Only few researchers have addressed this issue partially [65], but the adoption of BIS as a separate entity is limited [15], [41]. In addition, in existing BIS adoption models, individual dimension is not embedded in the context of BIS adoption at organization level whereas user's context is inevitable for the BIS adoption process at organizational level [15]. To date, no study has

discovered any theory or model used for the BIS adoption in the T&A industry with the lens of individual, technological, organizational, and environmental contexts. Existing BIS models cannot be considered appropriate for the T&A industry due to its unique characteristics with seasonal products as compared to other manufacturing industries with stable products [51]. Therefore, the main objective of this study is to fill the above-mentioned research gaps by developing and validating a theoretical model with potential determinants pertaining to the BIS adoption in the T&A industry in Pakistan. A theory/model can build a conceptual base for understanding interoperability/ interconnectivity among significant determinants by identifying potential barriers and drivers [12]. Hence, the relevant studies were reviewed to identify the research gap that defined the aim of this research and led to formulating the research questions of the current study.

1.3.1 Research Questions

In particular, the current research conducted to address the main question: ***How can the BIS be adopted in the T&A industry in Pakistan?*** To answer this main question, four sub research questions (RQ) are designed as follows

- RQ 1: What is the current adoption status of the BIS in the T&A industry in Pakistan?
- RQ 2: What are the determinants influencing the adoption of BIS in the T&A industry in Pakistan?
- RQ 3: Which are the most significant determinants influencing the adoption of BIS in the T&A industry in Pakistan?
- RQ 4: What model can be proposed for the adoption of BIS in the T&A industry in Pakistan?

1.3.2 Research Objectives

Based on the research questions in section 1.3.1, the research objectives are:

- To investigate the current adoption status of the BIS in the T&A industry in Pakistan.
- To explore the determinants that influence the BIS adoption in the T&A industry in Pakistan.
- To identify the most significant determinants for the adoption of the BIS in the T&A industry in Pakistan.
- To develop and validate the BIS adoption model for the T&A industry in Pakistan.

1.4 Scope of the Study

The focus of this study is mainly on the T&A industry in Pakistan. The T&A manufacturing, production and retail companies are selected for this research. This study applied the mixed method research approach to examine the potential determinants influencing the adoption of BIS with the lens of individual, technological, organizational, and environmental contexts. In addition, this study focused on the technological (BIS) diffusion at the industrial level and the unit of analysis is the T&A companies, software companies, and academics. Therefore, key participants in this study were industry experts from the T&A industry, scholars from universities, and BIS experts from software companies with authoritative designations such as senior researchers, CEOs, Chief Technology Officers (CTO) or Information Technology (IT) managers, CIOs, IT Directors, administrative managers or other managers with main authority that are generally involved with organizational decision-making procedures. These criteria are important to ensure that the key participants have sufficient knowledge on discussed items and have suitability according to this study objective.

The current adoption status of the BIS in the T&A industry was investigated by Systematic Literature Review (SLR). Twenty-two interviews were conducted for exploration of determinants. The total extracted determinants from the case study were ranked by using Best Worst Method (BWM). Further, a model was developed and validated by conducting a survey from the T&A industry in Pakistan. Decision making trial and evaluation laboratory (DEMATEL) technique is used to analyze the survey data for refining the final BIS adoption model.

1.5 Significance of the Study

The theoretical significance of this study is theory contribution and enhances the academic body of knowledge. In the market, several studies have been conducted related to the adoption of ERP or other conventional systems in Pakistan but are rare on the BIS adoption and almost no one studies for the T&A industry in Pakistan. Further, existing models or theories can be extended or refined by the proposed conceptual model and provide a clearer understanding of the potential determinants contributing to the process of BIS adoption not only in the T&A industry but also in other organizations with the same business domain. Theoretically, this study adds to the knowledge by investigating the individual determinants with technological, organizational, and environmental determinants addressing the BIS adoption in the T&A industry. As users are main stakeholders of any innovation. Thus, individual related determinants have great importance to harness the real value from the BIS adoption [15], [60].

The current empirical results add knowledge to the research related to the BIS adoption and would guide the scholars considering the companies' choice of new determinants before proposing or validating any existing theory or model. The findings of the current study can be helpful for decision makers of the T&A companies to improve the adoption processes and technologies in terms of budget, time, and business requirements in developing countries, especially in Pakistan. In a contemporary competitive business scenario, it is very important to understand the relationship between the industry and business conditions with technological

solutions in companies that will enhance their sustainability by converting data into actionable intelligence [66]. It urges the industry practitioners to examine all potential determinants before implementation of any innovation.

If organizations integrate the BIS solutions by considering the significant determinants, then they can harness great benefits from the BIS projects and maintain their sustainability in competitive markets. The current study results will encourage the adoption of BIS and other advanced manufacturing technologies that appear to herald a future in which the value chains of the T&A industry are shorter, collaborative, and offer more sustainable benefits [3]. Well-informed decision-making mimics biological processes by analyzing data and resources for less wasteful in manufacturing and production which leads to significant socio-economic value creation from the environmental impact of industry procedures. Industry experts can plan for manufacturing, production, retailing, marketing, and selling strategies in a better way before entering in the fourth industrial revolution “Industry 4.0”.

Hence, results are also helpful to guide the software vendors to identify their target markets and customers and make technology solutions with attractive offerings available, especially in developing countries which are facing more technology and sustainability related challenges because of cost and mass shifting of manufacturing units from developed countries to less developed countries due to easy availability of labor and material at low costs. It is believed that the applied methods and methodologies of this study offer an essential comprehension of complex phenomena with new insights which would support not only industry practitioners in the industry but also researchers towards novel theory development and implementation.

1.6 Organization of the Thesis

This thesis consists of seven chapters which are organized into three main sections as illustrated in the following Figure 1.1.

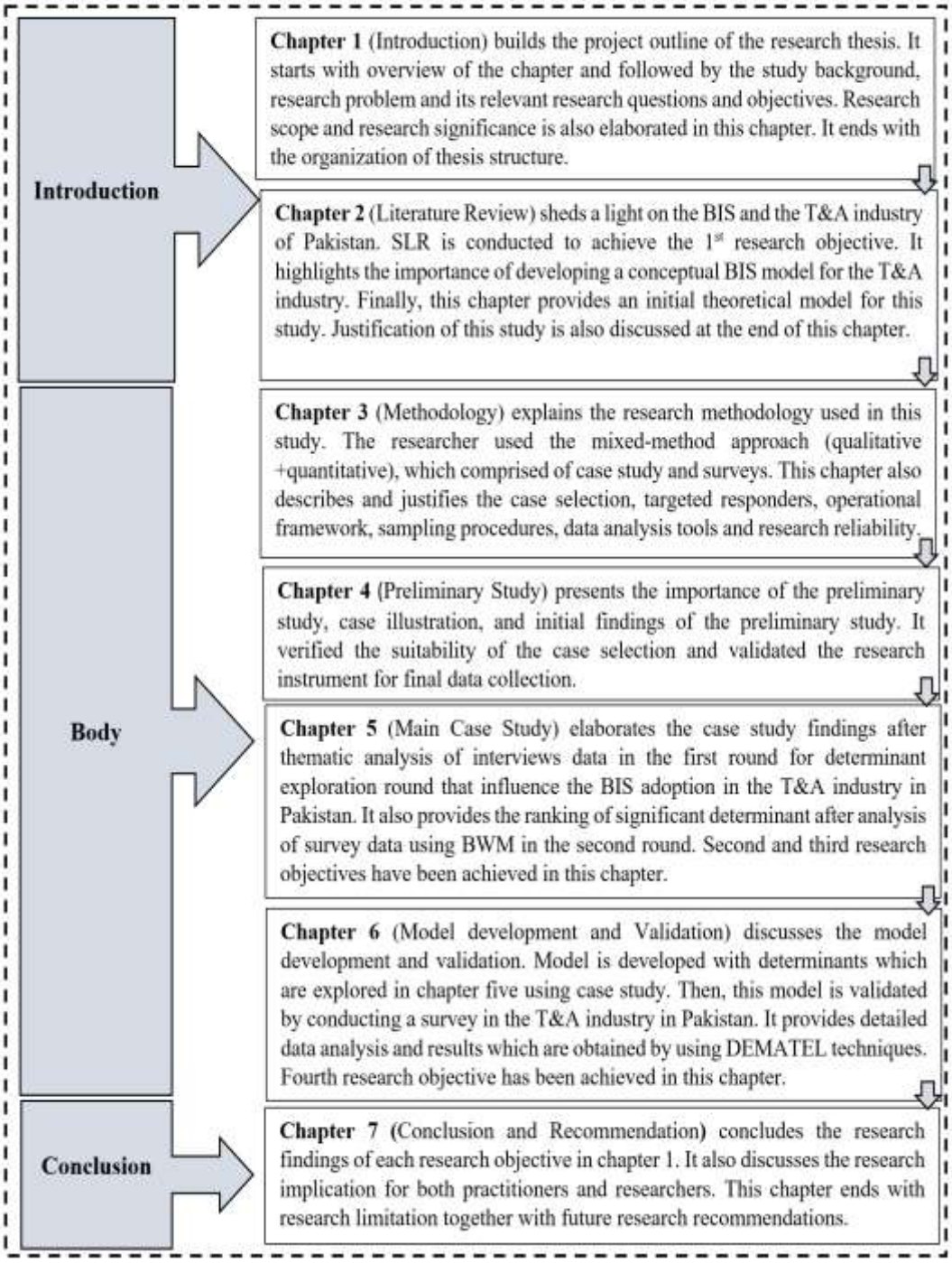

Figure 1.1 Organization of the thesis

1.7 Summary

This chapter presents an overview of the current research. It starts with the background of the study and followed by a problem statement, the research questions and research objectives. The scope and significance of the research are discussed subsequently. Finally, the organization of the thesis is outlined as well.

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LIST OF PUBLICATIONS

1. **S. Ahmad**, S. Miskon, R. Alabdan, and I. Tlili, **(2020)** "Towards Sustainable Textile and Apparel Industry: Exploring the Role of Business Intelligence Systems in the Era of Industry 4.0," *Sustainability*, vol. 12, p. 2623, **(Q2, ISI Impact factor= 2.592)**
2. **S. Ahmad**, S. Miskon, T. A. Alkanhal, and I. Tlili, **(2020)** "Modeling of Business Intelligence Systems Using the Potential Determinants and Theories with the Lens of Individual , Technological , Organizational , and Environmental Contexts-A Systematic Literature Review,"*Appl Sciences.*, vol. 10, no. 9, pp. 1–24, **(Q2, ISI Impact factor= 2.474)**
3. **S. Ahmad**, S. Miskon, R. Alabdan, and I. Tlili, **(2020)** "Exploration of influential determinants for the adoption of business intelligence system in the textile and apparel industry," *Sustainability.*, vol. 12, no. 18, pp. 1–21, 2020. **(Q2, ISI Impact factor= 2.592)**
4. **S. Ahmad**, S.Miskon, "A Conceptual Model of Business Intelligence System Adoption for the Textile and Apparel Industry of Pakistan," *Mehran University Research Journal of Engineering & Technology*," **(Emerging ISI)**
5. B. A. Alsaigh, K. Soehod, and **S. Ahmad**, **(2020)** "Challenges that influence the implementation of the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) Standards in Hospitals," *Int. J. Psychosoc. Rehabil.*, vol. 24, no. 06, pp. 3589–3602. **(Scopus Indexed)**
6. H. M Shehzad, R. Ibrahim, A. F. Yousaf, K. A. M. Khaidzir. S. Shaukat, S. Ahmad, **(2020)** "Recent Developments of BIM adoption Based on Categorization, Identification and Factors: A Systematic Literature Review". *International Journal of Construction Management,* **(Scopus Indexed)**
7. **S. Ahmad**, S. Miskon, and S. Tlili, **(2020)** "Development and Validation of Business Intelligence System Adoption model for the Textile and Apparel Industry in Pakistan," *Big Data,* **(Revision submitted, Q1 ISI Impact factor= 3.644).**

BOOK CHAPTER

1. **S. Ahmad** and S. Miskon, **(2019)** "The Adoption of Business Intelligence Systems in Textile and Apparel Industry: Case Studies," in *Advances in Intelligent Systems and Computing, vol 1073*, Advances., vol. 1073, G. N. Saeed F., Mohammed F., Ed. Switzerland: Springer, Cham, p. pp 12-23. **(Springer ISI, Book Chapter)**

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2. **S. Ahmad** and S. Miskon **(2019)**. "A Systematic Review of Factors Influencing the Adoption of BI Systems for Textile and Apparel Industry of Pakistan, *"Postgraduate Annual Research Seminar 2019 (PARS 2019) School of Computing, Universiti Teknologi Malaysia Johor Bahru Malaysia on 10-11April 2019.* ***(Non-Indexed)*** *(Presenter)*
3. B. A. Alsaigh, K. Soehod, and **S. Ahmad**, **(2019),** "Challenges that influence the implementation of the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) Standards in Hospitals," *5th Asia International Conference (AIC-2019)* KLCC, Kuala Lumpur Malaysia *on 6-8 December 2019.* ***(Scopus Indexed)*** *(Presenter)*
4. **S. Ahmad** and S. Miskon, **(2020)**, "IoT Driven Resiliency with Artificial Intelligence, Machine Learning and Analytics for Digital Transformation," *International Conference on Decision Aid Sciences and Application 2020 (DASA 2020)* 8-9 November 2020. **(Scopus Indexed)** (Presenter).