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Strategizing Radio Frequency Identification (RFID) in the Retail Supply Chains of Pakistan: A Multiple Case Study

Sanaa Khayyam
Department of Management, Information and Production Engineering,
University of Bergamo, Italy
sanaa.khayyam@unibg.it; sanaa.hameed.ms@gmail.com

Asher Ramish
Hasan Murad School of Management,
University of Management & Technology, Pakistan
asher@umt.edu.pk; asherramish@yahoo.com (*Corresponding Author*)

Khaliq Ur Rehman
Office of Research Innovation and Commercialization,
University of Management & Technology, Pakistan
khaliqcheema@gmail.com; khaliq.rehman@umt.edu.pk

Aly Raza Syed
Hasan Murad School of Management,
University of Management & Technology, Pakistan
aly.raza@umt.edu.pk

ABSTRACT

Adopting enabling technologies in developing countries is a challenge for enterprises due to the lack of awareness levels. This study aims to facilitate the retail sector of developing countries like Pakistan by providing them with the framework for Radio Frequency Identification (RFID) implementation, which they can implement in their context with slight modifications. This paper uses an exploratory research design with multiple case study methods within the qualitative research domain. The proposed framework covers technical and non-technical aspects and dimensions and would help adopt and implement RFID in developing countries. The current study attempts to eliminate the gaps in the previous frameworks through the inputs taken from the semi-structured interviews from the retail sector of Pakistan. Interviewees were selected based on purposive sampling. The study would is for the retail sector of developing countries to adopt and implement RFID in their supply chains through the application customized framework according to the nature of the organization. This framework will help the managers by improving the overall tracking and tracing of the products. This research will add value to the existing literature as significantly less research has been performed in the retail sector of developing countries related to RFID implementation.

Keywords: *RFID, supply chain, retail, developing countries, framework, case study*

1. INTRODUCTION

Today's supply chains aim to achieve end-to-end visibility for better inventory management; therefore, corporations require real-time data and accurate information flow for accurate decision-making to shape up businesses and supply chain strategies. There is a need to know about the process of RFID (Radio Frequency Identification) implementation and factors affecting the decision of RFID adoption as a tool or as a strategy within the supply chain of Pakistani firms. Over the past 15 years, RFID is getting serious attention from organizations, but the actual adoption of RFID is very slow (Bansode & Desale, 2009). There is less research available regarding the pre-implementation stage of RFID and the gaps that exist in its implementation within the supply chain of Pakistan. In this era of business competition, organizations need to eradicate the supply chains gaps and effective management to gain a competitive advantage.

The literature on supply chain & operations management reveals that effective supply chain management can only be possible with the highest levels of information sharing and collaboration between the business entities (Patterson *et al.*, 2003). In this era, any supply chain aims to reduce end-to-end costs and increase profit margins by adopting the latest techniques like RFID and sustainable best practices. During the last few decades, the enabling role of IT has dramatically changed the landscape of the

SCM process and brought automation of processes and operations into play (Fawcett *et al*., 2011). IT application including EDI, DSS, TPS, RFID, ERP, SRM, has significantly improved information sharing and collaboration by providing POS data and accurate time information throughout the business chain. Latest technologies like Blockchain also have many applications in the supply chain and various functions for better transparency throughout the supply chain (Sivula *et al*., 2021). Another study argues that Blockchain can also facilitate supply chain collaboration and integration (Wang *et al*., 2021). In one of the studies, trust was a key for blockchain-oriented applications to achieve transparency in the supply chain (Batwa & Norrman, 2021). Vast literature repositories propagate that developing countries should shift–and embed new technologies like RFID (Srivastava, 2004) into their supply chain systems and processes.

There are gaps in RFID implementation that need addressing while adopting and implementing supply chains in developing countries. RFID is an enabling technology that helps supply chains create seamless chains with increased visibility and efficiently manage supply chains. The usage of the RFID technology in SCM is innovative yet challenging (Sauer & Reich, 2009). Due to gaps in their processes and infrastructure, the developing economies usually have more margins to improve and grow. However, in the developed countries, global companies like Walmart, Gillette, Metro, Tesco, HP, BMW, P&G, and Intel were early adopters of RFID. Patterson et al. (2003) cautioned that a prudent–decision is required when companies are in the process of adopting RFID as both the results and benefits of such adoption of RFID can vary at different levels of implementation. For instance, RFID has fewer outcomes at the pallet level than the case level & item-level RFID adoption (Patterson *et al*., 2003).

There are different factors like social variables, performance issues, cultural issues, process improvements, inventory management, shrinkage, theft, cost-cutting, visibility, real-time data/ POS. Different global companies were operating in developed countries considered before deciding on RFID implementation. RFID applications are used in operations within supply chains and assist companies in getting competitive advantages, developing their suppliers, handling the strategic planning of companies, and develop supply chain strategies. For example, Wal-Mart mandates its suppliers to shift on RFID to work as a strategic source. RFID implementation is critical in a developing country like Pakistan because huge costs are associated with this decision. The problem is that RFID adoption is very slow in Pakistan, and hardly any research evidence is available to support the RFID adoption decisions in Pakistan (Rehman & Rehman, 2012). Cost is perceived as the primary factor to consider before taking the RFID adoption decision, but the literature shows that this is not the only issue associated with the decision. The literature strongly suggests future researches to re-engineer supply chains using new technologies like RFID (Hossain & Quaddus, 2011). Sarac *et al*. (2010) suggested that re-shaping supply chains can also increase the value and gain in the retail industry with RFID. The technology adoption strategy must be well defined and planned on scale and scope to get expected benefits from the RFID. These dimensions are also crucial while studying RFID implementation (Roh *et al*., 2009).

Previous studies explained the role of RFID in retail and suggested studying the improvement of intra-organization and inter-organization decisions with RFID. The RFID adoption variables are comparably different for adopters and non-adopters (Hossain & Quaddus, 2011). In their study, Ngai & Gunasekaran (2007) suggested working on the challenges and barriers and the critical success factors of adoption and implementation strategies for RFID in supply chains for future research (Ngai & Gunasekaran, 2007). Another research suggested in its study that future research should with a small number of firms in the form of case studies in different countries to investigate the range of issues, which may affect the RFID implementation (Sharma *et al*., 2015).

Hence, the research questions need attention before proposing a framework for RFID implementations, and the same RQs have formed the basis of the following research.

Q1. *What are the factors/drivers which support the decision to adopt RFID?*

Q2. *What are the hurdles/barriers companies faced in implementing RFID in developing countries like Pakistan?*

Q3. *How to design and propose a framework for implementing RFID in the supply chain within developing countries?*

2. LITERATURE REVIEW

2.1 Identification Technologies

Researchers can trace back the shreds of evidence regarding the use of identification technologies in the supply chain since the 1970s as many American companies were using the bar code technology to trace and track the inventory, and in the 1980s and 1990's the bar code used the majority of the companies. With technological advancement in the 2000s and onwards, auto-identification technologies like RFID and bio-metric identification started replacing the previous technologies.

2.2 RFID Technology

RFID technology is contactless interrogation and identification methods of objects. It is similar to barcoding as it uses to label the Products; however, it is different as it has some additional advantages over barcodes, e.g., There is no need for barcode lines to read, the RFID tag can read in multiples, individual items can be coded and identified, and RFID tags can read and write. RFID is a wireless tracking technology and works as an extension of the existing bar code technology fully integrated with the EPC (product code) Global Network. It will not be incorrect to say that RFID replaces barcodes, but it offers many additional benefits over Barcode technology (Peppa & Moschuris, 2013).

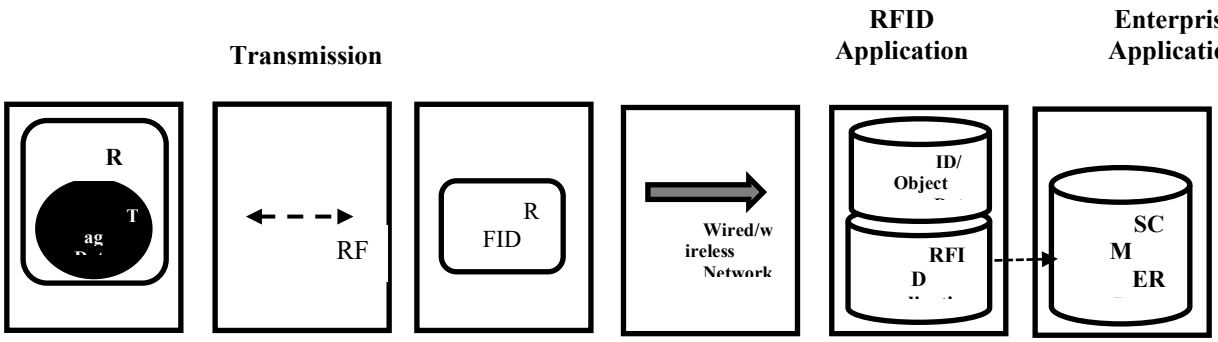

Figure 1. RFID in supply chain (Dovere *et al*., 2015)

RFID tags have many designs and different functional characteristics such as power sources, carrier frequency, read ranges, data storage capacity, memory type, size, operational life, and Cost (Wamba *et al*., 2008). RFID works at different levels of frequencies which include lower, high, and ultra-high ranges. RFID tags are also of different types, shapes, and sizes, e.g., active tags (contain energy in itself) and passive tags. Along with the different types of tags, the readers are different depending on their range and functionality (Dovere *et al*., 2015). Over the past few decades, companies are integrating this technology into strategic planning, just as in the case of Wal-Mart (Simchi-Levi *et al*., 1999).

Then comes the most critical part of this technology, commonly referred to as the EPC (electronic product code) and ISO (international operation system). Each country has its own set of frequencies approved by the global EPC system, and no other country is allowed to use that frequency, e.g., Europe is using 896 MHz frequency, America is using 915 MHz, and Japan is using 960MHz. One primary concern that has emerged for new adopting countries is the lack of availability of vacant frequencies. As many states have occupied all the frequencies, new adopting countries have no other vacant bandwidth. RFID is widely used in almost all fields of life nowadays. RFID is a foundation technology for IoT, i.e., the Internet of Things, and so far could not gain significance due to its higher unit cost (de Vass *et al*., 2021).

As advancements in IT continues, adoption latest technologies have started to become a routine within firm's operations, e.g., the computer-aided Enterprise Information Systems (EIS) such as Enterprise Resource Planning (ERP) (Soh *et al*., 2000), Supply Chain Management (Beamon, 1998; Lambert, 2000), Product Lifecycle Management (Thomas *et al*., 1999), Customer Relationship Management (CRM), Manufacturing Execution System (MES), Warehouse Management System (WMS), and Enterprise Asset Management (EAM) are significantly making inroads, improving enterprise operational efficiency, and reducing operational Cost (Yan et al., 2008). RFID applications currently are being used in different supply chains in different industries, including Technology Industry, Food Industry, Retail Industry, Fashion, and Textile Industry, Pharmaceutical and Hospital Industry, Forest Industry, Fish and Sea Industry, Construction Industry, Transportation and Shipping Industry, Military Industry, Energy Industry, banking industry, manufacturing, airline industry, Road toll plazas, Seaports, Government matters, People Tracking (Peppa & Moschuris, 2013). A unique study has also proposed a framework for implementing reverse logistics through "end-to-end supply chain tracking" (Usama & Ramish, 2020).

2.3 Definition of Supply Chain management

The phenomenon of supply chain management has a different understanding in the mind of different supply chain professionals and supply chain council**s.** Every year this definition evolves to an improved version for a better understanding of both practitioners and academics. Initially, the supply chain deals with within organization's flow of goods and services. It later included the flow of people, along with the movement of the materials in its ambit. To this date, both the definitions and domains of supply chains are evolving quickly by incorporating other related actives and flows into it, especially the use of Information Technology centric applications and devices.

Supply Chain Management is "*A set of approaches utilized to integrate suppliers efficiently, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements (Simchi-Levi et al., 2008)*."

Table 1. Evolution of supply chain management definition

Dubey et al. (2012)	Supply Chain Management as a concept manages the flow of material, information and funds end to end, i.e., from upstream to downstream members. It also deals with the disposal of material after consumption as per the environmental norms. SCM tries to achieve this at the lowest cost with maximum efficiency.
Randall and Mello (2012)	Supply Chain Management incorporates supply and demand management inside and across companies.

Table 1. Evolution of supply chain management definition (Con't)

Machowiak (2012)	SCM is a methodology of improving the business process, making them more resilient, more agile, and as a result, more competitive. The primary function of SCM is to improve product or service competitiveness.
Melnyk et al. (2009)	The definition that "SCM is primarily responsible for managing the buying as well as managing the flow of orders and information" is no longer valid. Today, all the related aspects such as improving customer service, mitigating supply chain risk, reducing waste, improving new product design processes, and enhancing product service quality are treated as integral parts of supply chain management.
McCormack and Kasper (2002)	Supply Chain Management involves processes that help a firm improve its competencies by synchronizing operations to include source, make and deliver processes in collaboration with channel partners and suppliers.
Harland (1996)	Supply Chain Management integrates two business functions, it manages direct relationships with suppliers and integrates a chain of suppliers and a customer's customers, and so on. The management of related businesses is involved in the ultimate provision of products and service packages required by end-users.
Lee and Billington (1993)	A supply chain is a network of facilities that procures material to intermediate and finished products and distributes finished products to customers.

Source: (Parkhi *et al*., 2015).

2.4 RFID in Retail Supply Chains

Simchi-Levi *et al*. (2008) added the specific retailing domain in the supply chain in their definition "Retailing with in supply chain is the set of business activities that adds value to the products and services sold *consumers for their personal or family use*."

A retail supply chain means the supply and movement of goods and services from the retail level of a supply chain to the consumers and end-users (Rana et al., 2014). Retailing is the specific part of the supply chain, which has focused only on retailer / wholesale level to end consumer. Strategy plays an integral role in the retail supply chain (Liu *et al*., 2014). The focus of the retail supply chain strategy is to increase the sales volume with increased profitability. In the recent past, retailers and retail chains are competing in different ways after introducing enabling technologies like RFID to achieve the POS data to have a real-time understanding of consumer buying and purchasing patterns (L. Wu et al., 2014). RFID serves as the tool to increase information sharing and enable real-time data in the retail supply chain (Aboelmaged & Hashem, 2018), as discussed earlier under enabling technologies. RFID has many potential benefits, and it is inevitable for all industries to compete in the economic markets without such enabling technologies (Dey *et al*., 2016).

Giant retail supply chains have big budgets to spend on their competitive advantages to the lead in the markets (Wei *et al*., 2015). The best supply chains align with its overall strategy; it aligns with the vendors' and supplier's strategies (Reyes et al., 2016). The enabling technologies like RFID increase transparency and clarity by enhancing the information sharing of real-time sales data and inventory management information (Al-Hakim & Lu, 2017). Technologies such as RFID helps retailers to adjust the supply of goods and services according to the unpredictable customer's preferences, demands, and buying patterns (Jung & Lee, 2015).

2.5 Existing frameworks for RFID implementation

Agrawal & Smith (2015) has discussed the adoption of RFID after realizing the benefits of labor reduction, potential cost-saving, and real-time visibility. According to him, RFID needs alignment with the company's strategy. Thus the primary concern is to consider RFID as a strategic investment, and hence ROI becomes a secondary issue in such case. The investment in RFID should be divided among all the supply chain partners (Veronneau & Roy, 2009). The policy of sharing the Cost of RFID among all members of the business chain also maximizes the output of the RFID implementation (Sarac *et al*., 2010). Many companies adopt RFID due to its numerous benefits like cost reductions, higher revenues, and improved processes and services**.** All adoption decisions were made to implement RFID in the existing processes & operations rather than on the process re-engineering. Re-engineering processes yield maximum benefits from RFID (Bottani & Rizzi, 2008; Dutta *et al*., 2007). Before adopting RFID technology, the organizations should understand its potential uses and benefits and then conduct a need analysis. Selecting the right technological solution for any environment is a crucial factor in getting maximum benefits (Sarac *et al*., 2010). There is a need to have a vision with the perception of value of RFID. Continued research on RFID's strategic value in the overall supply chain will lead the firms to gain sustained competitive advantages (Tajima, 2007).

Bunduhi, Weisshaar, & Smart (2011) highlighted that process innovation and direct benefits ascertained were the main reason for the adoption of RFID. On the other side, the most challenging factor for firms to adopt RFID is the "cost of technology and ROI." Cost includes developmental, initiation, capital, implementation, relational, and ethical costs (Roh *et al*., 2009). According to Ngai & Gunasekaran (2007), RFID adoption decision is driven by factors like external pressure (from the

environment of buyer or supplier or competitors), organizational readiness, and expected benefits of RFID for the specific firm at a specific scale (single-multiple) & scope (solo-integrated)**.** Understanding the expected benefits by the firms regarding at which level or scale and with which scope they have to adopt the RFID will help them make a better decision. Even though there is the realization of the benefits of RFID to the extent that it changes the process and society, there are still issues in its adoption like heavy investments, technical problems, security, and internal operations; the gaps also exist in performance measurement in supply chain knowledge management that might help understand the RFID adoption in a better way (Ramish & Aslam, 2016).

According to Ustundag & Tanyas (2009), the aim of getting supply chain integrity and getting rid of inventory discrepancies leads the companies to adopt the RFID, and the only challenge highlighted is demand uncertainty. Some authors explain that the adoption model has four types of factors affecting RFID adoption decisions: technological, organizational, and environmental, and expected benefits of RFID (Hossain & Quaddus, 2011; Wu *et al*., 2006). They further propagate that technological factors include (complexity, compatibility, trialability, cost, standards); organizational factors include (resource factors, management factors), environmental factors include (pressure, support, uncertainty) and expected benefits include (financial returns, and business processes). According to research on deployment of RFID in libraries in India, the main drivers for RFID adoption were to automate the system without human interaction, to control the theft, stock verification, and to relocate the misplaced items. The challenges they faced were consumer privacy issues / ethical concerns, costs, lack of standards and regulations in India (e.g., data ownership, data collection limitations). User confusion (e.g., lack of training and experience with the technology) and immaturity (e.g., lack of accuracy, scalability), cost, and standard procedures and regulations are essential issues in RFID adoption in India.

Table 2. Summary of literature review

Authors	Factors promote RFID Adoption	Challenges in RFID adoption	Scope / focus	Industry
Peppa & Moschuris (2013)	Traceability, Lead time	Security		
Ha *et al*. (2014)	Operational problems & consumer privacy (shrinkage reduction, reduced labor costs, and improved customer service)	Cost of RFID high capital investment	Effects of RFID in supply chain	Food & beverages
Wu *et al*. (2006)	The efficiency of tracking, visibility, purchasing power	Technology, standard, patent challenges, cost (manufacturing cost + customization cost), infrastructure, return on investment (ROI), & barcode to RFID migration challenges		
Sarac *et al*. (2010)	Cost reduction, increased revenues, process improvements, service quality	Lack of international standards, cost of RFID, ROI, technological/environmental issues		
Tajima (2007)	Asset/material and data/information management throughout the SC	ROI, technical, shifting from bar code to RFID tag, privacy		
Roh et al. (2009)	External pressure, expected benefits, organizational readiness/willingness	Considerable investment, understanding of scale & scope of RFID		
Ustundag & Tanyas (2009)	Inventory discrepancies	Demand uncertainty		
(Lai et al. (2014)	Improving the service quality, customer satisfaction, personnel identification,	cost, ubiquity, compatibility, security and privacy risk, top management support, hospital scale, financial readiness, and government policy	Key factors influencing RFID adoption	Hospitals

Based on the research findings, cost, compatibility, security and privacy risk, top management support, hospital scale, financial readiness, and government policy were the key factors influencing RFID adoption in hospitals (Lai *et al*., 2014b). The significant constructs in one of the research studies in 2018 are well explained as technological benefits, costing of system, uncertainties and risk factors, and other motivating factors which may be internal or external (Tu, 2018). The implementation framework for RFID adoption relies on the resource-based view when it discusses the scale and scope of the organization (Ultan *et al*., 2018). The factors that influence the strategic decisions of RFID adoption identify the desired benefits and outcomes from RFID technology with the supply chain. The new way of improving the economies is to adopt the internet of things, which are also associated with many obstacles like implementation risk, tag cost, system cost, ROI. The scale of an organization is directly proportional to the implementation cost and system cost. With the challenges encompassed, there are still many motivating factors to adopt the enabling technologies like RFID, which work in collaboration with the supply chain, e.g., real-time information sharing & communication and the digital technologies, which encourage the organizations to develop the systems (Al-Hakim & Lu, 2017).

2.6 The inception of RFID in Pakistan

The inception of RFID in developing countries has been very slow. Pakistan is a developing country with several industries and many multinationals like India, Sri Lanka, and Korea. Pakistan is leading the developing countries in different industrial sectors. In many instances, the cost-related issues would not allow the companies in Pakistan to deploy the latest technology. Developing countries usually wait for the technology to come at lower prices. Still, several companies in Pakistan have shifted on the RFID technology; a list of the companies with their industry type and level of RFID deployment is given below in the table. Many authors have attempted to undergo research work on RFID related issues from the perspective of developing countries (Adhiarna *et al*., 2011; Baliamoune-Lutz, 2003; Bingi *et al*., 2000; Brown & Russell, 2007b; Lai *et al*., 2005a; Walsham *et al*., 2007; Yusof *et al.*, 2015)

Table 3. Summary of RFID applications in Pakistani firms

Organization	Industry	Basis of decision	Level of RFID
US Apparel	Apparel industry	To reduce lead times	Only washing unit (operational level-single activity)
Sapphire Retail	Apparel Retail	Inventory management Security	Store inventory
Allied Bank	Service/ Banking Retail	Industry pressure Inventory management	Security, door locks
Metro Cash & Carry	Retail industry	Shrinkage & theft control	Security & theft control
Chen One	Apparel retail	Inventory audit	Security reasons
People soft	Software(web services)	Top management initiative	Security reasons
Hushpuppies	Shoe retail industry	Automate inventory management	Inventory handling
Stylo shoes	Shoe retail industry	Inventory control & process automation	Inventory handling
ICI	Paints & chemicals	To control the inventory & theft	Security level, door locks & inventory in & exit places only

Several studies related to RFID in the retail are available; for example, research in the retail of Saudi Arabia was undergone by (Alqahtani & Wamba, 2012), the retail sector of South Africa by (Brown & Russell, 2007a), retail of China by (Lai *et al.*, 2005b), livestock retail in Australia by (Hossain & Quaddus, 2011), Metro retail in the UK by (Ton, 2014). Although the literature provides examples of induction of RFID in developing countries, there is still a considerable gap in the research work done under the umbrella of RFID adoption related to Pakistan. After conducting the literature survey, the following figure is derived as a research gap within RFID implementation and adoption. It shows that the research conducted in the past is less focused on the pre RFID implementation areas and in determining the strategic relation of RFID adoption with supply chain and strategy-technology fit.

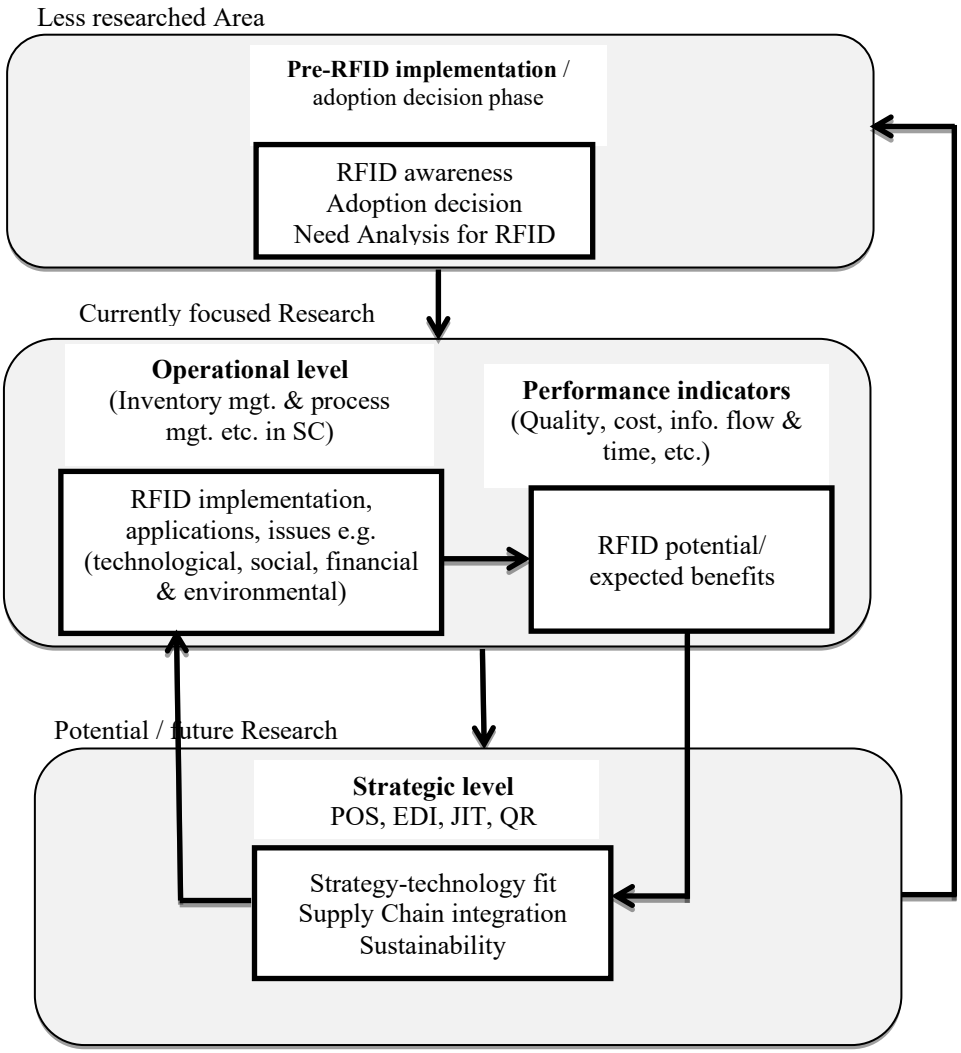

Figure 2. Summary of literature review

3. METHODOLOGY

The research method used in this research is the multiple case study method. A research method that helps in insight investigation of real-life phenomena in their natural setting is a case study (Yin, 2009). Interview techniques are used as a data collection tool. Interviews are recorded, and notes are taken. Three different types of notes were taken in this study, i.e., observational, methodological, and theoretical (Schatzman & Strauss, 1974). Interview questions were semi-structured, asked in the form of an interview guide to collect data in this research. The organizations, which are currently using RFID applications in any aspect, are considered as population. As the size of the population is quite large**;** therefore**,** a generalized sample was taken.

In this study, the research paradigm is interpretive (Jonker & Pennink, 2009). According to the interpretive paradigm**,** people construct reality in society and their perceptions and experiences (Neuman, 2014). People's perspectives are subjective and may have many meanings, and it can change with the change in the social setting (Hennink *et al*., 2011; Saunders *et al*., 2011; Wahyuni, 2012). It also comprises a detailed explanation of the observed behaviors and direct quotations from people (in that social setting) about their experiences, beliefs, and case histories (Creswell & Creswell, 2017; Leedy *et al*., 2014). The research design is "exploratory & explanatory design," which explores and explains the facts (Cuthill, 2002). The suggested framework in this research is extracted from the data and information collected through interviews & observations. Each theme is the result of the respondents' responses and the interview outcomes; the literature review also supported the theme/concepts selection for the framework.

The information about the respondents was collected to make it part of the case study database on their names, addresses, phone number, and email address. The sampling technique that is used in this research study is "Purposive sampling," which means the sample is selected purposefully. Each sample unit is selected assuming that the unit is relevant and appropriate respondent to provide

relevant data. The sample comprises all those firms, which were approachable and accessible. The sample size for this research study is 11, with few interviewees interviewed twice to get more clarified information. Strategic level and middle-level managers of the retail sector were taken as the unit of analysis. The logical reason behind this is that the strategic level managers make decisions and middle-level managers usually implement the process.

Companies selected for case studies are manufacturing groups having their retail store chains with RFID. Only one manufacturing company that did not have its retail store was taken in the sample, and the reason for that selection was the pilot project of RFID that the company implemented. US Apparel is the manufacturing firm selected because it is one of those companies that initiated RFID applications in the supply chain in its true spirit. The reliability is achieved by checking and observing the similarities in the respondents' responses (Rossiter, 2002). The reliability of the research study is achieved through data triangulation. The validity of the research work is achieved through the replication logic, which means asking the same semi-structured questions from different people to validate the information (Adcock & Collier, 2001). Multiple case study methods allow the replication, which eventually validates the data.

After taking the response's appointment, the interviews were taken and recorded following the case study protocol. A semi-structured questionnaire was used. Along with the recordings, the visiting cards of the respondents were requested and kept in record. Verbal consent and permission were taken to use the company's name and its professional's name who were interviewed. Information verification consent was also taken from the respondents. The two types of qualitative data were collected, i.e., primary and secondary data. The primary data collected comprised interviews of highly experienced professionals and the secondary data is collected in the form of literature. The following table includes the professional's designations and the respective case study companies.

Table 4. Summary of Case study Companies

Company	Industry	Designations	# of meetings
US Apparel	Textile (Manufacturing)	Head of Purchase department	2
		Head of IT department	1
		IT manager	1
		Head of logistics department	2
Sapphire Group	Retail	IT manager of Retail Store	1
		Head of Purchase department	1
Metro cash & carry	Retail	Head of Security department	1
		Procurement & replenishment head)	1
		Purchase & Supply chain manager)	1
Allied Bank	Retail Banking	IT head	2
ST. micro-electronics	RFID solution provider	Country Head	2

4. FINDINGS

In order to develop a practical RFID implementation framework, respondents were inquired about the relevant aspects and factors of RFID adoption in Pakistan during interviews produced essential facts at the planning and pre-planning phase. The significant observations of the interviews were the lack of information and complete understanding about the RFID applications in the supply chain and their possible benefits. Since all the interviewed professionals had vast experience in their fields, they still were only aware of few applications of RFID and its associated benefits in the supply chain. The responses received from the interviews highlighted the inside causes of less adoption of RFID, i.e., less awareness of the technology and its benefits. The culture pointed out as the main barrier to the RFID implementation at the operational level. The top, operational, and lower levels managers are less aware and not trained to use RFID. They all suggested running training programs to increase awareness regarding RFID benefits and their role in supply chains.

In response to the requirements for RFID implementation, different professionals provide different opinions, e.g., system requirements, many issues highlighted by the interviewees, i.e., lack of infrastructure, IT incompetence system compatibility, and IT inefficiencies. The lack of infrastructure in Pakistan does not let the RFID implementation in its true sense. The businessman's approach in Pakistan is reactive, and whenever radical changes happen in the system, the businessmen react and take only reactive measures instead of proactive measures. The reason for the failure of the RFID project in one of the companies was IT inefficiencies. One of the respondents suggested localizing the tags and readers to enhance the compatibility with the system. The primary and most crucial hindrance in Pakistan is that the technology is not localized; instead, it is hired and borrowed. Readymade system solutions are being purchased and implemented, failing; as the system prerequisites are not fulfilled, and compatibility remains an issue.

The respondents highly desired awareness and education through training. Cultural and social attributes were also identified as the major hindrance. Respondents also highlighted people's readiness to accept change and top management's commitment during the interviews. At the individual level, all respondents were highly motivated and passionate about implementing RFID solutions, but not at the organizational level as the decision-making by the owners, who are usually skeptical and not willing to invest such considerable amounts. Cost is the natural barrier, but

in terms of the payback period of RFID, it usually is an issue due to prolonged or un-defined timelines. In some cases, the return on investment is not concise and convincing. The professionals also suggested change management as their culture and norms are different from the rest of the world. They emphasized using a mandated strategy to get the process implemented. Respondents were asked about "the awareness, understanding, and knowledge about the functionality of the RFID in the existing system." Their respective responses ascertained included the inefficiencies in the IT systems to effectively communicate the usage and functionality of the RFID to the workforce at the bottom level.

Most of the respondents highlighted the importance of training and development and the awareness and education sessions for the people involved in the implementation. Training and development have been inculcated in the suggested framework in the pre-planning phase, which will be conducted at all framework steps, and continuous improvement will only be possible if the implementers and executors learn and master all steps. Also, forming a cross-functional team would help plan and elaborate the scale/scope / stage of the RFID implementation and incorporate it into the framework. For the planning phase, the respondents further highlighted investigating the existing systems and fulfilling the requirement for the new system through expert people and state-of-the-art knowledge.

4.1 Aspects of RFID adoption

The aspects of RFID adoption and implementation are social, cultural, legal, economic/financial, environmental, technical, and political. According to resource-based and organizational theories, RFID adoption decisions are affected by operational efficiency, supply chain efficiency, organizational infrastructure, and context (Park *et al*., 2010). Organizational culture and behaviors were highlighted as some of the barriers to RFID adoption and implementation. Status quo and change resistance attitudes and lack of awareness of the RFID systems and applications create a less motivational culture. Lack of infrastructure has been a hindrance in RFID adoption & implementation; although the companies are financially sound and capable of investing in such projects, the cost of investment is an indirect barrier (Barney, 1991). These citations from the literature also confirm some of the feedback we received during interviews.

The data shows that the cost is essential in the Pakistani business environment, but it is also a fact that if the top management commitment is involved in the project, then the cost is no longer a barrier. This is supported by the theory of planned behaviors and the theory of reason action. As the business models in Pakistan are working on the resourced-based view thus, to gain the competitive advantage, the businesses need to enhance their resources in the form of RFID implementation, which, upon developed optimally, will eventually be considered as an organizational resource. The innovation diffusion theory (IDT) and theory of evolution (TOE) explain the organizational level adoption factors for RFID. Although the external environment is not controllable by the organization, it still has its importance. The external environment includes external pressure (legal issue, governmental and business obligation, competition, and normative pressure), external support (government bodies, technology providers, and communication networks), and external uncertainty. Organizational factors of adoption include organizational structure, organization size (Stru¨ker & Gille, 2010), human, technical and financial resources. Other factors include management attitude, organizational readiness and willingness, organizational culture, innovativeness, and risk attitude.

5. DISCUSSION

The respondents highlighted the hurdles and obstacles related to issues, and the responses were related to infrastructure, cost, technical expertise, handling and knowledge about RFID, system inefficiencies in existing setups, and social and cultural issues. The workforce considered the new system and IT solution a threat against their jobs and was reluctant to learn the new ways. The workers conceived these IT innovations as if the organization is replacing the workforce with technology. Culture is the most crucial element in RFID adoption implementation in Pakistan. There is no culture of innovation and creativity in the Pakistani business environment. The successful implementation can be achieved by taking care of each aspect and focusing on the systems' demands. Thus, the pre-implementation stage and planning are crucial for the success of the RFID implementation. Industry professionals and academic people's mutual opinions and input can provide the customized frameworks and guidelines for future implementations. After implementation, the operational cost and operational management issues should be part of the pre-implementation phase. This phase would always be self-motivated. However, the subsequent phases would be forced to get results. The culture and people in Pakistan do not support change like RFID in Supply chains, and it creates the feelings of getting rid of the workforce by the induction of any Technology in the supply chain. The reality is the opposite of this perception; RFID is for the help of humanity to streamline the supply chain, increase efficiencies of business, and bring transparency in information sharing.

The RFID expert responded about the social and political role in RFID adoption and implementation; as for RFID implementation, the bandwidth issue is very critical due to unique frequencies being booked by different countries. The ISO bandwidth can be checked on PTA (Pakistan Telecommunication Authority) website for more information on Pakistan's allowed frequencies. Thus the political issues are questionable in such cases," and another company's professional responded that external factors are not controllable. The factors highlighted in this research must be tested using individual case studies and then comparing the results. The culture varies at the organizational level too. So RFID implementation framework should be customized according to the company's need. For the detailed understanding and decision making about the scale, scope, and stage of the RFID adoption and implementation in the given framework, the RFID experts, suggested the organization answer the following questions by themselves that are "what type of

tag is required?; what are the requirements of business activity?; what level of tagging is needed?; what is the purpose of RFID implementation in the business system?". These outcomes are accommodated with the software and hardware selection part in the suggested framework.

5.1 Practical Implications of research for society

The retail industry in Pakistan is not limited to the retail stores of consumer items. The retail industry includes all the retail stores, food chains, shopping places, and family entertainment places, which come under the retail of services. Each retail chain in this industry follows its supply chain. Information technology and its enabling tools and applications re-shape the competition among the supply chains by re-engineering the businesses. RFID is also one of the enabling tools and technology that helps retail chains achieve their business targets and sales volumes in terms of financial gains. This research helps the retail supply chains to adopt and implement the enabling technology, i.e., RFID. This research serves as the guide to plan and implement the technology tool and helps the retail chains to serve the society with enhanced information sharing better and adapting required changes with the time regarding customers' needs and demands. This study gives an insight into the planning, monitoring, and implementation phase of RFID adoption.

This framework is strictly focused on Pakistan's retail industry, so it serves as the helping manual and motivational factor to adopt RFID and make it easy to implement. With real-time data, the retailers and their manufacturers get real-time feedback to improve the product specifications and features. By knowing the consumer's preferences, the suppliers are better positioned to supply the required goods and services by using principles of continuous improvement and optimization of resources. Society is benefited by optimizing resources, which leads to cost efficiencies for the manufacturing firms. The consumers get product differentiations and customization with competitive pricing and on-time deliveries. This suggested framework is based upon the key points extracted from the interviews and theoretical background. During the interviews, it was observed and recorded that lack of awareness regarding the benefits of RFID was at the highest level. The managers and highly experienced professionals are also not fully aware of the full benefits and applications of RFID in supply chains. The industry practitioners in the developing country should be educated via academia, and there must be seminars, workshops, and conferences to spread the knowledge and awareness about RFID's implications in supply chain management.

RFID frameworks need analysis from three different perspectives, i.e., scope, scale, and stage for RFID implementation. Every organization has its understanding of the scope of the RFID framework's implementation. They may want to implement for people management, technological advancement, to implement organizational change, or address the environmental requirements at the organization. Organizations may want to implement the RFID frameworks at the organization, industrial, or country level. After this, the cross-functional team formation should be done, including the representatives of each department who have sufficient knowledge to support the implementation process. Next comes the extensive and detailed stage of planning. The planning phase includes needing analysis, expected project outcomes, analysis, understanding of the existing system, cost analysis, ROI, and payback period calculation on RFID investment. Managerial requirements, technical requirements, financial requirements, social and environmental requirements should be assed and fulfilled.

The next phase is deploying the action plan and purchase decision of hardware and software for the RFID implementation. If the system does not fulfill the requirements, the process should go back to the planning phase, put in a plan accordingly again, and then move on. Then start the project as a pilot in one section or on one product to observe the results. Get the feedback of the pilot project and manage the change. Do amendments where needed. Implement the process and supervise, then continuously improve along with the operations. It is a suggested model which should be tested and amended depending upon the target firm and its system.

6. CONCLUSION

This study focuses on the RFID implementation in the supply chain of developing country Pakistan. Extensive literature reviews and interactions with industry experts reveal that business people in developing countries do not fully know the RFID applications in business. Lack of understanding and readiness to adopt RFID blocks the industry practitioners of developing countries from attempting to experience new ways of operating supply chains. Culture is a red light and at the top of the list of the barriers to implementing RFID in Pakistan. The reason for the lack of innovation is the weak infrastructure and less awareness about their capabilities. Industry practices lack the inclusions of academic concepts. There is a need to reduce the gap between industry and academic knowledge. Education and guidelines about the benefits and applications of RFID's, the technology adoption and RFID implementation in supply chains would not be issued.

Furthermore, there must be some guidelines and set action plans for industry practitioners and robust frameworks based on the specific industry dynamics to help guide and motivate industry practitioners to experience the innovation and creativity in supply chains. The current study only focuses on the retail industry; researchers can explore the other industries in the future. In order to test and improve the suggested framework for RFID implementation, it needs to extend to the other sectors and industries. Further researchers can explore barriers and drivers for RFID adoption in the specific industry within Pakistan.

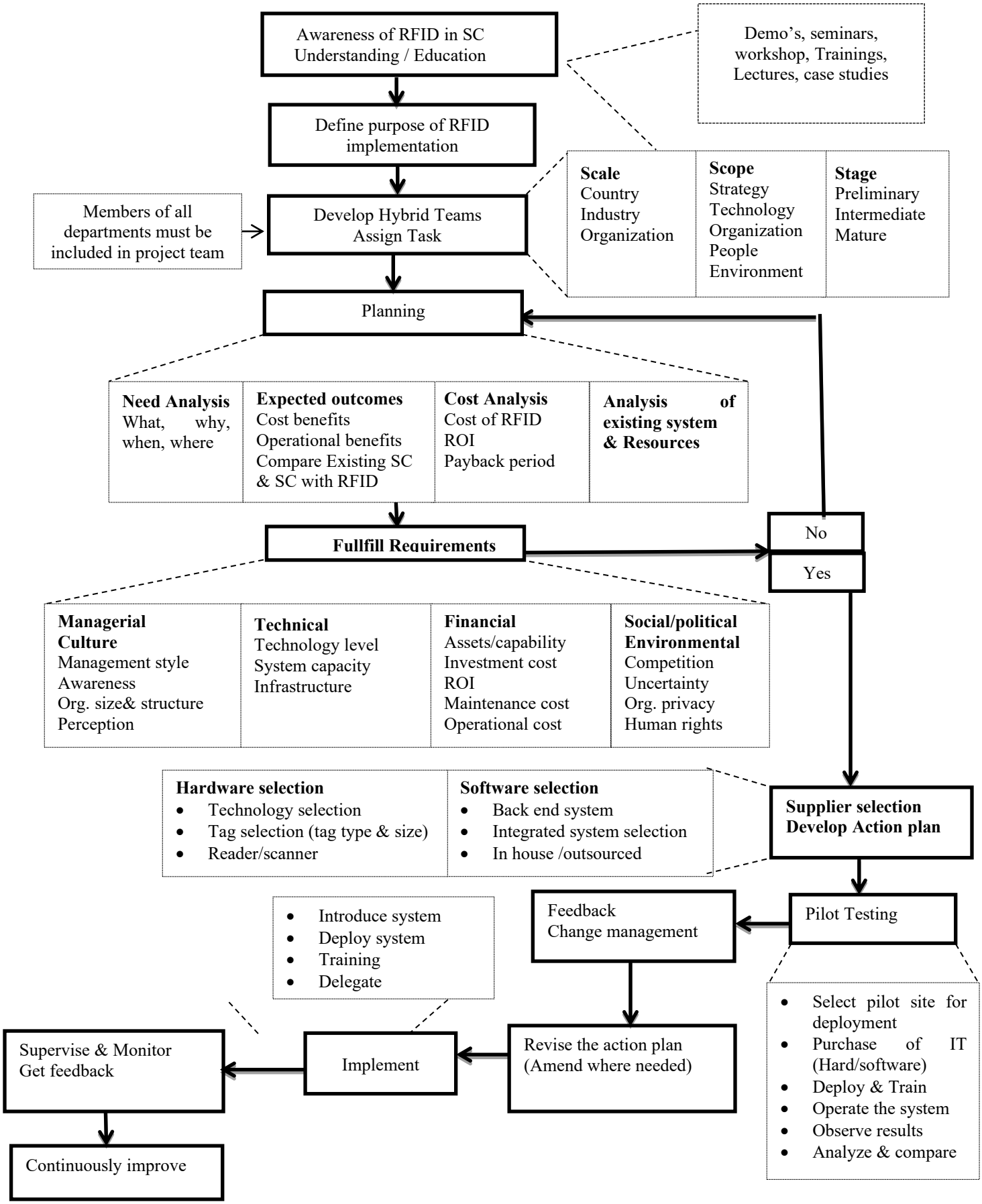

Figure 3. Suggested Framework for RFID

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Sanaa Khayyam is currently a PhD Scholar and enrolled in Technology, Innovation and Management (TIM) within Department of Management, Information and Production Engineering at the University of Bergamo, Italy. Currently she is part of networking team funded by EuroMA and involved in multiple research projects focused on reshoring. Her research interests are also extended towards the fields of industry 4.0, Blockchain applications in supply chain management, Smart supply chain, circular economy and sustainable supply chain management, Management, Production and Operations Management, and Project Management. Sanaa has graduated her MS in Supply Chain Management and MBA in Human resource management from University of Management and Technology (UMT), Pakistan. She has ample experience of online retailer business as she has been working as entrepreneur since 2014.

Asher Ramish is currently an Assistant Professor in the Department of Operations and Supply Chain. He has more than 19 years of experience both in academia and industry. His research interests are also extended towards the fields of Services Supply Chain Management, Logistics, Supplier Relationship Management, Strategies in Supply Chain Management, Supply Chain performance measurement, Production and Operations Management, and Project Management. Asher has authored a number of research papers in his ardent area too. Asher has been an AD-HOC member of the reviewer board of 9 ISI impact factor emerald journals and one ISI impact factor Taylor and Francis journal. Besides his enrollment in the doctorate program in services supply chain management, Asher previously has done his MS in Production Management from Technical University of Hamburg-Harburg, Germany, on a full scholarship sponsored by a world-renowned German company Koerber AG. He also holds a Bachelor in Mechanical Engineering from the University of Engineering and Technology (UET), Lahore.

Khaliq Ur Rehman recently earned his PhD in Enterprise Management from School of Management, Wuhan University of Technology, Wuhan China. He is an author of several research papers published in National (Recognized by Higher Education Commission) and International Journals (Listed In Thomson Reuters, JCR, SJR, and other renowned Publisher). He has also been the member of editorial / reviewer board of international Conferences and international journals. Dr. Rehman is pursuing his research expertise in conceptual and Qualitative Research. His research interests include Entrepreneurship, Resilience, Enterprise Management, Organization Theory, Performance Evaluation, Governance, Learning Organization, and Knowledge Management. He is currently working in the office of Research Innovation and Commercialization at University of Management& Technology, Pakistan as Manager Research.

Aly Raza Syed holds a degree of Masters in International Business from Helsinki (Finland) and is currently pursuing his Ph.D in the field of management from Putra Business School, Malaysia. He has vast experience of working with corporate Pakistan for over a decade where he worked as a consultant & trainer for various organizations. Aly reverted back to academia and is currently working as an Assistant Professor at the Hasan Murad School of Management (UMT) in an academic capacity. He has also been the Director Out Bound Training at the Center for Executive Education (CEE), where he worked as a Bespoke Corporate Trainer, Consultant and Intervention specialist. Aly has been delivering lectures, conducting workshops and being an ardent speaker at many conferences. He has authored several articles, research papers and written case studies which have been subsequently published in international journals of high standing. His key areas of interest are in the fields of Strategic Management and Policy, HR Development, Knowledge Management, and International Business.