

A STUDY ON CASH SUPPLY CHAIN MANAGEMENT IN BANKING SECTOR, SRI LANKA

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STATEMENT OF THE SUPERVISOR

The candidate has carried out research for the MBA in Supply Chain Management in the Department of Transport and Logistics Management of University of Moratuwa under my supervision.

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August 31, 2021

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ABSTRACT

A study on cash supply chain management in banking sector, Sri Lanka

In contrast to the global situation, Sri Lankan cash supply chain does not use SCM applications significantly. In general, currency moves through the supply chain in a very similar way as of the retail product flow. Being service providers, banks seek optimum service delivery in regard to cash supply chain to achieve customer satisfaction. Globally, researchers have studied the cash supply chain using both manufacturing and service supply chain concepts. Globally, IT systems and scientific models are being used for cash order management, automatic cash order processing for ATM replenishments, cash inventory management, forecasting cash demand, cash monitoring tools and for optimal CIT route planning. In global practices, it is evident that ecological factor has been embedded in the decision-making process to minimize environmental impact as a part of the sustainable cash supply chain.

Currently most of the banks in Sri Lanka may have not achieved the maximum operational effectiveness of cash supply chain as satisfied percentage in overall satisfaction shown by the branch managers of banks in Sri Lanka varies between 47% and 72%. Further, no statistically significant evidence to claim that more than 50% bank managers are satisfied on prevailing cash supply chain under 95% level of confidence highlighting that there are gaps that need to be addressed strategically as a country in optimizing the money supply chain using globally improved supply chain management strategies.

The study found that high satisfaction of private bank on Information Technology systems to communicate with upstream, information systems related to Asset and Liability Management function, information security, and business continuity compared to the state bank is statistically significant at a level of 95% confidence.

Banks which have outsourced services or have a central cash processing unit show more satisfactory level compared to the banks that handle cash distribution administration in a decentralized manner. However, there was no significant difference with regard to the overall satisfactory of cash supply chain between government banks and private banks under 95% level of confidence.

The cost involved through the supply chain might not be optimal as there are gaps related to cash distribution administration, security, transportation, information systems and cash inventory management which are basic functions of cash supply chain.

The Covid 19 pandemic has led many banks to rethink about the business continuity arrangements based on the strategies that have been currently implemented. In view of the strategic development of the cash supply chain in Sri Lanka, AHP mathematical model revealed that Physical Security, Service Point Capacity, Insurance, Information Systems, Distribution and Cash Inventory are the key functional areas that need to be focused.

Key words: Service Supply Chain Management, Cash Supply, Banks, AHP

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LIST OF ACRONYMS

AHP	Analytic hierarchy process
ALM	Asset and Liability Management
AML	Anti Money Laundering
ATM	Automated Teller Machines
BTA	Bank Transaction Account
CBSL	Central Bank of Sri Lanka
CDD	Customer Due Diligence
CIT	Cash In Transit
CRM	Customer Relationship Management
EOD	End Of the Day
ISMS	Information Security Management Systems
LCB	Licensed Commercial Banks
LSB	Licensed Special Banks
MCDM	Multi-Criteria Decision-Making
MMDA	Money Market Deposit Account
NDA	Non-Disclosure Agreement
PCI-DSS	Payment Card Industry Data Security Standard
SCM	Supply Chain Management
SLA	Service Level Agreement

1. INTRODUCTION

1.1 Background

Money in circulation is the main component of the money supply in the economy. Cash (currency notes and coins) which is the most liquid form of the money supply plays a key role in everyday life of general public and corporates. The Central Bank of Sri Lanka (CBSL) has the sole authority to issue currency notes and coins in Sri Lanka under section 49 of the Monetary Law Act No. 58 of 1949. The main channel is Licensed Commercial Banks (LCBs), When LCBs request currency notes and coins from the CBSL for their transactions, currency notes and coins are issued in denominations requested by them. These currency notes and coins are added to circulation through the transactions with their customers. Cash reaches consumers through various distribution channels, such as bank branches, automated teller machines (ATM), and retailers.

Licensed Commercial Banks (LCBs) play a decisive role in cash supply chain in holding, counting and validating cash to processing, transporting and protecting in a way that ensures cost-efficiency, cash availability and service quality in providing integrated service from Central Bank to Public/corporates. Strategic decision towards cash supply chain will create competitive advantage to the Banks and assure the business sustainability as per the common understanding.

1.2 Statement of the problem

Upon request made by the LCBs, cash supply chain process is initiated and CBSL issues the currency as per the request. After receiving the cash to Head Quarters of LCB/Specific centers, feed the branches in remote area (if any) and feed the ATMs/CRM as per the requirement decided by the respective branch. With the complexity of the branch network, logistic arrangements, cash inventory management, resource/capacity management, cash demand forecasting and security arrangements are key common functions focused by the retail banks.

The generic challenges in supply chain management such as demand forecasting, inventory planning, resource maintenance, network optimization, logistic planning is highlighted for the cash

supply chain by viewing cash as “inventory” moving through retail bank supply chain. In optimizing the cash supply chain, retail banks need to consider strategic approach to transform cash supply chain from the traditional approach as an integrated approach by stakeholders who have very different objectives and incentives within their silos, i.e. supply chain management thinking. Further, strategies should shift the cash supply chain from “reactive” to “needs-based”, while boosting productivity ("Optimizing the retail bank supply chain," 2014).

Orlando (2011) revealed that operational efficiency of cash supply chain in Brazilian banking industry as a result of applying supply chain management models, i.e. Supply Chain Council (SCOR, version 10.0) and considered customer relationship management, customer service management, demand management, order fulfillment, Manufacturing flow management, procurement, product development and commercialization, returns as business processes. This model allowed for a deeper operational and functional assessment (Júnior et al., 2011).

With the evolvement of Supply Chain Management (SCM) practices and Information Technology (IT), different strategies are used to improve cash operations, logistics and processing challenges in cash supply chain by the banks. Hence the research interest of the researcher is to study the strategies used by banks in Sri Lanka with respect to both supply chain management practices and sustainable service supply chain practices.

1.3 Objectives

Supply chain management applications are more commonly used in every industry as it assures the business success in an integrated and holistic manner. Banking sector as service-oriented sector are behind the times regarding supply chain management applications. However, banks continuously improve their service efficiencies with the usage of new IT systems and streamline the processes with industry best practices to assure innovative results. The objectives of the research are as follows.

- Identifying and comparing cash supply chain management practices among government and private banks with the research interest whether the overall satisfaction of cash supply chain management is different between government banks and private banks.
- Identifying most important functional areas in cash supply chain management to be improved further in Sri Lanka.

1.4 Significance of the study

Despite the increase in usage of virtual money by individuals and non-individuals in transactions, the volume of currency in circulation has risen during the last decade. Sri Lanka Money Supply M0 is the most liquid measure of the money supply including coins and notes in circulation and other assets that are easily convertible into cash and the current trend is shown in Figure 1.1. This implies the proper management of cash supply chain is a demanding service requirement of banks. It is a general understanding that if the points of sales are out of money and this may even cause a bank run, which could undermine the financial health of these institutions. Thus, the study on cash supply chain management in banking sector in sustainable service engagement perspective is a justifiable research interest in Sri Lanka. This will identify key functional areas to be improved in cash supply chain from bankers' perspective and discusses global supply chain practices.

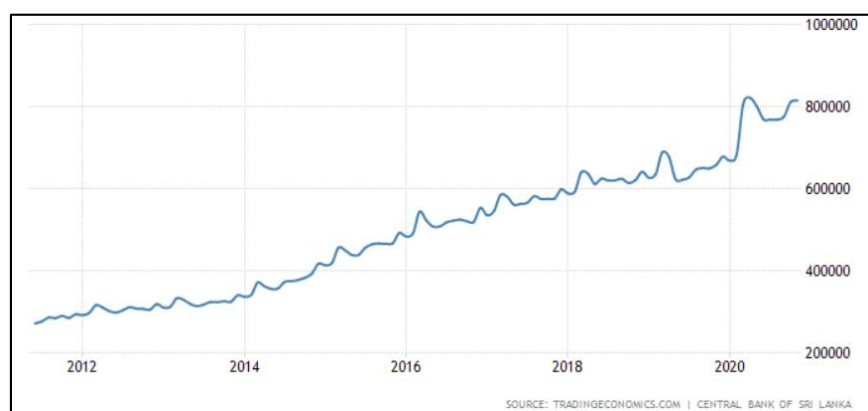


Figure 1-1: Sri Lanka Money Supply M0 (LKR Million)

Source: Tradingeconomics.com

1.5 Methodology

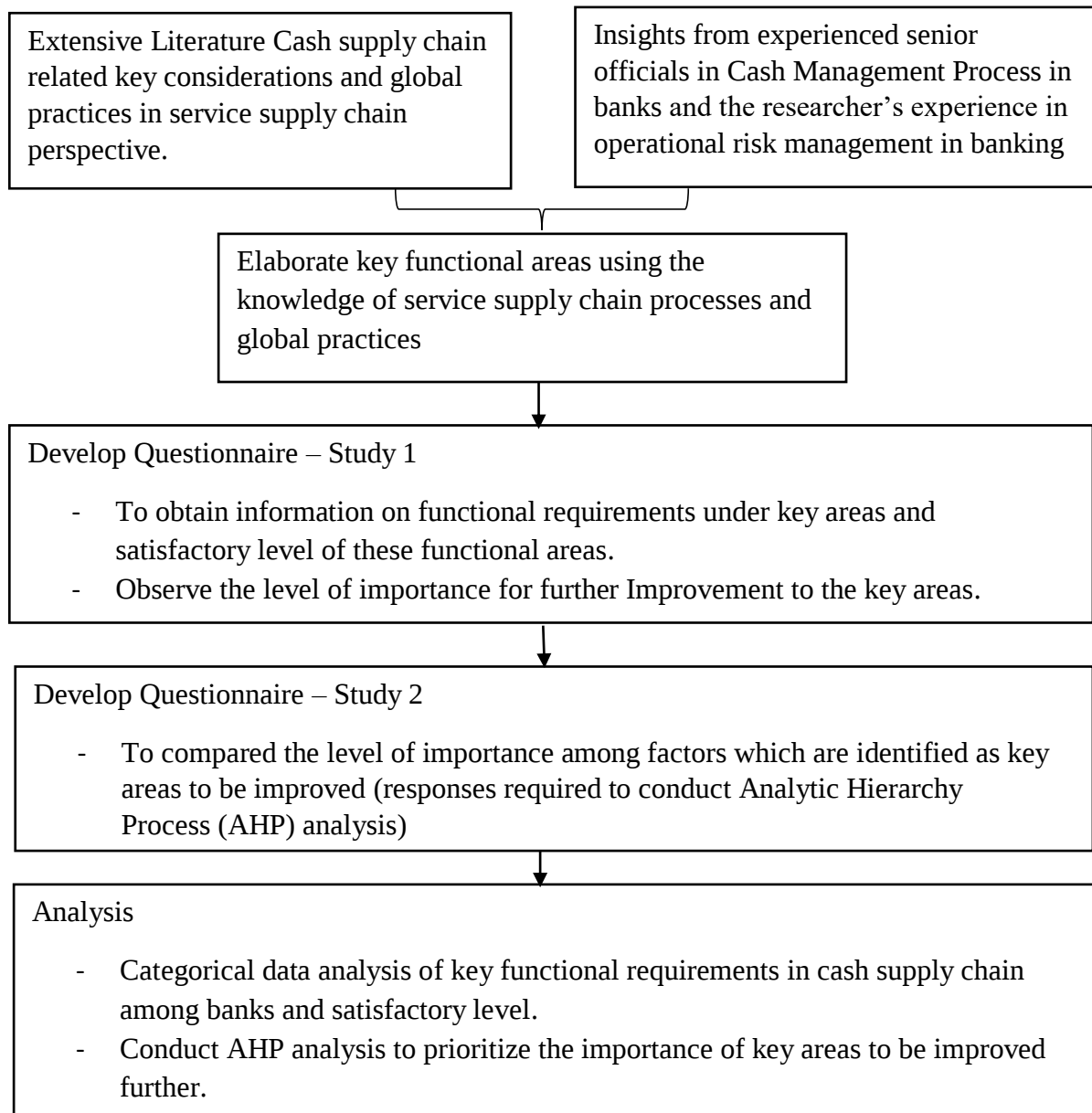


Figure 1-2: Research Methodology

Source: Author's sample

1.6 Scope of the study

The study was limited to cash supply chain management in regard to local currency circulation (LKR bank notes and coins) in banking sector.

1.7 Limitations of the study

Since the sample size of this research was limited to 59, the insights that could be gained from them on the research area were limited.

1.8 Chapter Framework

The Chapter breakdown of the research is as follows;

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Data Analysis and Findings

Chapter 5: Discussion of Findings

Chapter 6: Conclusion and Future Directions

2. LITERATURE REVIEW

2.1 Introduction

This section provides an overview to the research by elaborating the definitions, terminologies, concepts and theories related to cash supply chain management in the banking sector.

2.2 Supply Chain Management

The term supply chain was first publicly introduced by Keith Oliver in a 1982 interview with the Financial Times. Sourcing, procurement logistic related planning and management are main activities of Supply Chain Management (SCM) as per the Council of Supply Chain Management Professionals (CSCMP). Further it includes coordination and collaboration with suppliers, intermediaries, third-party service providers, or customers as channel partners. Thus, it is a concept of extending the business relationships beyond enterprise boundaries considering entire business processes throughout a value chain. With the globalization and the rapid development of information technology, business collaboration and successful integration through out the value chain has become apparent in the recent decades.

Organizations can improve flexibility and competencies by diverting the ownership of sourcing and distribution as productive cross functional approach under Supply chain management. It is common that sourcing and distribution functions are outsourced to minimize cost factor ensuring overall performance in an optimum manner. Costs of daily logistical operations can be reduced by increasing the number of organizations involved to satisfy customer demand. The integration of partners in supply chain is the concept of SCM to improve inventory, velocity and visibility of the movement in a way that trust and collaboration are improved. A successful supply chain integrates individual functions into key supply chain processes focusing collaboration between buyers and suppliers, joint product development, common systems, and shared information. SCM was redefined with the rapid development of service sector. Start-up of service supply chain, supply chain in service industry and after –sale service supply chain are three common themes in the literature taking the services into consideration.

2.3 Service Supply Chain Management

Lin et al. (2009) has defined service supply chain as “a network of suppliers, service providers, customers and other service partners that transfer resources or servitised products delivered to and receive by the customers.” In view of delivering effective service to customer, Service Supply Chain Management is defined as the management of processes, resources and information. According to Lin et al. (2009), the services delivered to customers do not solely refer to pure service products but also refers to servitised products. Cash supply chain can be considered under service supply chain management even though Cash and coins move physically.

2.4 Cash Supply Chain Management

Cash supply chain management can be simply defined as balancing transaction costs and availability of cash to the end user. Cash supply chain management of banks is a cross-functional approach that integrates supply and demand management within and across banks. Cash supply chain includes cash production, cash processing and cash logistics. This involves cash supply, collection, counting, authentication, and storage. In addition this involves the reverse flow of currency as well. For example removal of unfit and counterfeit notes and coins. The process also includes the information systems that are used to coordinate the activities in the cash supply chain. An efficient cash management process must ensure its availability at points of sales at a suitable cost. Any failure or imperfection in the operations can tarnish the reliability of customers towards the bank. At the same time the bank will have to bear high costs that result due to over or under estimated demand.

The main areas of the cash supply chain can be listed as cash production, cash processing and cash logistics. Cash production refers to designing and printing of banknotes and coins. This is done by the Central Bank. Cash processing involves receiving, sorting, storing and dispatch of banknotes and coins. Cash logistics is the process of planning and transporting currency and repairs and maintenance of devices. This is an end to end process where cash and information flow through the chain. Cash flows from Central Bank to the end users and cash returns flow from end users back to the central bank. Similarly, the information also flows in both directions. Figure 2.1 shows cash supply chain in simple manner.

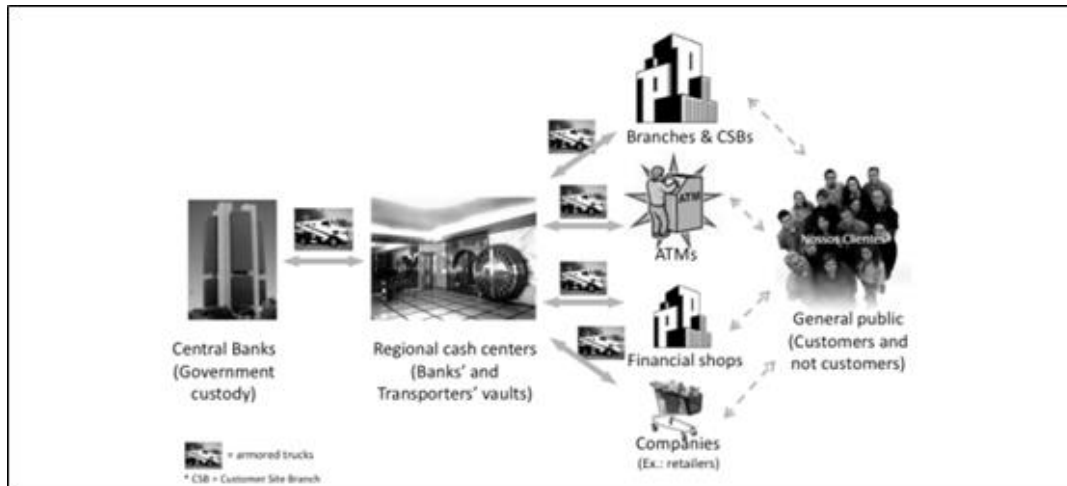


Figure 2-1: Cash supply chain

Source: (Junior & Okino, 2011)

Effectiveness of the cash supply chain can be improved by reducing waste, overhead costs and delivery delays. An effective cash supply chain aligns the bank's business strategies with its vision and objectives. Van Anholt (2014) produced a schematic overview of a cash supply chain which is shown in the figure 2.2.

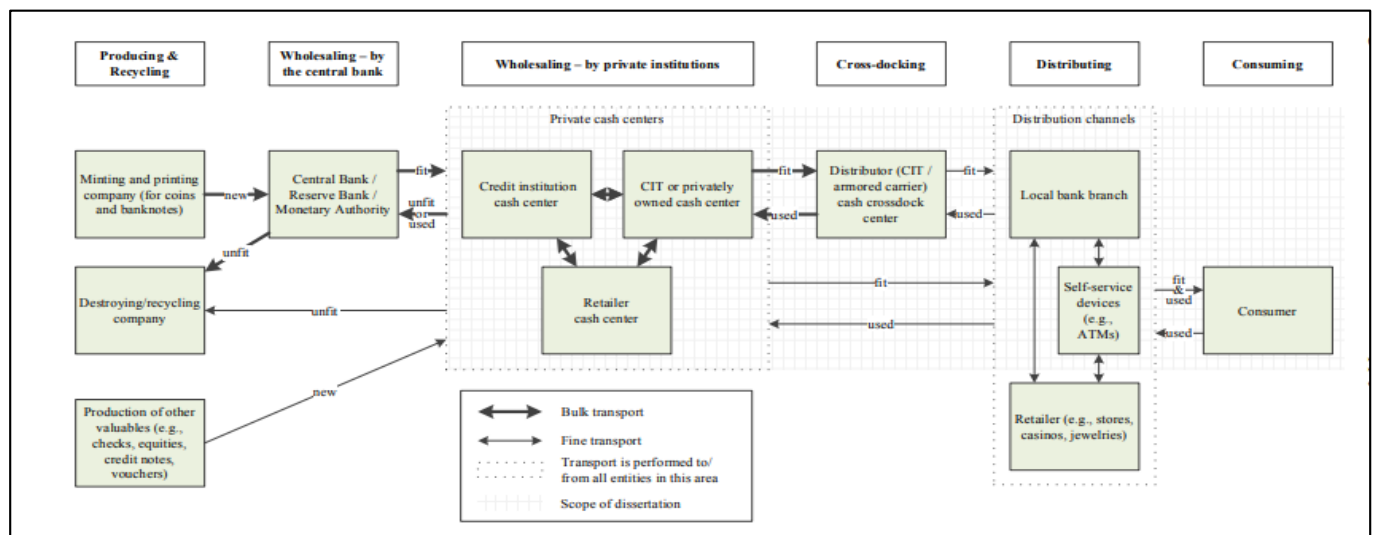


Figure 2-2: Schematic overview of a cash supply chain

Source: Van Anholt(2014, p. 9).

However, only very few studies have been conducted in Sri Lanka in regard to cash supply chain management in the banking sector.

2.5 Banking Sector of Sri Lanka

Licensed Commercial Banks (LCB) and Licensed Special Banks (LSB) are the two service entities in Sri Lankan Banking sector. As at the end of 2020, there were 24 LCBs in Sri Lanka. There were 6703 banking outlets and 5744 ATMs of the LCBs. Total number of LSBs as at the end of 2020 were 6. Total numbers of LSB banking outlets were 703 while 432 ATMs were available. Therefore the total number of bank branches and other outlets available as at the end 2020 was 7406 and the total number of ATMs was 6176 (Central Bank of Sri Lanka, 2020).

2.6 Supply Chain Management in Banking Sector

There are only few types of researches have been carried out in the banking sector of Sri Lanka in regard to supply chain management. Cash supply chain management is one of the significant operations of the banks. Integrated payment methods have increased the accessibility of cash to customers. Due increased number of ATMs Island wide, the volume of daily transactions has increased significantly. The management of these platforms increases the operational cost of the bank. Operational expenses related to cash supply chain includes keeping, counting, transporting and securing of cash. As per the surveys conducted globally, the annual cash handling cost of banks is more than US\$ 300 billion. Therefore it is evident that commercial banks need to have efficient strategies for cash handling. The banks need to reduce costs in the supply chain to improve its productivity. As the supply chain of a bank is highly complex, the costs of maintaining cash supply chain are high. Costs are incurred to maintain equipment and technologies, transport cash to branches and ATMs, etc. Further cash circulation has also increased due to rising demand for cash. As a result, banks have to open more ATMs and contract more agencies to supply cash to customers. Another important feature of banking services supply chain is technology deployment. These features have further increased the cost of cash management.

2.7 Cash Inventory Management

Cash is considered as the inventory in retail banking. Strategies should be implemented for inventory control, handling and processing cost reduction and to enhance efficiency. Inventory management in banks is achieved by controlling cash flows through two methods namely, the threshold method and the cushion method.

In the threshold method, a Bank Transaction Account (BTA) limit is indicated for every customer. The volume of money BTA-MMDA (Money Market Deposit Account) transfers is unrestricted and the cost of such transactions is nil. If the account balance of BTA account goes beyond the BTA limit in a day, a BTA-MMDA transfer is made before the close of business. Threshold values are set to make sure that cash in the BTA is maintained at acceptable levels.

In the cushion method, cash deposits received within a particular month are put in the MMDA account, provided that the monthly BTA-MMDA transfers are maintained below six.

In 2014, Van Anholt presented the following model for cash inventory control.

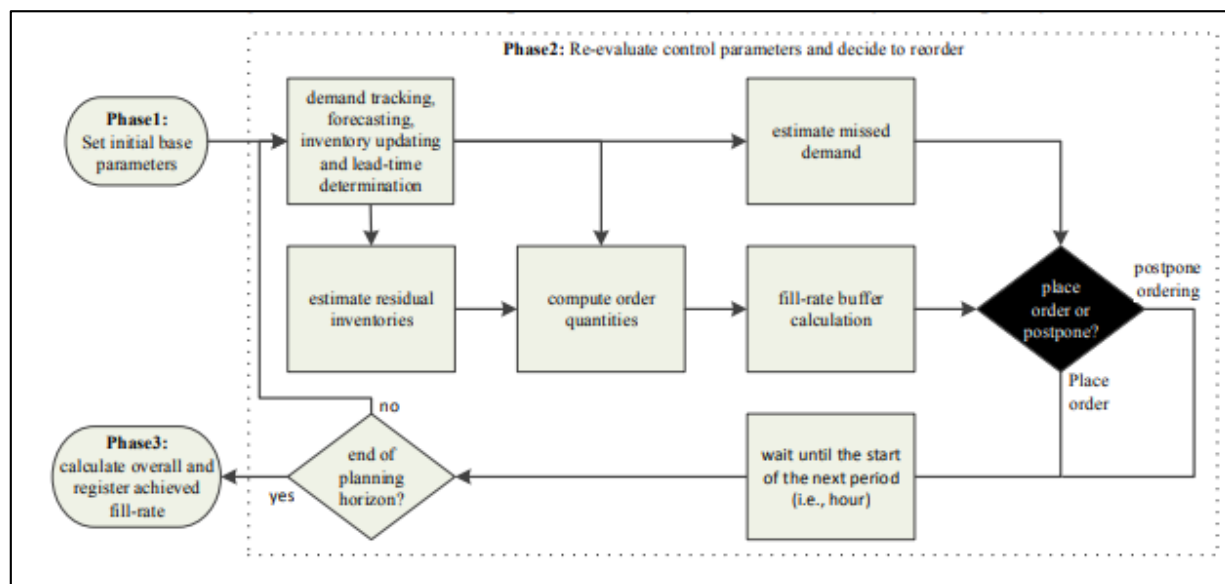


Figure 2-3: Schematic depiction of dynamic inventory control model

Source: Van Anholt(214, p.110).

2.8 Cash Demand Forecasting

Cash demand forecasting plays a significant role for the efficiency of banking operations. Deposit taking institutions such as commercial banks are keen on forecasting the future growth of the deposits. It helps to determine the price of the deposits, for asset and liability management and for capacity consideration. Jarrow and Van Deventer (1998) as cited in Wager (2010) used an arbitrage free methodology for valuing demand deposits and credit card loans. In regard to cash supply chain, several models have been developed in forecasting Cash demand. Cabrero et al.(2009) as

cited in Wager (2010) conducted a study on daily circulation of banknotes of the European Central Bank from liquidity management perspective. The study compared an ARIMA model with structural time series model by taking forecasting accuracy into consideration.. Temporal process of cash withdrawals for individuals was used by Brentnall et al. (2008) as cited in Wager (2010) as a different approach in forecasting the cash demand. As per the interrelated nature of currency demand on a macroeconomic level, a system wide view is required to adopt in cash supply chain management (Wagner, 2010).

Accurate information regarding current cash positions and accurate cash forecasts are vital for managing liquidity. Companies that are good in cash, Accounts Payable management and Accounts Receivable management have greater visibility and control over the elements of liquidity. Some recommendations to improve liquidity management are as follows. Standardize liquidity related processes, automation of processes to reduce approval cycles, continue growing electronic transactions and derive insights from existing data to improve cash forecasts. Effective liquidity management helps to bring down costs and offer opportunities for additional enterprise benefits.

Researchers have developed cash inventory management models in regard to deterministic demand and stochastic demand as well. In these studies principles of inventory theory is applied to cash management. Baumol-Tobin economic model is one of the early works developed for cash management. This was developed independently by Baumol(1952) and Tobin(1956) to determine demand for money. This model assumes demand for cash is happened in constant rate. When presenting transaction and interest costs, optimal “lot sizes” related to risky asset that needs to be converted to cash or the optimal frequency of such conversions is calculated by model. This model was extended by Miller and Orr in 1966. This model assumes the cash demand is stochastic. In 1970, mathematical control theory based model was proposed by Sethi and Thompson to forecast cash demand. As per their studies cash demand is deterministic even though it is constant over time. This study was further extended by Bensoussan et al. in 2009.

Physical cash includes paper currency (Bank notes) and coins. Physical cash plays significant role in the transaction volumes even in countries that use electronic transactions. Cash is circulated in the economy through depository institutions which get cash from Central banks. There are many

studies on circulation of paper currency in different countries. In determining optimal ordering policies for bank notes of Israel's central Bank, a discrete dynamic programming model is developed by Ladany in 1997. Further, inventory model presented by Massoud (2005) was able to determine both the optimal order size and frequency of banknote in minimizing the cost. As per Hatzakis et al. (2010), it is very important to align the thinking as closed loop supply chain concept when considering the movement of physical cash among key nodes (i.e. Public, depository institutions and central banks). Thus, bank notes are re circulated within the cash supply chain as reverse logistic concept. These two movements are interconnected.

2.9 ATMs and queuing

ATM is a cash storage and the factors that determine the loading requirement of the ATMs are as follows. Location of the ATM, income status of the user, day of the week, salary day, being a rainy day and being a holiday are few factors that affect the demand. Compared to the Regression analysis, time series analysis found as better technique in developing forecasting model for ATMs (Perera & Hewage, 2018).

Queuing is a common phenomenon in retail banking. Queuing occurs in counters of the branches where tellers are the servers. This also happens at ATM machines where the machine serves as the server. Queuing can vary in different environments. The factors that affect the waiting lines depend on the information available to customers and service systems eventually supported by the number of servers which depend on the demand. Accordingly, number of tellers can be adjusted to meet the customer demand. In contrast, the number of ATMs cannot be adjusted based on customer demand as it is a fixed number. In both environments the banks need to develop priority systems to make sure that valuable customers' waiting time is short. In 1984 Kolesar analysed a branch with two ATM machines. He collected the data related to arrival time of the customers and service time. As unlike customer service times and machine idle times, queue lengths and customer waiting times are unable to collect through ATMs, Larson (1990) developed a queue inference engine which was able to estimate the expected waiting times of customers.

2.10 Reverse logistics

Reverse logistics is an important facet of the cash supply chain. Reasons for reverse logistics are to remove unfit bank notes, to store and to stop non interest earning bank notes from accounting

perspective and send them to the central bank. In China, the excess cash beyond the cash quota of the bank is required to return to the People's Bank of China (Smith, 2010). However not all the returned currency is unfit and it is not destroyed. This indicates that the Central Bank is subsidizing the storage and operations of notes and coins sorting and re issuing. As per the Geismar et. al (2007), this process has outsourced and removed from core process of commercial banks in USA and Australia and it ensures that no large volumes of currency will not be returned for sorting and they charge a fee to provide the service South Africa has privatized the reverse flow of the cash movement (Rajmani et.al.,2006). The amount of unfit currency destroyed each year is 30% higher than that of the previous year as large volume of currency is required to sort the amount of unfit (Smith, 2010). Thus an average life of a currency is only three years. Cleaning and destruction of bank notes are two challenges of reverse logistics in currency supply chain. Another reason for unfit notes is due to counterfeits. This occurs specially for high denominations. In addition notes can carry germs and fungus can grow on currency.

2.11 Currency Management and Distribution

The cash supply chain network of China consists of China Banknote Printing and Minting (CBPM), PBOC, secure transportation organizations, commercial banks and bank customers. Bank notes and coins are forwarded to the central vault of the treasury first at national level. Then currency are forwarded to sub vaults of the treasury at the provincial level. Afterwards they are sent to central branch vaults at the city level. Finally they are sent to branch vaults at the country level and finally to the vaults of the commercial banks. Ultimately the bank notes and coins are distributed to the public through financial transactions (Smith,2010).

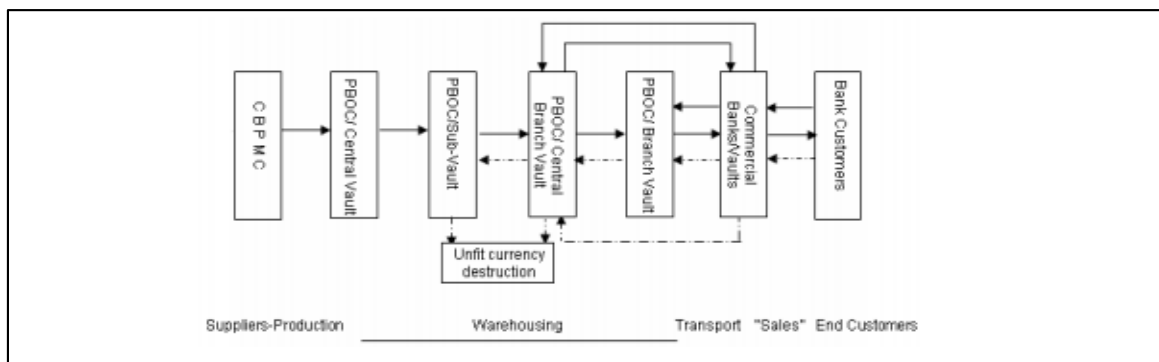


Figure 2-4: Basic Structure of RMB Supply Chain

Source: Smith(2010, p.7).

2.12 Transport and storage

Security of the currency transportation is the responsibility of the lower level recipients. It is identified that there is a significant increase in currency theft and robberies. Accordingly, security of transporting, storing has become as an important requirement.

2.13 Cash Supply Chain Management: Bank's cost factor

Demand of the customers for cash is the crucial factor to cash circulation in the economy. Holding the sufficient cash inventory level is a dilemma for banks. The banks need to hold an adequate amount of cash to meet the customers' demand at all time. At the same time, banks want to minimise the cash inventory level as holding cash is a cost of lost opportunity. The cost of cash circulation throughout the chain should be reduced to ensure cost effectiveness of the cash supply chain (Rajmani et al.,2006).

Banks need to bear costs in different stages of the cash supply chain. The bank incurs cost for transporting cash to branches or ATM and transporting cost is calculated based on the number of bundles of bills multiplied by distance travelled. Cost incurred on sorting cash by denomination, sorting unfit cash for ATM operations is computed per bundle. In Transit inventory is another cost the bank needs to bear in transit cost is calculated by multiplying the number of bundles in transit on a given day by the cost of funds. Cost of funds is an opportunity cost (Rajmani et al., 2006). The cost of holding bank's vault inventory is calculated by multiplying the number of bundles in the vault at the end of the day by the cost of funds.

2.14 Supply Chain Management Strategies

To quantify the benefits of optimal inventory levels, the following strategies can be implemented. Competitive sourcing contracts, rationalizing the supplier base, streamlining cash handling and vault management processes, and optimizing the ATM network and routing processes. Following supply chain practices focus to improve cash supply chain in retails banks in line with the generic supply chain practices in consumer business ("Optimizing the retail bank supply chain," 2014)

Statistical forecasting is used forecasting technique in demand planning to determine cash depletions out of branches and ATMs with the time. In leveraging the customer service levels targeted, it is required to determine the cash requirement of vaults, branches and ATMs. Hence,

multi echelon inventory planning should be implemented. In determining cash replenishment cycles which would minimise transportation costs and cost of carrying cash Economic Order Quantities should be used. Cash distribution between vault to branches and ATMS needs to be planned according to the supply plan which decided based on the forecasted cash levels.

In managing the supply, non-critical processing services can be outsourced to external service providers by the Bank. To manage the demand they can evaluate use of ATM deposit imaging. With regard to currency processing equipment, supply management strategies include consolidating suppliers through a competitive sourcing process, supplier management in central manner and, performance management related to all equipment and service contracts. As a demand management strategy, banks should standardize on fewer equipment specifications.

When deploying ATMs, the cost of capital is a decisive factor in the decision to buy or lease. Also banks need to analyse lifecycle cost to decide ATM replacement period in an optimum manner. Consolidate ATM maintenance to one enterprise wide supplier. Establish suppliers through a competitive source process for armed courier services in cash transportation and distribution. Thereby, establish a primary supplier within each major geographical location. For demand management, standardise service level for deliveries, to and from ATMs and branches for replenishment. Also advanced ATMs can be installed which can recycle cash deposited by customers and use the same money for withdrawals. This will reduce the deliveries to ATM for replenishment.

Logistic planning through outsourced cash management companies and optimizing network are two main areas to be focused by banks in reducing delivery and maintenance costs. For example, cash management service with 2,577 of ATMs including cash deposit and dispense belonged to TD Canada Trust is outsourced to G4S ("Optimizing the retail bank supply chain," 2014).

As per the Júnior (et al., 2011), following supply chain practices can be considered to improve the performances of cash supply chain.

Use shared vaults and reduce the number of banks, transporters and custodian vaults located in the same area by having the players share vaults. Improve demand information alignment between the

banks and transporter. This involves improving cash transporter-bank communications, which will reduce distribution, transportation and processing efforts.

By letting the players share vaults, the number of banks, transporters and custodian vaults in the same location can be reduced. It is important to improve alignment of demand information between banks and transporters. This entails developing connections between cash transporters and banks, which will minimize the effort of distribution, transit, and processing. This will streamline distribution of cash inventories throughout the supply chain. IT systems need to be integrated. The hiring and management of cash transportation, custody, and processing services should be based on indicators. Collaborative planning, forecasting, and replenishment should all be implemented. Also cross-docking should be used. There is opportunity for transportation optimization, which can be accomplished through the use of the cross-docking. Lean Methodology can be applied. In order to reduce losses caused by reprocessing of cash transfers between entities (i.e. bank to bank and bank to custodian), this method tries to redesign the process flow in productive manner. Further, transportation can be optimized using improved configuration of chain framework.

2.15 Reference Models for Analysis of Cash Supply Chain

From a supply chain perspective, Supply Chain Operations Reference Model (SCOR) is a generally recommended model that can be used to analyze the cash supply chain. Supports the decision-making process by simplifying the supply chain framework, which is inherently complex (Huan, Sheoran & Wang, 2004). SCOR model combines industry best practices and the bank's vision with the business processes. Information technology is used to foster communication between the players in the supply chain. Thus, the management efficiency associated with the supply chain is improved (SCC, 2010a). The model provides cross-industry processes to benchmark activities related to supply chain such as plan, source, make, deliver and return which need to be considered in all nodes in the chain. Further, these processes are interrelated. (LAI, NGAI and CHENG, 2002) Figure 2.2 illustrates the structure of the SCOR model.



Figure 2-5: The SCOR model structure

Source: SCC (2010b).

Service supply chain management models were presented by Lambert et al. (1997) and García-Dastugue et al. (2001) as cited in Lin et al.(2010) combined the service supply chain models presented by Ellram, Tate et al.(2004) and Johnson and Mena (2008). Lin et al. (2009) established a service supply chain management process model based on the above mentioned literature and traditional supply chain models. They proposed 10 key processes for service supply chain management as shown below in figure 2.3.

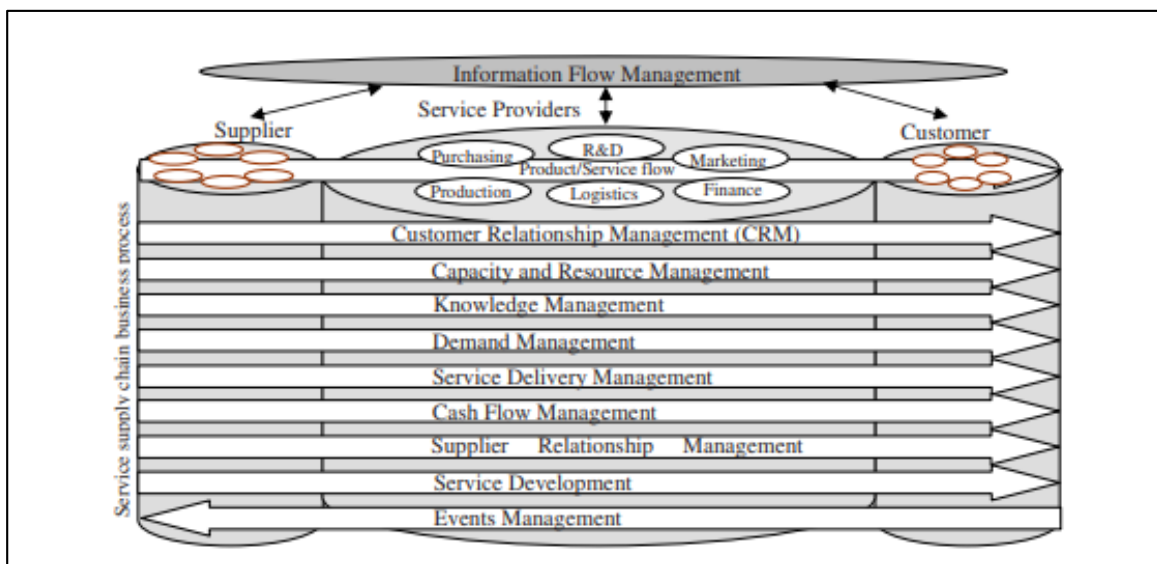


Figure 2-6: Service supply chain process structure

Source: Lin et al.(2010, p.10).

2.16 Sustainable Banking

Sustainable banking can be broadly defined as integrating environmental, social and governance criteria into the decision making processes and activities of the bank, aiming at long term benefits to the bank, its clients and the people at large. In 2016, CBSL joined the International Finance Corporation (IFC) supported Sustainable Banking Network. (SBN). In 2017, CBSL initiated a process to develop a road map for sustainable finance in Sri Lanka and this was launched in June 2019. “This Roadmap provides a broader direction to financial regulators and financial institutions to effectively manage ESG risks associated with projects they finance and promote assistance to businesses that are greener, climate-friendly and socially inclusive” (Central Bank of Sri Lanka, 2020).

Ceilings on credit extension to certain carbon intensive or polluting activities, framework and guidelines on green finance, consideration of climate changes and impacts for stress testing, climate related and green financing risks related disclosures, green credit policy instruments, and green differentiated reserve requirements are being considered as regulatory toolkits available for the regulators on sustainable finance (Central Bank of Sri Lanka, 2020).

A framework for sustainable service supply chain practices has been introduced by Aliakbari et.al in 2020. This is illustrated below.

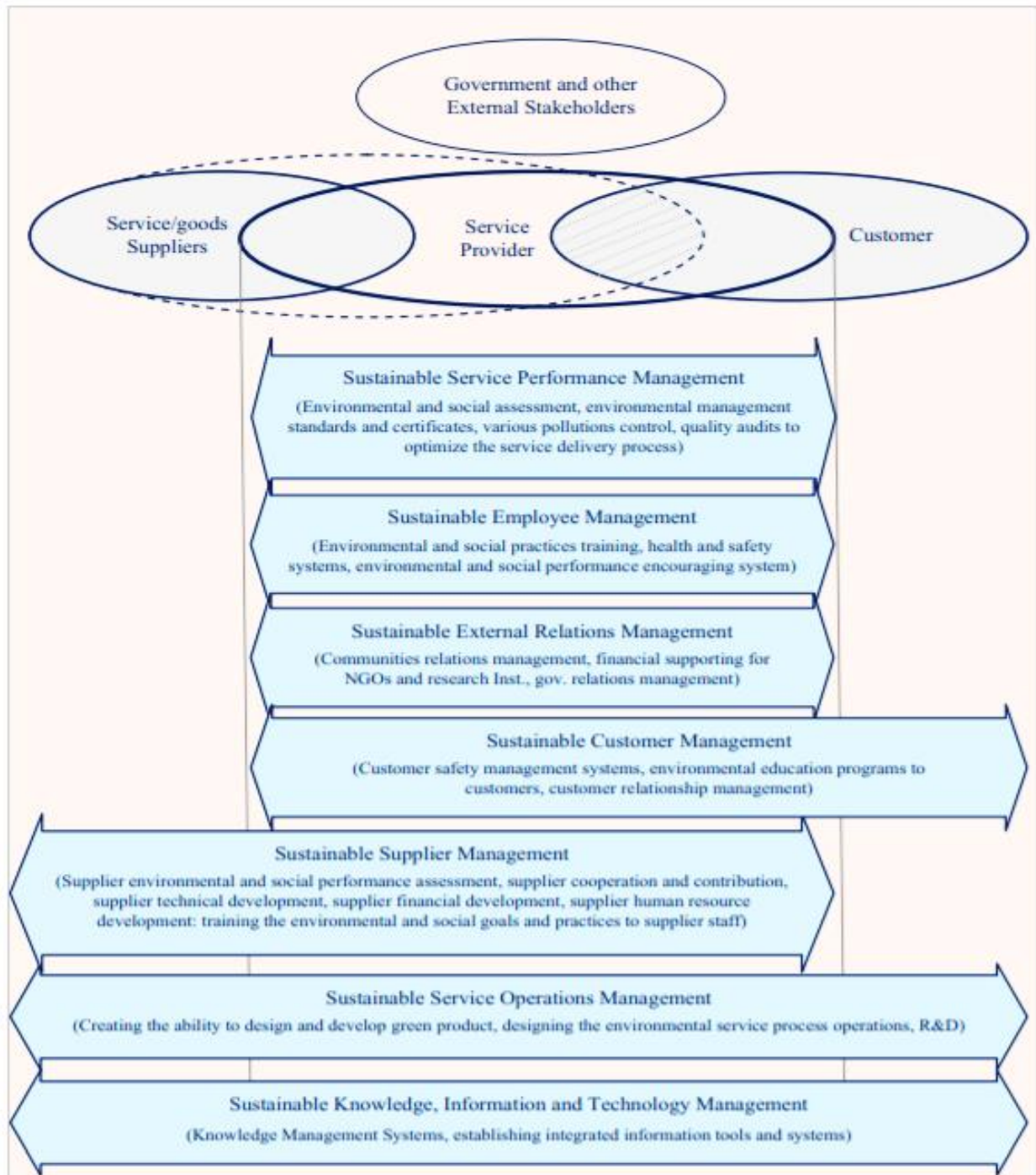


Figure 2-7: Sustainable service supply chain

Source: Alikabari et al. (2020, P.12)

2.17 Statistical Analysis Methods

2.17.1 Inference for Categorical Data

This refers investigating single parameter mainly the proportion of “successes”, relationship between two or more categorical variables and comparing two parameters.

Statistical test of normality

In general when sample sizes are large, it is robust to use parametric statistics even under nonnormality nature of variables. Hence, one of common tests for normality is the Kolmogorov-Smirnov test which has the null hypothesis that a set of data comes from a Normal distribution.

Even though the test reveals that variable is statistically different from a normal distribution, researcher should avoid over-interpreting the findings using background of the research data and research area.

The number of observations has a considerable influence on significance of the test results. Accordingly, only a minor deviation from normality will be considered significant for very large sample sizes, while very high deviations will be necessary to reject the null hypothesis for small sample sizes.

Mann-Whitney test

For small samples of non-normal data or ordinal dependent variables, non-parametric statistics like the Mann-Whitney are commonly utilized.

This test is used to determine whether the distribution of a variable differs between the two groups known that variable is in continuous level and cannot be assumed the normality in both groups.

It can also be used to compare two groups of an ordered categorical variable. It's the non-parametric version of the independent-samples t-test, except instead of looking for variations in the mean, it looks for differences in the general distribution across groups. The test does not make any assumptions about the distribution of the variable in either group.

Confidence Intervals population Proportion

Sample proportion $\hat{p}$ is defined as a ratio of number of successes according to the given interest against the sample size. It is an estimate to population proportion (p) which follows a binomial distribution with mean p and variance $(p(1-p))/n$. For large sample sizes, binomial distribution can be approximated to normal and it enables to use standard normal statistic (Z) in testing of significance and confidence intervals for sample proportion.

Confidence interval for population proportion can be estimated using estimated standard deviation by replacing unknown population proportion from sample proportion.

$$\text{Standard error} = \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

Based on approximation of normal distribution, Confidence interval for p is $\hat{p} \pm z \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$
Under 95% confidence level z is critical value related to $(100\%-95\%)/2$ of standard normal distribution.

Hypothesis test for population proportion for the value of interest

Null hypothesis (H_0) is the population proportion p is equal to the value of interest (p_0) against following possible alternative hypotheses (H_a):

$P(Z > z)$ for $H_a: p > p_0$

$P(Z < z)$ for $H_a: p < p_0$

$2P(Z > |z|)$ for $H_a: p \neq p_0$.

Test statistic;

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1 - p_0)}{n}}}$$

Two-Way Tables and the Chi-Square Test

Two way tables namely contingency tables are used in categorical data analysis and it provide base for statistical inference specially the relationship between variables in categorical mode. The association between the row and column variables in a contingency table can be tested using the chi-square test.

Null hypothesis (H₀) is ‘there is no association between the variables’ and the alternative hypothesis (H_a) is ‘there is some association between variables’. It is necessary to interpret the association based on data, as hypothesis test does not mean the type of association rather than examining the significance of a relationship.

Chi-square test statistic

$$\chi^2 = \sum \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$$

Test statistic has a chi-square distribution with (r-1)(c-1) degrees of freedom, where r and c represent the number of rows and columns in the two-way table respectively. It is a general norm to have expected value of more than 5 for each cells in the two way table.

2.17.2 Analytical Hierarchy Process

The Analytic Hierarchy Process (AHP), a mathematical model was proposed by Saaty (1977) that helps the decision makers arrive at the most logical choice, based on their preferences. Using the AHP, we first determine the options available to the decision makers and their goals in making decisions. These goals and options will then be used to construct an analytic hierarchy, which reflects the various factors in the decision-making process and their importance. The outcome of the AHP is a priority vector, which gives us an insight into the best option for the decision makers.

As cited by Singer & Ozahin (2018), following are the four steps of AHP. The initial step, Multi-Criteria Decision-Making (MCDM) problem is decomposed into sub problems by creating decision elements hierarchically. Main goal is stated at apex level while defining the goal related main and sub criteria which are used to evaluate alternative at lower level as per the Aragonés-Beltrán et al.(2014). Secondly, criteria and alternatives are evaluated as pairwise comparison based on a standardized nine-point scale. Albayrak and Erensal (2004) show that decision elements are

priorities within each elements relatively at this stage. In the third stage, consistency is checked using consistency index (CI) and consistency ratio (CR) for each criterion that found based on maximized eigenvalue as cited in Lee et al. (2012).

$$CR = \frac{CI}{RC}$$

RC stands for Random consistency index and can be obtained using following table.

n	3	4	5	6	7	8	9	10	11	12	13	14	15
RCI	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

CI value is calculated as follows.

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

$\lambda_{\max}$ is the maximum eigenvalue of the matrix and n is the matrix size ($n \times n$). Singer & Ozahin (2018) cited that the comparisons are accepted only for CR value is equal to or less than 0.10 and it is required to repeat the procedure until each comparison meet this requirement according to the Abdollahzadeh et al. (2016). Weights for evaluation matrix are determined though the normalization process as the last step in this mathematical model.

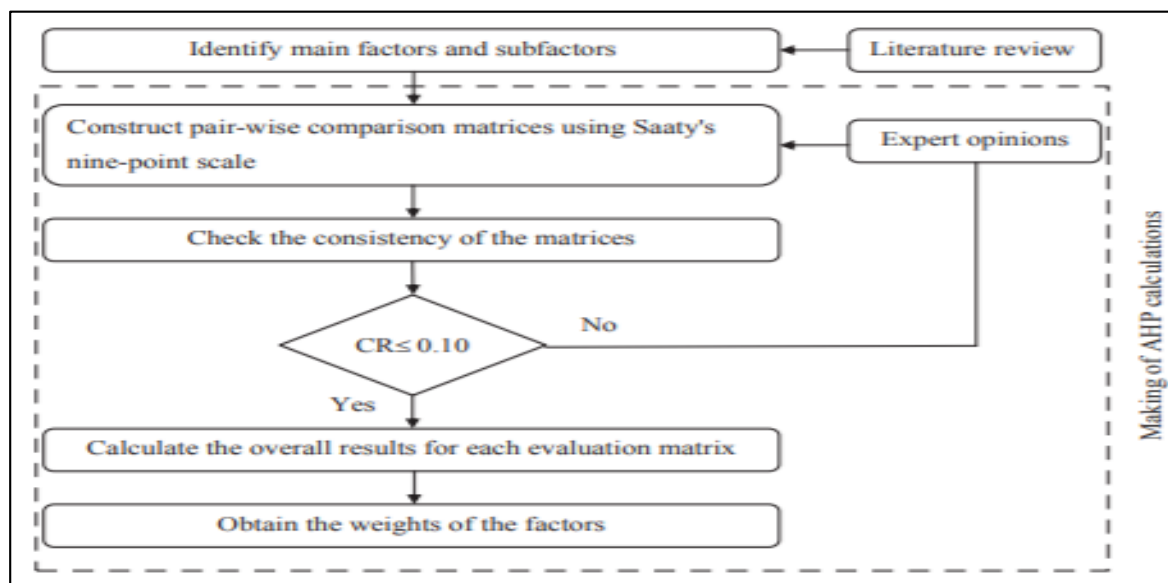


Figure 2-8: AHP Method

Source: Singer & Ozahin (2018, p. 368)

3. METHODOLOGY

3.1 Introduction

An extensive literature survey has been carried out to identify and examine key processes in service supply chain management and global practices in cash supply chain management. Insights relating to functional requirements related to cash management process of banking sector were identified based on the informal discussions had with experienced officials and the working experience of the researcher in operational risk management in banking. The explained research methodology can be graphically represented as below. It represents all three objectives and the path to reach the final solution for the research problem.

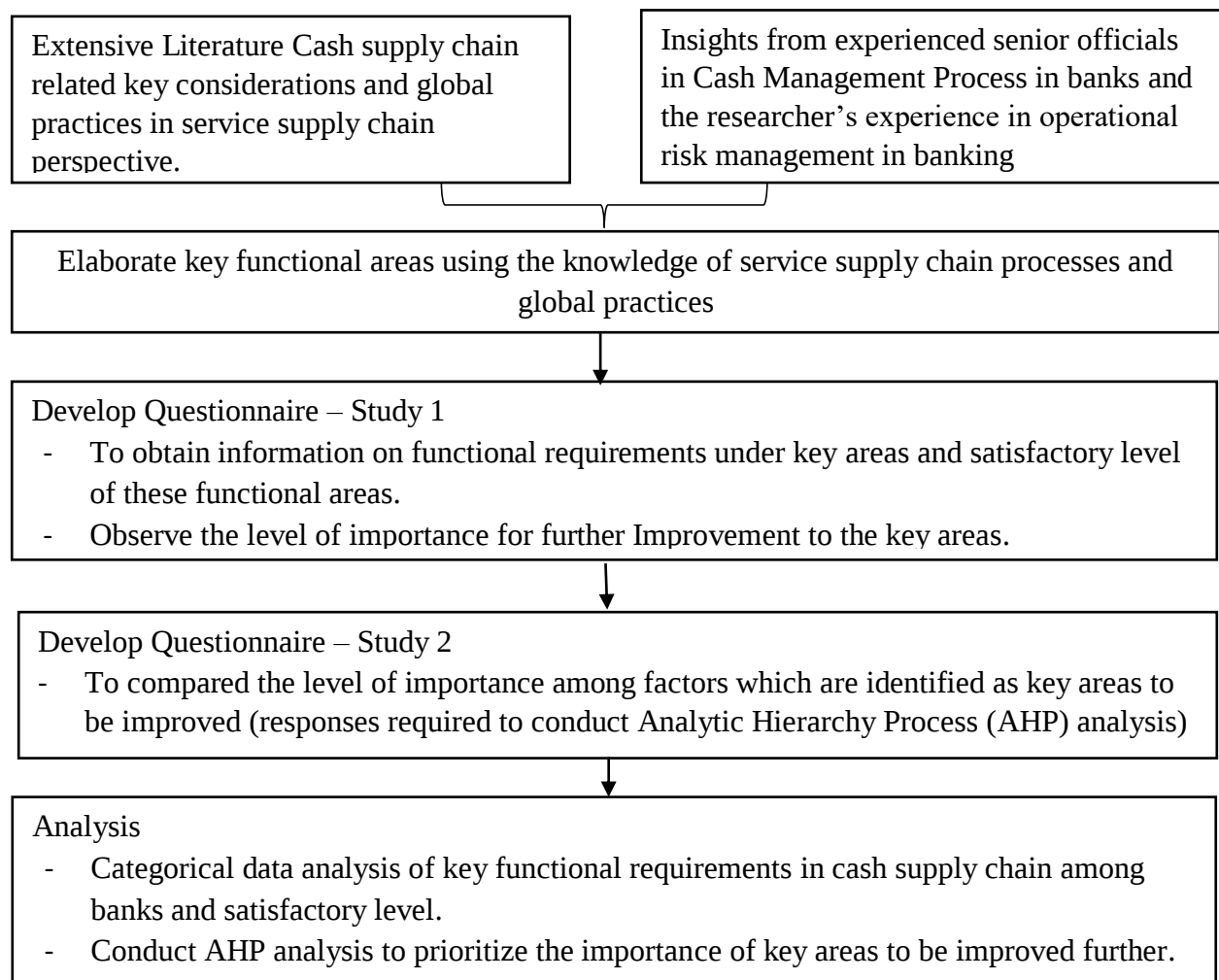


Figure 3-1: Research Methodology

Source: Author's sample

3.2 Participants and Procedures

The Unit of analysis of this study is banks in Sri Lanka representing both government and private banks which are regulated under Central Bank of Sri Lanka. There are 24 Licensed Commercial Banks and 6 Licensed Specialized Banks as of as of 31st March 2021. Based on the area focused in the study, banks with branch network are considered. Since the banks are subject to similar regulatory requirements in regard to cash management process, banks which maintain branch network can be considered as a homogeneous group.

Study 1 followed the survey research strategy where data was collected using structured, self-administered questionnaire which included the functional requirements under key areas in cash management with respect to branch/bank perspective under the service supply chain concepts. The study 1 questions create a general understanding of salient areas to be focused under each key functional area based on the knowledge gained from literature review and the opinions of the experts on the industry best practices and procedures. The awareness provided as requirements under key functional areas would be helpful to provide respondents' opinions on the level of importance to further improvement of those factors. As the study focuses on the satisfactory level to represent the decision makers' perspective, the questionnaires were only distributed among the branch managers of banks. Being a branch manager of a bank, it is assumed that all necessary banking business related key learnings including cash management are met by them as professionals. 160 questionnaires were emailed to 10 branch managers. The names of the banks are Bank of Ceylon, National Savings Bank, Peoples Bank, Sanasa Development Bank, State Mortgage & Investment Bank, Commercial Bank, Hatton National Bank, Sampath Bank, DFCC Bank, National Development Bank, Nations Trust Bank, Seylan Bank, Standard Chartered Bank, The Hongkong & Shanghai Banking Corporation Ltd (HSBC), Pan Asia Banking Corporation, Amana Bank. These banks were selected to represent both government and private banks in Sri Lanka.

The questionnaire was prepared as a Google form as it is easy to collect data electronically under the Covid-19 pandemic situation. The researcher did not configure the automatic settings to capture e-mail of respondents which is a facility of google form and the naming of the bank is an option in the study 1 questionnaire. Mentioning whether the bank is government or private is a compulsory requirement as the researcher has an interest of comparing the overall satisfactory

level and the practices among those two categories which is a known argument as government management practices are different from private management practices.

Study 2 was focused to collect the data for Analytic hierarchy process (AHP) to prioritize the importance of key areas to be improved further. After collecting the data from study 1 questionnaire, key factors to be improved were identified and requested to compare as pairs. In the Study 2, 15 questionnaires (2 per each bank) were e-mailed to most experienced branch managers whose email addresses were mentioned in study 1 questionnaire.

There were 25 and 34 respondents for study 1 questionnaire from government banks and private banks respectively. Study 2 questionnaire was sent to 15 branch managers and out of which 10 responded.

3.3 Variables

Network, Technology and Information management, Customer Relationship Management, Supplier Relationship Management, Demand Management, Capacity and Resource Management, Knowledge Management, Service Delivery Management, Financial Flow Management, Service Development and Innovation, Performances and Event Management are the 10 key processes proposed by Lin et al in 2010 for service supply chain management. In view of the branch manager/bank perspective, the study focused key functional areas in cash supply chain to align the aforesaid processes for significant coverage in service supply chain management.

3.3.1 Information Systems

Information flow is a main flow of traditional supply chain models. As service is more information intensive today, service performance and quality are largely dependent on the usage of information technology in sharing information. Therefore, Information Sharing is considered as a key area which is backed by deployment of technologies to manage the real time information for greater integrity and transparency. With regard to the cash supply chain, timely sharing of information for better liquidity management is a main requirement. Thus, branches need information Systems to take more effective decisions relating End of the Day (EOD) cash excess and shortage and synchronization of this information with Asset and Liability Management (ALM) function of the

bank. Sometime information sharing with supply chain partners, e.g. suppliers of cash logistic function (if outsourced) can be a key element of supplier relationship management.

3.3.2 Service Point capacity

This focused on the resources covering both tangible and intangible components which are of critical importance for the effective operation of the cash supply chain. Hence, vault capacity, ATMs/CRM allocation and adequacy of competent staff at service points are considered.

3.3.3 Liquidity Management

In the study, financial flow is considered as the main flow of the cash supply chain. Key elements such as managing payment and other invoicing activities throughout the other operational processes were not separately considered. This is because, when responding to the questionnaire as a respondent on key functional area, those elements were considered inevitably. Thus, liquidity management is the key functional area to be focused in the cash supply chain and management oversight that ensures overall cash flow under ALM functions, branch cash position management and demand forecasting systems were considered. Since the Asset and liability management is a key specialized area which involves strategic financial management, this can be considered as one of the areas highly focused on knowledge management concept in cash supply chain in the bank's perspective.

3.3.4 Insurance

As an industry best practice, banks have obtained insurance policies as a risk mitigation strategy to cover the financial loss that can be occurred to its vault and ATM/CRM cash as a result of natural disasters, fraud and manmade disruptive events. Higher the amount maintained in the form of cash at branches or ATMs would lead for a higher insurance premium. However, the insurance limit should not lead to intolerable operational deficiencies such as maintaining very low insurance limits against daily business volumes without considering weekend withdrawal behaviors, seasonal behaviors, pandemic behaviors etc. This can be considered as a management requirement to meet customers' current requirements as a service development.

3.3.5 Cash Inventory Management

With the available information, branch managers effectively replenish cash vault and ATMs in a timely manner. Reorder level is a key concept in inventory management under the supply chain management concept. In Sri Lankan context, mainly cognitive approach is applied based on recent past and near future cash flow management which has no scientific approach and mostly known as unoptimized cash flow management approach.

3.3.6 Compliance

Under the concept of service delivery management, compiling to prevailing regulatory requirements related to cash supply chain is a mandatory function to be met by the banks. It ensures the reputation of cash supply chain which guarantees a sustainable business under the responsibility of ethical business engagement. Thus, implementation of AML/CDD policies procedures was considered.

3.3.7 Physical Security

Under the concept of service delivery, cash supply chain requires utmost physical security to protect the physical cash flowing through the process at various supply chain nodes such as service points, counters, fixed ATMs/CRMs, cash distribution centers and cash in transits. However, the physical security of cash in transit is a requirement related to cash distribution which evolved as a specific security requirement other than physical security of the premises.

3.3.8 Distribution

Distribution function in cash supply chain plays a vital role. It includes distribution administration, transportation, warehousing and security in cash in transit. In supply chain this function mainly considered as logistic function, one of the most developed areas with effective inventory management and distribution channel optimization. Therefore, this key area can be considered under both Service Delivery management process and Capacity and resource management processes. Nature of the transportation service, Cash in Transit (CIT) security service, distribution administration and distribution centers were considered.

3.3.9 Value Added Services

Cash sorting, cash bundling and packing as per the denomination requirements are common value added services in cash supply chain. As a part of reverse logistic in cash supply chain, processing of unfit cash is also a value added service. The requirement for frequent cash disinfection and cleaning appears as mandatory safety measures in cash supply chain with the spread of Covid-19 pandemic. ATMs specially located in remote areas are separately handled by the cash logistic function. These services improve the quality in service delivery of cash supply chain.

3.3.10 Service Point Monitoring

In ensuring the uninterrupted service delivery, it is required to establish ATM/CRM monitoring function to timely communicate the authorized parties to avoid unmercenary operational delays which could cause reputational risk.

3.3.11 Maintenance

Physical assets used in the cash supply chain are required to reduce the possibility of service disruptions and system failures due to maintenance issues. As a part of service delivery management, preventive maintenance of machineries, power sources and IT infrastructure were considered.

3.3.12 Information Security

With regard to confidentiality, availability and integrity in managing the information, information security measures can be considered as a part of both information management flows. Thus, salient information security controls covering staff, customers and third party were considered from the banks' perspective. Third parties abided to banks' information security policies enable trusted business engagement in supplier management. (e.g. password protected Information systems, available for authorized users, restricted functions and authorized user on need to know basis, access controls such as two factor authentication where it is necessary, information security policies-including Acceptable use policy, controls for information sharing storing printing, information classification as critical information etc., frequent system user reviews, timely system user activation and deactivation, review and monitoring of system access privileges, system audit trails/logs, incident reporting mechanism). Further adhering to the international standards in

information security such as ISO 27001, Information Security Management System (ISMS) and Payment Card Industry Data Security Standard (PCI-DSS).

3.3.13 Customer & Supplier Interactions

As a part of event management process and service delivery management, well set procedures and systems should be in place for effective communication in improving the customer relationship. These procedures are set to make timely response to customer complaints, other emergencies and risks. Thus, bank wide common mechanisms such as customer chatter, call center, whistle blowing procedure were considered. Further, banks should communicate requirements of prior notification for bulk cash outflows, security controls and procedures set out for outsourced partners through Service Level Agreements and other acknowledgments such as Non-disclosure Agreements, ATM/CRM operational instructions, service and security notification, SMS alert as elements to service delivery, knowledge management and supplier relationship management processes.

3.3.14 Business Continuity Arrangements

The requirement for the business continuity arrangement has emerged than ever during the pandemic with area wide, country wide lockdowns. Due to travel restrictions imposed and the limiting of staff capacity, cash supply chain was directly affected. Delays in Cash distribution and cash replenishment to remote branches, attending to disrupted ATM services for rectification, limited support services, monitoring functions due to staff restrictions, security threats and issues in enabling serving delivery channels relating to cash supply chain such as mobile ATMs are evident during the pandemic. Thus, business continuity arrangement provided by the bank and outsourced service providers in security or cash logistic functions were considered.

3.3.15 Ecological Factor

In regard to sustainable supply chain management, ecological factor is common to any supply chain as a one of the triple bottom lines of sustainability. The improvements to embed the ecological factor into cash supply chain can be considered under service development and innovation process. However, the common methods of improving ecological factors in cash supply chain were considered.

3.4 Measurement Scales

Dichotomous questions are used for a clear distinction of qualities, experiences, or respondent's opinions. In the survey questionnaire, there were questions that ask for a Yes/No, True/False, and Satisfied/Unsatisfied.

There are many types of rating scales developed to measure person's attitude on the given opinion. The most widely used is the Likert scale. It assumes that the strength/intensity of an attitude is linear. Five point scales is used to allow the respondent to express how much they agree or disagree (i.e. Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) with a particular statements. Likert scale with nine points varying from 'Extremely unimportant' to 'Extremely important', were used to obtain the level of importance for further improvement of Key functional area. In pair wise comparison of significant functional areas under AHP, 9 point scales in Table 3.1 was used.

Table 3-1: Scale of importance level for pair wise comparison

Preference factor	Degree of preference	Explanation
1	Equally important	both key functional areas are equally important for further improvement
3	Slightly important	Judgment slightly favor towards one key functional area when considering the importance for further improvement
5	Important	One key functional area is important than other when considering the importance for further improvement
7	Very Important	One key functional area is very important than other when considering the importance for further improvement
9	Extremely Important	One key functional area is extremely important than other when considering the importance for further improvement

Source: Done by the author

Also open ended questions were included to obtain information on the current practices which is unknown to the researcher. Therefore, mostly the research data used in the analysis is categorical data in ordinal scale.

3.5 Statistical Analysis

Descriptive analysis covers with contingency tables to discuss the categorical data obtained through the questionnaire. Inferential statistics were used to compare the satisfactory level of cash management between government banks and private banks.

As there is general perception that there is a different in implementing strategies or their execution due to the difference of management styles which impact decision making process, investment on technology . Therefore researcher in view of checking the level of satisfactory between two groups for each key elements which are common to cash supply chain. A comparison of the mean of the distribution of the elements of key processes/functions (variables) related to Cash Supply chain in between Bank types was desired. Under the behavior of non-normality of variable distributions, it is robust to apply parametric statistics for very large sample sizes. Since the sample is not very large and distributions of responses related to satisfactory level seems to be skewed as per the percentiles of each variables (key elements), Kolmogorov-Smirnov test was conducted as hypothesis testing to check normal distribution. Since the results show that variables are not normally distributed, researcher decided to conduct Mann -Whitney U Test which is a non-parametric test to check the significance of difference in satisfactory level between two groups instead of comparing mean score of two groups using independent sample t-test.

Overall satisfactory level of cash supply chain management is tested for specific research interests as statistical inferences. The Analytic Hierarchy Process (AHP) was conducted to prioritize the identified significant functional areas that to be further improved as strategies in road map of the cash supply chain management in Sri Lanka.

4 DATA ANALYSIS AND FINDINGS

4.1 Introduction

As per the research objectives in the study following approaches were made to analyze data. Cross-tabulations were created to summarize the observed frequencies of categorical outcomes to compare cash supply chain management practices among government and private banks. Research questions related to overall satisfaction of cash supply chain management practices, i.e. ‘Is the satisfaction of cash supply chain management different between government banks and private banks?’, ‘Are more than 50% of branch managers satisfied with current cash supply chain?’ are statistically tested as statistical hypothesis testing using SPSS software. Finally, the most important functional areas that to be further improved in cash supply chain management of Sri Lanka is derived through a mathematical model called the Analytic Hierarchy Process (AHP) using Microsoft Excel.

4.2 Sample Profile

The sample consists of 34 private banks and 25 government banks. The majority of the respondents were by private banks which is 58% while 63% of the respondents are male bank managers. The majority of the bank branches are located in Colombo district as it is the capital city of Sri Lanka and the main commercial city of the country. 47% of the sample represents Colombo district and the rest of the sample represents outstation banks. Therefore, there is an island wide coverage to represent all the main cities. All the respondents have working experience of 5 years or more. 73% of the sample represents branch managers who have work experience of 5 years to 10 years.

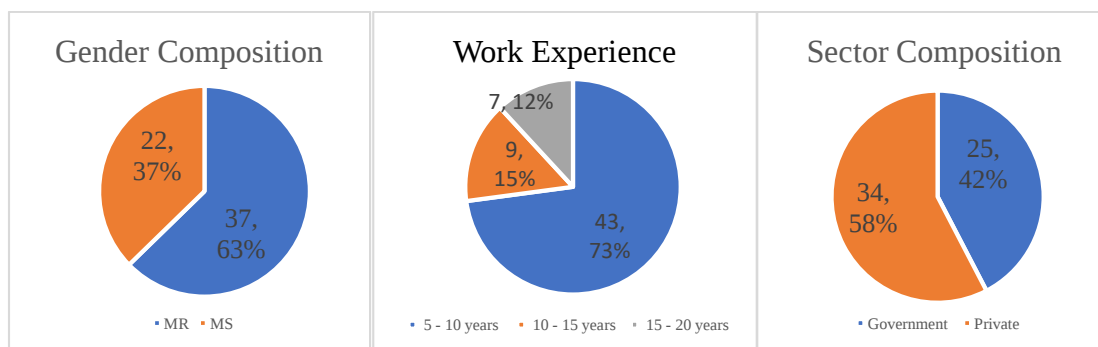


Figure 4-1: Sector, Gender and Age Compositions

Source: Author's sample

Table 4-1: District Wise Respondents

District	Government	Private	District	Government	Private
Ampara	1	1	Kandy	2	2
Anuradhapura		1	Kurunegala	1	1
Badulla	2	1	Matara	2	
Colombo	10	18	Nuwaraeliya		2
Galle	3	3	Polonnaruwa	1	1
Gampaha	2	1	Vavuniya		1
Kalutara	1	2			

Source: Author's sample

4.3 Descriptive Statistics of Specific Requirements under Key Functional Areas.

4.3.1 Service point capacity

a. Vault Condition/Capacity:

Vault condition/capacity at branch is at satisfactory level for current cash storing requirement.

Table 4-2: Vault Capacity/Condition - frequencies and proportions

Response (5 point Likert Scale)	Government	Private	Grand Total	Government	Private	Grand Total
Strongly agree (5)	3	6	9	12.0%	17.6%	15.3%
Agree (4)	16	18	34	64.0%	52.9%	57.6%
Neutral (3)	2	4	6	8.0%	11.8%	10.2%
Disagree (2)	3	5	8	12.0%	14.7%	13.6%
Strongly disagree (1)	1	1	2	4.0%	2.9%	3.4%
Grand Total	25	34	59			

Source: Author's sample

73% of the total respondents made positive responses about the level of satisfaction of the vault capacity in terms cash storing requirement. However, only 15% of the sample represents a strongly positive response on the criteria. 16% of the respondents disagreed on the level of satisfaction of the vault capacity.

Table 4-3: Vault Capacity/Condition – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.68	1.036
Government	25	0	4.00	4	4	3.68	0.988

Source: Author's sample

The average (mean) score on the Vault Capacity/Condition is 3.68 for both types of bank. This reflects a slightly less favorable opinion about Vault Capacity/Condition than 'Agree' responses and substantially more favorable than 'Neutral' responses. Low dispersion indicates high agreement towards the mean in both cases and indicate similar spread from the standard deviation

b. Counters, ATMs & CRMs:

Sufficient number of counters, ATMs/CRMs are allocated based on the transaction volumes.

Table 4-4: Counters, ATMs & CRMs - frequencies and proportions

Response	Government	Private	Grand total	Government	Private	Grand total
Strongly agree	2	2	4	8.0%	5.9%	6.8%
Agree	14	26	40	56.0%	76.5%	67.8%
Neutral	3	4	7	12.0%	11.8%	11.9%
Disagree	5	2	7	20.0%	5.9%	11.9%
Strongly disagree	1		1	4.0%	0.0%	1.7%
Grand Total	25	34	59			

Source: Author's sample

75% of the total respondents made positive responses about the sufficiency of counter, CRM/ATM allocations. However, only 6.8% of the sample represents a strongly positive response on the criteria. 13% disagreed on the counter, CRM/ATM allocations. 82% of the private sector bank managers and 64% of the government sector bank managers stated that ATMS/CRMs and counters are sufficient.

Table 4-5: Counters, ATMs & CRMs – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.82	0.626
Government	25	0	4.00	4	4	3.44	1.044

Source: Author's sample

The average score of the responses under 5 point Likert scale in private bank is slightly higher than the government bank. The mean score of private banks substantially more favorable to “Agree” response while government bank more favorable to ‘Neutral’ response. As per the standard deviation, low agreement towards the mean value in government bank is indicated compared to the private bank.

c. Staff:

Sufficient number of staff members is allocated to all sections in cash management, i.e. counters, ATMs/CRMs, vault handling staff, etc. based on the business volumes.

Table 4-6: Staff - frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly agree		3	3	0.0%	8.8%	5.1%
Agree	16	17	33	64.0%	50.0%	55.9%
Neutral	7	6	13	28.0%	17.6%	22.0%
Disagree	2	6	8	8.0%	17.6%	13.6%
Strongly disagree		2	2	0.0%	5.9%	3.4%
Grand Total	25	34	59			

Source: Author's sample

61% of the total respondents made positive responses on the allocation of competent staff at service points. No respondents from government banks strongly disagreed to the criteria. Overall 17% of sample has negative opinion on the competency staff in the service points. 23% of private bank managers and 8% government bank managers stated that allocation of competent staff is not sufficient.

Table 4-7: Staff – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.38	1.074
Government	25	0	4.00	4	2	3.56	0.651

Source: Author's sample

Similar average scores of the responses under 5 point Likert scale are indicated for both types of bank and Government Bank responses has low spread towards the mean score compared to private bank responses. However, the mean score indicates the average number of responses are on agreement between “Agree” response and ‘Neutral’ response.

4.3.2 Liquidity management

a. Management oversight:

Asset and Liability Management Committee together with Risk Management, Compliance and Audit functions ensure the management of overall cash flow management in the bank as per the policies such as Asset and Liability management Policy, Risk Management Policies.

Table 4-8: Management oversight - frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand total
Strongly Agree	7	5	12	28.0%	14.7%	20.3%
Agree	11	20	31	44.0%	58.8%	52.5%
Neutral	5	6	11	20.0%	17.6%	18.6%
Disagree	2	0	2	8.0%	0.0%	3.4%
Not Aware	0	3	3	0.0%	8.8%	5.1%
Grand Total	25	34	59			

Source: Author's sample

73% of the total respondents made positive responses about the management oversight. Only 3.4% of the sample represents a strongly negative response on the criteria. However, 8.8% of branch managers in private banks stated that details regarding management oversight is not aware to them.

Table 4-9: Management oversight - Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	31	3*	4.00	4	2	3.97	0.605
Government	25	0	4.00	4	3	3.92	0.909

*“Not aware “considered as missing value

Source: Author’s sample

Similar average scores of the responses under 5 point Likert scale are indicated for both types of bank and Government Bank responses has higher spread towards the mean score compared to private bank responses. However, the mean score indicates the average number of responses are on agreement towards “Agree” response for both types of Bank.

b. EOD Cash position Management:

Branch staff is adequately guided with well-set procedures on the End of the Day (EOD) cash excess/shortages management.

Table 4-10: EOD Cash Position Management - frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	2	4	6	8.0%	11.8%	10.2%
Agree	13	22	35	52.0%	64.7%	59.3%
Neutral	9	7	16	36.0%	20.6%	27.1%
Disagree	1	1	2	4.0%	2.9%	3.4%
Grand Total	25	34	59			

Source: Author’s sample

69% of the total respondents made positive responses about the guidance for EOD cash management. However, only 3.4% of the sample represented negative response on the criteria. There are 76% of private bank managers and 60% of government bank managers stated that EOD cash position management is adequately guided.

Table 4-11: EOD Cash Position Management - Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.85	0.657
Government	25	0	4.00	4	3	3.64	0.700

Source: Author's sample

Slightly similar average scores and spread of the responses under 5 point Likert scale are indicated for both types of bank and the mean score indicates more towards “Agree” response.

c. Demand forecasting systems:

Robust demand forecasting systems is in place for more accurate predictions

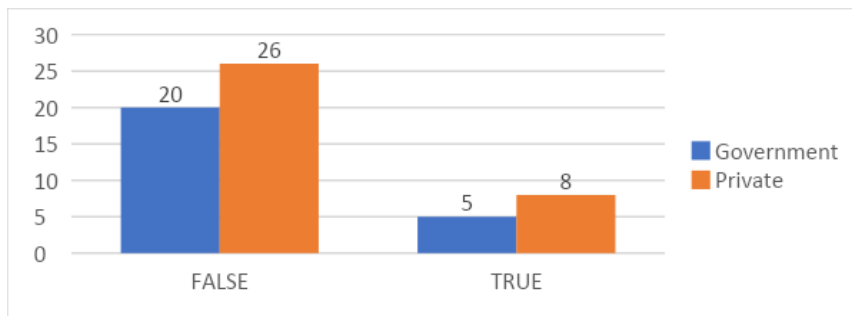


Figure 4-2: Demand Forecasting Models

Source: Author's sample

Only 13 respondents have stated that they use demand forecasting systems.

4.3.3 Insurance limit Review:

a. Branch Cash related Insurance Limit:

Insurance limit related to Branch Cash position is reviewed adequately and timely for the current trend.

Table 4-12: Branch Cash related Insurance Limit – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly agree	4	2	6	16.0%	5.9%	10.2%
Agree	14	21	35	56.0%	61.8%	59.3%

Response	Government	Private	Grand Total	Government	Private	Grand Total
Neutral	3	6	9	12.0%	17.6%	15.3%
Disagree	4	4	8	16.0%	11.8%	13.6%
Strongly disagree		1	1	0.0%	2.9%	1.7%
Grand Total	25	34	59			

Source: Author's sample

69% of the total respondents made positive responses about the branch cash insurance limit. 15% of the sample gave negative responses on the criteria.

Table 4-13: Branch Cash related Insurance Limit – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.65	0.981
Government	25	0	4.00	4	4	3.68	1.030

Source: Author's sample

Similar average scores and spread of the responses under 5 point Likert scale are indicated for both types of bank and the mean score indicates more towards “Agree” and “Neutral” responses.

b. ATMs/CRM Cash related Insurance Limit:

Insurance limit related to ATMs/CRMs cash positions are reviewed adequately and timely for the current trend.

Table 4-14: ATMs/CRMs Related Insurance Limit – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	4	5	9	16.0%	14.7%	15.3%
Agree	14	18	32	56.0%	52.9%	54.2%
Neutral	3	6	9	12.0%	17.6%	15.3%
Disagree	3	4	7	12.0%	11.8%	11.9%
Strongly Disagree	1	1	2	4.0%	2.9%	3.4%
Grand Total	25	34	59			

Source: Author's sample

69% of the total respondents made positive responses on the CRM/ATM insurance limit. Negative responses were given by 14% of the sample on the above criteria.

Table 4-15: ATMs/CRMs Related Insurance Limit – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.56	0.894
Government	25	0	4.00	4	3	3.72	0.936

Source: Author's sample

Slightly similar average scores and spread of the responses under 5 point Likert scale are indicated for both types of bank and the mean score indicates more towards “Agree” and “Neutral” responses.

4.3.4 Cash Inventory Management

a. Possible frequency of cash ordering:

Table 4-16: Cash Ordering Frequency

Cash Ordering frequency	Government	Private	Grand Total	Government	Private	Grand Total
Daily	4	3	7	16.0%	8.8%	11.9%
three times per week	6	2	8	24.0%	5.9%	13.6%
two times per week	3	6	9	12.0%	17.6%	15.3%
Weekly	4	9	13	16.0%	26.5%	22.0%
once in two weeks	4	7	11	16.0%	20.6%	18.6%
twice a month	2	2	4	8.0%	5.9%	6.8%
Monthly	2	2	4	8.0%	5.9%	6.8%
Other		3	3	0.0%	8.8%	5.1%
Total	25	34	59			

Source: Author's sample

More than 60% of the sample has the possibility to order cash within a period of week. When consider the two-week time period government bank represent lower proportion (39%) than private bank (50%).

b. System based models for cash inventory management:

System based models are used to determine reorder levels for reliable cash replenishments.
(Usage of inventory models)

Table 4-17: Cash inventory models

Response	Government	Private	Grand Total
FALSE	25	33	58
TRUE		1	1
Grand Total	25	34	59

Source: Author's sample

98% of the respondents stated that they don't use system-based models to decide reorder level for reliable replenishments.

4.3.5 Compliance

a. AML/CDD implementation:

The bank effectively implemented procedures, policies and central monitoring mechanism with regard to Customer Due Diligence (CDD) & Anti Money Laundering (AML) related regulatory requirements.

Table 4-18: AML/CDD implementation – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	2	8	10	8.0%	23.5%	16.9%
Agree	19	21	40	76.0%	61.8%	67.8%
Neutral	4	5	9	16.0%	14.7%	15.3%
Grand Total	25	34	59			

Source: Author's sample

85% of the total respondents made positive responses about the AML/CDD implementation. This is because banking is a highly regulated service sector. Both Private and Government banks are equally positive about the criteria.

Table 4-19: AML/CDD implementation – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	2	4.09	0.621
Government	25	0	4.00	4	2	3.92	0.493

Source: Author's sample

Slightly similar average scores for both types of Bank and Private bank has higher deviation to the average response, i.e. the response “Agree” compared to government banks.

4.3.6 Physical security

a. Security personnel:

Adequate number of security personnel is available to ensure the protection of the branches.

Table 4-20: Security personnel – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	4	4	8	16.0%	11.8%	13.6%
Agree	15	19	34	60.0%	55.9%	57.6%
Neutral	4	5	9	16.0%	14.7%	15.3%
Disagree	2	6	8	8.0%	17.6%	13.6%
Grand Total	25	34	59			

Source: Author's sample

71% of the total respondents stated that the security personnel are adequate. 14% of the sample had negative responses on the criteria. Both Private and Government banks are equally positive about the criteria.

Table 4-21: Security personnel – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.62	0.922
Government	25	0	4.00	4	3	3.84	0.800

Source: Author's sample

Slightly similar agreement on the response ‘Agree’ as per the average scores of both types of Bank and Private bank has higher deviation to the average response.

b. Physical security of the infrastructure:

Physical security related infrastructure/equipment are installed adequately in branches and service points (ATMs/CRMs/Mobile ATMS) to mitigate the risk of fire, fraud and natural disasters.

Table 4-22: Physical Security of the Infrastructure – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	1	5	6	4.0%	14.7%	10.2%
Agree	11	21	32	44.0%	61.8%	54.2%
Neutral	10	3	13	40.0%	8.8%	22.0%
Disagree	3	4	7	12.0%	11.8%	11.9%
Strongly disagree		1	1	0.0%	2.9%	1.7%
Grand Total	25	34	59			

Source: Author’s sample

64% of the total respondents made positive responses about the physical security of the infrastructure. 40% of branch managers of the government banks had neither positive nor negative opinion on the physical security of the infrastructure. 77% of private bank managers and 48% of government bank managers stated that physical security of infrastructure is adequate.

Table 4-23: Physical Security of the Infrastructure – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.74	0.963
Government	25	0	3.00	4	3	3.40	0.764

Source: Author’s sample

Average (mean) scores are 3.74 and 3.40 for private banks and government banks respectively. This reflects substantially more favorable to “Agree” than “Neutral” by private banks and slightly less favorable opinion to “Agreed” compared to “Neutral” by government banks. Low dispersion indicates high agreement towards the mean in both cases and indicate slightly similar spread of both types of banks.

4.3.7 Distribution

a. Cash transportation

Table 4-24: Cash Transportation – frequencies and proportions

Category	Government	Private	Grand Total	Government	Private	Grand Total
Only Bank	11	7	18	44.0%	20.6%	30.5%
Both Bank & Private	13	19	32	52.0%	55.9%	54.2%
Outsourced	1	8	9	4.0%	23.5%	15.3%
Grand Total	25	34	59			

Source: Author's sample

54% of the total respondents use both bank and private involvement for cash transportation. Overall only 15% has outsourced the cash transportation and 23% of private banks and only 4% of the government banks have outsourced the service. 21% of private bank managers and 44% of government bank managers stated that the cash transportation is handled by themselves.

b. Cash transportation security

Table 4-25: Cash transportation security

Category	Government	Private	Grand Total	Government	Private	Grand Total
Bank only	15	6	21	60.0%	17.6%	35.6%
Both Bank & Private	9	17	26	36.0%	50.0%	44.1%
Outsourced	1	11	12	4.0%	32.4%	20.3%
Grand Total	25	34	59			

Source: Author's sample

44% of the total respondents use both bank and private involvement for cash transportation. Overall only 20% has outsourced the cash transportation. 32% of private banks and only 4% of government banks have outsourced the service. 60% of private bank managers and 18% of government bank managers stated that the cash transportation is handled by themselves.

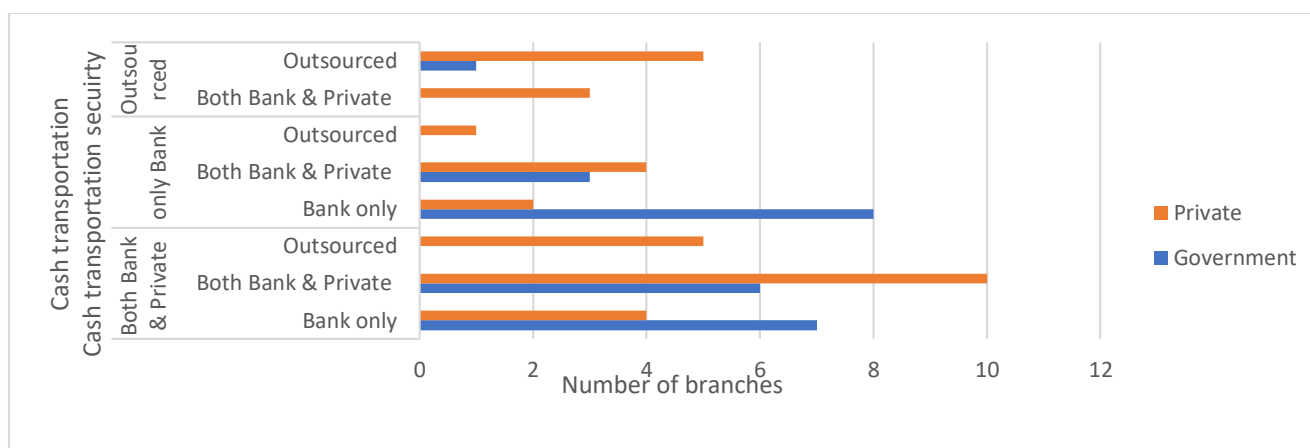


Figure 4-3: Classification Cash Transportation and Transportation Security

Source: Author's sample

Majority of the private banks use a combination of both bank and private service provider involvement for cash transportation and security of cash in transit (CIT). Majority of the government banks fulfill cash transportation requirement using both bank own service and the private service.

c. Cash distribution administration:

Table 4-26: Cash Distribution Administration

Category	Government	Private	Grand Total	Government	Private	Grand Total
The Bank - CCPU	7	8	15	28.0%	23.5%	25.4%
The Bank	17	19	36	68.0%	55.9%	61.0%
Outsourced	1	7	8	4.0%	20.6%	13.6%
Grand Total	25	34	59			

Source: Author's sample

Majority 61% of the total respondents' cash distribution administration is handled by the bank. Overall 14% of the sample has outsourced the function. 21% of private banks and 4% of government banks have outsourced the cash administration function. As a separate strategy, banks have central cash processing unit to use both bank and private involvement for cash transportation. Respectively, 68% and 56% of the government banks and private banks handle cash administration function by themselves without having CCPU.

d. Availability of Distribution Centers by the bank or Outsourced company:

Table 4-27: Availability of Distribution Centers

Response	Government	Private	Grand Total	Government	Private	Grand Total
No	10	14	24	40.0%	41.2%	40.7%
Yes	15	20	35	60.0%	58.8%	59.3%
Grand Total	25	34	59			

Source: Author's sample

59% of the total respondents stated that distribution centers are available. Both types of banks have similar positions for the criteria.

e. Satisfactory level of Cash Distribution:

Table 4-28: Cash distribution satisfaction- frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Satisfied	7	10	17	28.0%	29.4%	28.8%
Slightly Satisfied	9	13	22	36.0%	38.2%	37.3%
Neutral	2	1	3	8.0%	2.9%	5.1%
Slightly Dissatisfied	4	7	11	16.0%	20.6%	18.6%
Dissatisfied	3	3	6	12.0%	8.8%	10.2%
Grand Total	25	34	59			

Source: Author's sample

66% of the total respondents made positive responses about the level of satisfaction. Both types of banks have slightly similar positions for the satisfactory levels.

Table 4-29: Cash distribution satisfaction – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.59	1.351
Government	25	0	4.00	4	4	3.52	1.388

Source: Author's sample

Respondents of both Private banks and Government banks have favorable opinion to “Agree” and “Neutral” in similar manner. Both types of Bank lower agreement on the mean score unlike other criteria considered above since standard deviation is 1.3.

4.3.8 Value Added services

a. Value added services provided by outsourced partners:

Table 4-30: Value Added Services

Status	processing unfit cash	Cash sorting	cash bundling/ Denominations	ATM cash replenishments	cash cleaning/ disinfection
No	2				4
Yes	6	8	8	4	3
Bank not considered				4	
Not aware					1
Total	8	8	8	8	8

Source: Author’s sample

Most of the banks that outsourced the cash distribution benefited from the value-added services. With regard to ATM cash replenishment, 4 out of 8 banks have not used the service of outsourced service providers.

4.3.9 Service point monitoring

a. ATM/CRM monitoring support:

The Bank has properly established a dedicated 24*7 ATM monitoring support unit and automatic alerting mechanism.

Table 4-31: ATM/CRM monitoring support – frequencies and proportions

Row Labels	Government	Private	Grand Total	Government	Private	Grand Total
Strongly agree	2	9	11	8.0%	26.5%	18.6%
Agree	20	16	36	80.0%	47.1%	61.0%
Neutral	2	6	8	8.0%	17.6%	13.6%
Disagree		3	3	0.0%	8.8%	5.1%
Strongly disagree	1		1	4.0%	0.0%	1.7%
Grand Total	25	34	59			

Source: Author’s sample

80% of the total respondents made positive responses about the support provided by the ATM/CRM monitoring function. 27% of private banks strongly agreed on the monitoring support while it was only 8% for the government banks.

Table 4-32: ATM/CRM monitoring support – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.91	0.900
Government	25	0	4.00	4	4	3.88	0.726

Source: Author's sample

Respondents of both Private banks and Government banks have favorable opinion to “Agree” and standard deviations show high agreement to the average response.

4.3.10 Information Systems

a. Information systems to communicate up stream

Information systems are effectively used to capture and share information on a timely manner with respective participants (i.e. cash distribution administration outsourced parties, internal customers/inter departments) in cash supply chain.

Table 4-33: Information systems to communicate up stream – frequencies and proportions

Row Labels	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	1	2	3	4.0%	5.9%	5.1%
Agree	4	18	22	16.0%	52.9%	37.3%
Neutral	9	9	18	36.0%	26.5%	30.5%
Disagree	8	4	12	32.0%	11.8%	20.3%
Strongly Disagree	3	1	4	12.0%	2.9%	6.8%
Grand Total	25	34	59			

Source: Author's sample

44% of the respondents made positive responses about the information systems which provide effective information sharing mechanism with upstream of the cash supply chain. Respectively 59% and 20% of private and government banks have stated that said information systems are

effective. 44% of the government bank managers stated that they have negative opinions on the effectiveness of these information systems.

Table 4-34: Information systems to communicate up stream – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	4	3.47	0.896
Government	25	0	3.00	3	4	2.68	1.030

Source: Author's sample

The average score of the private banks is higher than the government bank. The mean score of private banks seems to be similarly favorable to “Agree” and “Neutral” while government bank mean score substantially more favorable to “Neutral” than “Disagree”. As per the standard deviation, low agreement towards the mean value in government bank is indicated compared to the private bank.

b. IT systems for specific critical processes automation

IT systems effectively use to manage daily cash position of the branch supporting banks ALM function (bulk cash transferring facilities and treasury systems), both branch and ATM reconciliations for financial consolidations and state of the art MIS.

Table 4-35: IT systems for specific critical processes automation – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	1	2	3	4.0%	5.9%	5.1%
Agree	9	24	33	36.0%	70.6%	55.9%
Neutral	12	5	17	48.0%	14.7%	28.8%
Disagree	2	3	5	8.0%	8.8%	8.5%
Strongly disagree	1		1	4.0%	0.0%	1.7%
Grand Total	25	34	59			

Source: Author's sample

61% of the respondents made positive responses about IT systems related to cash management in the bank. However, 76% of private banks are positive on the effectiveness of the IT system related

to cash management in the bank while government banks have only 40%. The majority of the government banks have neutral opinion on the effectiveness of IT systems.

Table 4-36: IT systems for specific critical processes automation – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.74	0.710
Government	25	0	3.00	3	4	3.28	0.843

Source: Author's sample

The average score of the private banks is slightly higher than the government bank. The mean score of private banks' responses is substantially favorable to "Agree" than "Neutral" while government bank mean score substantially more favorable to "Neutral" than "Agree". The dispersion of the responses towards the average score is slightly similar.

4.3.11 Maintenance

a. Preventive maintenance

To ensure the uninterrupted customer service, preventive maintenance is in place in regard to ATMs/CRMs, Counting Machines, Power sources, IT infrastructure telecommunication etc.

Table 4-37: Preventive maintenance – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	7	9	16	28.0%	26.5%	27.1%
Agree	10	18	28	40.0%	52.9%	47.5%
Neutral	6	6	12	24.0%	17.6%	20.3%
Disagree	2	1	3	8.0%	2.9%	5.1%
Grand Total	25	34	59			

Source: Author's sample

75% of the total respondents made positive responses about the maintenance. Overall 20% of neutral response is observed on the maintenance.

Table 4-38: Preventive maintenance – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	4.03	0.758
Government	25	0	4.00	4	3	3.88	0.927

Source: Author's sample

The average score of the private banks is slightly higher than the government bank. The mean score of private banks' responses is substantially favorable to "Agree" than government bank. Agreement to the response "Agree" by government banks' responses is lower compared to private banks' responses.

4.3.12 Information security

a. Implementation of Information Security

The bank has effectively implemented Information security measures related to cash management processes covering staff, customer and third-party involvement.

Table 4-39: Implementation of Information Security – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	1	8	9	4.0%	23.5%	15.3%
Agree	18	22	40	72.0%	64.7%	67.8%
Neutral	6	4	10	24.0%	11.8%	16.9%
Grand Total	25	34	59			

Source: Author's sample

83% of the total respondents made positive responses about the information security. No negative responses were observed. 88% of private bank managers and 76% of government bank managers stated that information security is sufficient.

Table 4-40: Implementation of Information Security – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	2	4.12	0.591
Government	25	0	4.00	4	2	3.80	0.500

Source: Author's sample

Both average scores are favorable towards "Agree" irrespective of the Bank

4.3.13 Customer and Supplier Interaction

a. Common pathways:

Channels are adequate (24*7 call center, other social media live chat, dedicated telephone lines, customer/supplier notifications & alerts, intranet, updated corporate website).

Table 4-41: Common Pathways – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree	1	3	4	4.0%	8.8%	6.8%
Agree	15	25	40	60.0%	73.5%	67.8%
Neutral	6	5	11	24.0%	14.7%	18.6%
Disagree	3	1	4	12.0%	2.9%	6.8%
Strongly Disagree	1	3	4	4.0%	8.8%	6.8%
Grand Total	25	34	59			

Source: Author's sample

75% of the total respondents made positive responses about the adequacy of common pathways. 82% and 64% of branch managers of private banks and government banks stated that common pathways are adequate.

Table 4-42: Common Pathways – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.88	0.591
Government	25	0	4.00	4	3	3.56	0.768

Source: Author's sample

Average score related to private banks' responses is slightly higher and more favorable to "Agree" response compared to government banks' responses.

b. Procedures on Customer & supplier engagement

Specific key procedures available to communicate with customers and suppliers are effective and adequate. (e.g. customer awareness on ATM/CRM procedures, evaluation procedures for customer satisfaction, performance of all parties engaged to cash supply chain (internal staff, third parties), Non-Disclosure Agreements (NDA),

Service level Agreements (SLA), whistle blowing procedure, customer charter, complaint handling procedures, internal circular instructions, staff trainings on customer relationship management, etc)

Table 4-43: Procedures on Customer & supplier engagement – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly Agree		6	6	0.0%	17.6%	10.2%
Agree	16	19	35	64.0%	55.9%	59.3%
Neutral	8	8	16	32.0%	23.5%	27.1%
Disagree	1	1	2	4.0%	2.9%	3.4%
Grand Total	25	34	59			

Source: Author's sample

70% of the total respondents made positive responses about the adequacy of common pathways. 73% of private bank managers and 64% government bank managers stated that available procedures to communicate with suppliers and customers are adequate and effective.

Table 4-44: Procedures on Customer & supplier engagement – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	3	3.88	0.729
Government	25	0	4.00	4	2	3.60	0.577

Source: Author's sample

Average score related to private banks' responses is slightly higher and more favorable to "Agree" response compared to government banks' responses.

4.3.14 Business Continuity

a. Business Continuity Arrangements

Business Continuity Arrangements are effectively executed by the bank during the pandemic.

Table 4-45: Business Continuity Arrangement – frequencies and proportions

Response	Government	Private	Grand Total	Government	Private	Grand Total
Strongly agree	1	7	8	4.0%	20.6%	13.6%
Agree	13	19	32	52.0%	55.9%	54.2%
Neutral	10	8	18	40.0%	23.5%	30.5%
Disagree	1		1	4.0%	0.0%	1.7%
Grand Total	25	34	59			

Source: Author's sample

68% of the total respondents made positive responses about the effectiveness of business continuity arrangement relating to cash supply chain management. However, overall 31% represent the neutral response on the effectiveness of the business continuity arrangement. 77% of private bank managers and 56% government bank managers stated that business continuity arrangements are effective.

Table 4-46: Business Continuity Arrangement – Summary Statistics

	Number of observations	Missing	Median	Mode	Range	Mean	Std. Deviation
Private	34	0	4.00	4	2	3.97	0.674
Government	25	0	4.00	4	3	3.56	0.651

Source: Author's sample

Average score related to private banks' responses is slightly higher and more favorable to "Agree" response compared to government banks' responses.

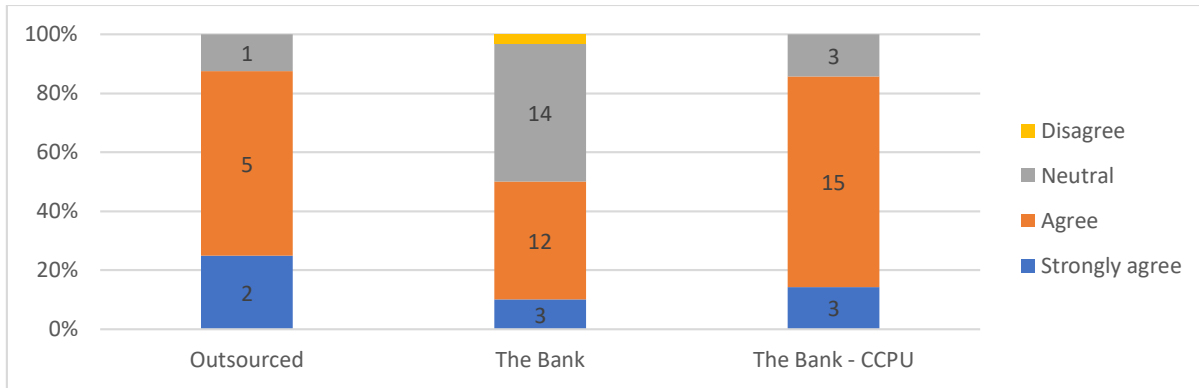


Figure 4-4: Business Continuity Arrangement by type of Administration of Distribution function

Source: Author's sample

More than 80% of the banks who have outsourced or banks with CCPU satisfied about the business continuity arrangements executed during the Covid-19 pandemic. It is a significant satisfactory level compared to the banks which operated the cash distribution administration without a central manner.

4.3.15 Ecological factor

Table 4-47: Methods of ecological approach in use

Encourage for slip less ATM usage			
Usage	Government	Private	Grand Total
Effectively use	17	21	38
Use but not effective	6	12	18
Not use		1	1
Not aware	2		2
Grand Total	25	34	59
Steps taken to use more digitalize information than hard copies			
Usage	Government	Private	Grand Total
Effectively use	16	26	42
Use but not effective	7	7	14
Not use	2	1	3
Grand Total	25	34	59

Measure carbon foot print of transportation, AC usage]			
Usage	Government	Private	Grand Total
Effectively use	12	18	30
Use but not effective	9	8	17
Not use	2	5	7
Not aware	2	3	5
Grand Total	25	34	59
Measure Electricity consumption of Branches, Distribution Centers, ATMs			
Usage	Government	Private	Grand Total
Effectively use	11	19	30
Use but not effective	9	8	17
Not use	5	7	12
Grand Total	25	34	59
Use reusable energy sources (eg. solar powered ATMS, Branches)			
Usage	Government	Private	Grand Total
Effectively use	5	10	15
Use but not effective	6	7	13
Not use	13	15	28
Not aware	1	2	3
Grand Total	25	34	59
Measure Water consumption of Branches, Distribution Centers			
Row Labels	Government	Private	Grand Total
Effectively use	15	15	30
Use but not effective	2	9	11
Not use	8	10	18
Grand Total	25	34	59
Use ecofriendly disposable material or degradable baggage/covers			
Row Labels	Government	Private	Grand Total
Effectively use	10	15	25

Use but not effective	5	9	14
Not use	9	9	18
Not aware	1	1	2
Grand Total	25	34	59

Source: Author's sample

Based on the observations, usage of ecological approach is less effective except for the digitalization and slip less ATM transactions.

4.3.16 Satisfactory percentiles of key elements of Cash supply chain

Table 4-48: Summary of satisfactory percentiles of key elements of cash supply chain

Key elements (Sub components of key processes/ functions of cash supply chain)	Bank Type	Percentiles						
		5	10	25	50	75	90	95
Vault_condition_capacity	Private	1.75	2.00	3.00	4.00	4.00	5.00	5.00
	Government	1.30	2.00	3.50	4.00	4.00	5.00	5.00
counters_atms_crms	Private	2.00	3.00	4.00	4.00	4.00	4.00	5.00
	Government	1.30	2.00	2.50	4.00	4.00	4.40	5.00
Staff_counters_atms_crms	Private	1.00	2.00	2.75	4.00	4.00	4.50	5.00
	Government	2.00	2.60	3.00	4.00	4.00	4.00	4.00
ALM_management_oversight	Private	3.00	3.00	3.00	4.00	4.00	5.00	5.00
	Government	2.00	2.60	3.00	4.00	5.00	5.00	5.00
Cash_management_EOD_procedures	Private	2.75	3.00	3.75	4.00	4.00	5.00	5.00
	Government	2.30	3.00	3.00	4.00	4.00	4.40	5.00
Insurance_branch_cash_position	Private	1.75	2.00	3.00	4.00	4.00	5.00	5.00
	Government	1.30	2.00	3.00	4.00	4.00	5.00	5.00
Insurance_atms_crms_cash_position	Private	1.75	2.00	3.00	4.00	4.00	4.00	5.00
	Government	2.00	2.00	3.00	4.00	4.00	5.00	5.00
AML_CDD	Private	3.00	3.00	4.00	4.00	4.25	5.00	5.00
	Government	3.00	3.00	4.00	4.00	4.00	4.40	5.00
Security_personnel	Private	2.00	2.00	3.00	4.00	4.00	5.00	5.00
	Government	2.00	2.60	3.50	4.00	4.00	5.00	5.00
Physical_security_infrastructure	Private	1.75	2.00	3.75	4.00	4.00	5.00	5.00
	Government	2.00	2.00	3.00	3.00	4.00	4.00	4.70
Satisfactory_level_of_cash_distribution	Private	1.00	1.50	2.00	4.00	5.00	5.00	5.00
	Government	1.00	1.00	2.00	4.00	5.00	5.00	5.00
ATM_monitoring	Private	2.00	2.50	3.00	4.00	5.00	5.00	5.00
	Government	1.60	3.00	4.00	4.00	4.00	4.40	5.00

Information_system_s haring	Private	1.75	2.00	3.00	4.00	4.00	4.00	5.00
	Government	1.00	1.00	2.00	3.00	3.00	4.00	4.70
Information_system_ ALM_function	Private	2.00	2.50	3.75	4.00	4.00	4.00	5.00
	Government	1.30	2.00	3.00	3.00	4.00	4.00	4.70
Maintenance	Private	2.75	3.00	4.00	4.00	5.00	5.00	5.00
	Government	2.00	2.60	3.00	4.00	5.00	5.00	5.00
Information_security	Private	3.00	3.00	4.00	4.00	4.25	5.00	5.00
	Government	3.00	3.00	3.50	4.00	4.00	4.00	4.70
Interaction_chanel	Private	2.75	3.00	4.00	4.00	4.00	4.50	5.00
	Government	2.00	2.00	3.00	4.00	4.00	4.00	4.70
Communication_proce dures	Private	2.75	3.00	3.00	4.00	4.00	5.00	5.00
	Government	2.30	3.00	3.00	4.00	4.00	4.00	4.00
Business_continuity_a rrangement	Private	3.00	3.00	3.75	4.00	4.00	5.00	5.00
	Government	2.30	3.00	3.00	4.00	4.00	4.00	4.70

Source: Author's sample

The summary shows that levels of satisfactory are asymmetrically distributed.

4.3.17 Overall Satisfaction of Cash supply chain management

Table 4-49: Overall Satisfaction

Row Labels	Government	Private	Grand Total	Government	Private	Grand Total
Dissatisfied	13	11	24	52.0%	32.4%	40.7%
Satisfied	12	23	35	48.0%	67.6%	59.3%
Grand Total	25	34	59			

Source: Author's sample

60% of the total respondents were satisfied on the current cash supply chain management. 52% of government banks and 32% of private banks stated that the cash supply chain management is dissatisfied. According to the findings of the key functional areas, there are differences in the practices among government banks and private banks. Therefore, it is of interest to find out if this difference can be generalized for banking sector.

4.4 Inferential Analysis on satisfactory levels between Private and Government Banks

4.4.1 Check for normality of 'satisfaction with cash supply chain key elements'

The hypothesis test was conducted to check whether the set of data specific to variables in both groups (i.e. Private Banks and Government Banks) are normal distributed. The test was conducted using the Kolmogorov-Smirnov test through SPSS.

H0: Data set has normal distribution

HA: Data set has not normal distribution

Table 4-50: Summary of Normality test

Element of Key Process/Function (Variable)	Bank_Type	Kolmogorov-Smirnova		
		Statistic	df	Sig.
Vault_condition_capacity	Private banks	0.328	34	0.000
	Government Banks	0.387	25	0.000
counters_atms_crms	Private banks	0.434	34	0.000
	Government Banks	0.344	25	0.000
Staff_counters_atms_crms	Private banks	0.306	34	0.000
	Government Banks	0.391	25	0.000
ALM_management_oversight	Private banks	0.308	34	0.000
	Government Banks	0.255	25	0.000
Cash_management_EOD_procedures	Private banks	0.353	34	0.000
	Government Banks	0.296	25	0.000
Insurance_branch_cash_position	Private banks	0.317	34	0.000
	Government Banks	0.342	25	0.000
Insurance_atms_crms_cash_position	Private banks	0.366	34	0.000
	Government Banks	0.338	25	0.000
AML_CDD	Private banks	0.321	34	0.000
	Government Banks	0.404	25	0.000
Secuirty_personnel	Private banks	0.337	34	0.000
	Government Banks	0.339	25	0.000
Physical_security_infrastructure	Private banks	0.373	34	0.000
	Government Banks	0.264	25	0.000
Satisfactory_level_of_cash_distribution	Private banks	0.296	34	0.000
	Government Banks	0.275	25	0.000
ATM_monitoring	Private banks	0.274	34	0.000
	Government Banks	0.446	25	0.000
Information_system_sharing	Private banks	0.311	34	0.000
	Government Banks	0.186	25	0.026
Information_system_ALM_function	Private banks	0.410	34	0.000
	Government Banks	0.250	25	0.000
Maintenance	Private banks	0.279	34	0.000
	Government Banks	0.231	25	0.001
Information_security	Private banks	0.344	34	0.000

	Government Banks	0.415	25	0.000
Interaction_channels	Private banks	0.402	34	0.000
	Government Banks	0.357	25	0.000
Communication_procedures	Private banks	0.299	34	0.000
	Government Banks	0.396	25	0.000
Business_continuity_arrangement	Private banks	0.282	34	0.000
	Government Banks	0.311	25	0.000

Source: Author's sample

Since all the p values are less than the statistical significance level (i.e. 0.05 error rate), there are significant evidence to reject the null hypothesis showing that the variables do not follow normal distribution.

4.4.2 Satisfaction with cash supply chain key elements by bank type

Due to the non-normality of the variables a Mann Whitney U test was carried out to infer whether the responses are difference between two groups based on mean rank instead of Mean score.

H0: No difference between two groups with respect the dependent variable, i.e. satisfactory level of the key element of cash supply chain considered

HA: Two groups are different with respect the dependent variable, i.e. satisfactory level of the key element of cash supply chain considered

Table 4-51: Summary of Mann-Whitney Test results

Element of Key Process/Function (Variable)	Ranks			Test Statistics grouping by Bank Type			
	Bank_Type	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)	Exact Sig. (2-tailed)
Vault_condition_capacity	Private	30.03	1021.00	424.000	-0.017	0.986	0.984
	Government	29.96	749.00				
counters_atms_crms	Private	32.24	1096.00	349.000	-1.409	0.159	0.158
	Government	26.96	674.00				
Staff_counters_atms_crms	Private	29.35	998.00	403.000	-0.375	0.708	0.708
	Government	30.88	772.00				
ALM_management_oversight	Private	29.21	993.00	398.000	-0.454	0.650	0.667
	Government	31.08	777.00				
Cash_management_EOD_procedures	Private	32.15	1093.00	352.000	-1.276	0.202	0.217
	Government	27.08	677.00				
Insurance_branch_cash_position	Private	29.57	1005.50	410.500	-0.244	0.807	0.816

	Government	30.58	764.50				
Insurance_atms_crms_cash_position	Private	28.71	976.00	381.000	-0.762	0.446	0.452
	Government	31.76	794.00				
AML_CDD	Private	31.78	1080.50	364.500	-1.125	0.260	0.286
	Government	27.58	689.50				
Secuirty_personnel	Private	28.51	969.50	374.500	-0.866	0.387	0.415
	Government	32.02	800.50				
Physical_security_infrastructure	Private	33.41	1136.00	309.000	-1.956	0.050	0.051
	Government	25.36	634.00				
Satisfctory_level_of_cash_distribution	Private	30.38	1033.00	412.000	-0.208	0.835	0.839
	Government	29.48	737.00				
ATM_monitoring	Private	30.41	1034.00	411.000	-0.246	0.806	0.800
	Government	29.44	736.00				
Information_system_sharing	Private	35.56	1209.00	236.000	-3.037	0.002	0.002
	Government	22.44	561.00				
Information_system_ALM_function	Private	34.21	1163.00	282.000	-2.452	0.014	0.015
	Government	24.28	607.00				
Maintenance	Private	30.99	1053.50	391.500	-0.553	0.581	0.604
	Government	28.66	716.50				
Information_security	Private	33.32	1133.00	312.000	-2.102	0.036	0.038
	Government	25.48	637.00				
Interaction_chanel	Private	32.72	1112.50	332.500	-1.719	0.086	0.094
	Government	26.30	657.50				
Communication_procedures	Private	32.60	1108.50	336.500	-1.547	0.122	0.125
	Government	26.46	661.50				
Business_continuity_arrangement	Private	33.74	1147.00	298.000	-2.165	0.030	0.034
	Government	24.92	623.00				
Overall_satisfaction	Private	32.46	1103.50	341.500	-1.505	0.132	0.181
	Government	26.66	666.50				

Source: Author's sample

It is revealed that satisfaction related to IT systems to communicate up stream, Information systems related to ALM function, Information security, Business continuity Arrangement are different in two groups and higher satisfaction in Private banks compared to Government Bank is statistically significant based on the Mann-Whitney U test and the Mean rank under 95% confidence level.

4.4.3 Confidence interval for overall satisfied proportion of overall satisfaction

Sample proportion for satisfied category $\hat{p} = 0.5932$

Since both $(n * \hat{p})$ & $(n * (1 - \hat{p}))$ is 34.9988 and 24.0012 the distribution of the overall satisfaction can be approximately considered as normal distribution. Z value for 95% level of confidence is, 1.96

$$(\hat{p} - z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}, \hat{p} + z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}) \text{ under 95\% level of confidence;}$$

Therefore satisfied proportion can be varied between,

$$(0.5932 + 1.96 * 0.064, 0.5932 - 1.96 * 0.064) = (0.4678, 0.7186),$$

i.e. satisfied % can be varied in between 46.78% and 71.86% under 95% level of confidence.

4.4.4 Hypothesis testing for overall satisfied proportion

H0: Overall satisfied proportion is equal to 50% ($p=0.5$)

Ha: Overall satisfied proportion is more than 50% ($p>0.5$)

Test statistic;

$$Z = \frac{\hat{p} - p_o}{\sqrt{\frac{p_o(1 - p_o)}{n}}}$$

$$Z_0 = (0.5932 - 0.5) / \sqrt{0.5 * 0.5 / 59} = 1.4317$$

Under 95% confidence level ($\alpha=0.05$), p value related to Z_0 is (1-0.9236), i.e. 0.0764

Since p value (0.0764) > α (0.05)

It is not significant at the 0.05 level to reject H0, i.e. there is not enough evidence to support the claim that more than 50% of bank managers are satisfied about the prevailing cash supply chain management.

4.4.5 Association between overall satisfactory level and bank type

H₀: Government banks and Private Banks do not differ in their satisfactory level of cash supply chain management.

H_A: Government banks and Private Banks do differ in their satisfactory level of cash supply chain management.

Table 4-52: Observed Values

	Government	Private	Total
Dissatisfied	13	11	24
Satisfied	12	23	35
Total	25	34	59

Source: Author's sample

Table 4-53: Expected Values

	Government	Private	Total
Dissatisfied	10.17	13.83	24.00
Satisfied	14.83	20.17	35.00
Total	25.00	34.00	59.00

Source: Author's sample

As all expected values are more than 5, the test can be preceded.

Test statistic is χ^2 with degrees of freedom 1 = 2.304

For $\alpha = .05$ and $v = 1$, accept H₀ if χ^2 with d.f.1 = 3.84

Since computed test statistic is smaller than X_1^2 , we do not reject the null hypothesis. Overall satisfactory level related to cash supply chain management of government banks and private banks do not differ under 95% level of confidence.

4.5 Identifying Key Areas of Cash Supply Chain from Bank's Perspective

4.5.1 Average scores for key functional areas

59 respondents provided their opinion on the level of importance for further improvement of key functional areas using 9-point scale. Average score is calculated for each key functional area to identify the most significant functional areas that would be improved in cash supply chain.

As a rule of thumb 20% from the number of factors to be considered, i.e. 3 factors to be considered. However, the scores implied that three more key functional areas have similar importance for further improvements.

Table 4-54: Summary of scores for key functional areas

	Key functional Areas in Cash supply chain management														
	Cash Inventory Management	Physical Security	Information Systems	Customer & supplier Interaction	Liquidity Management	Distribution	Maintenance	Service Point Capacity	Value added services	Insurance	Information Security	Service point monitoring	Business Continuity	Compliance (AML/CDD)	Ecological Factor
Total score	480	492	482	451	458	481	459	483	440	485	433	440	451	440	458
Average score	8.14	8.34	8.17	7.64	7.76	8.15	7.78	8.19	7.46	8.22	7.34	7.46	7.64	7.46	7.76

Source: Author's sample

4.5.2 Pareto Analysis

Pareto Analysis is carried out to find the cumulative coverage of those selected functional areas and justified the selection of those six factors.

Table 4-55: Cumulative percentages of scores for key functional Areas

Key functional area	Total Score	Cumulative score	Cumulative %
Physical Security (PS)	492	492	7.10%
Insurance (I)	485	977	14.09%
Service Point Capacity (SPC)	483	1460	21.06%
Information Systems (IS)	482	1942	28.01%
Distribution (D)	481	2423	34.94%
Cash Inventory Management (CIM)	481	2904	41.88%
Maintenance	459	3363	48.50%
Liquidity Management	458	3821	55.11%
Ecological Factor	458	4279	61.71%
Customer & supplier Interactions	451	4730	68.21%
Business Continuity Arrangements	451	5181	74.72%
Value added services	440	5621	81.06%
Service point monitoring	440	6061	87.41%
Compliance (AML/CDD)	440	6501	93.76%
Information Security	433	6934	100.00%
Total	6934		

Source: Author's sample

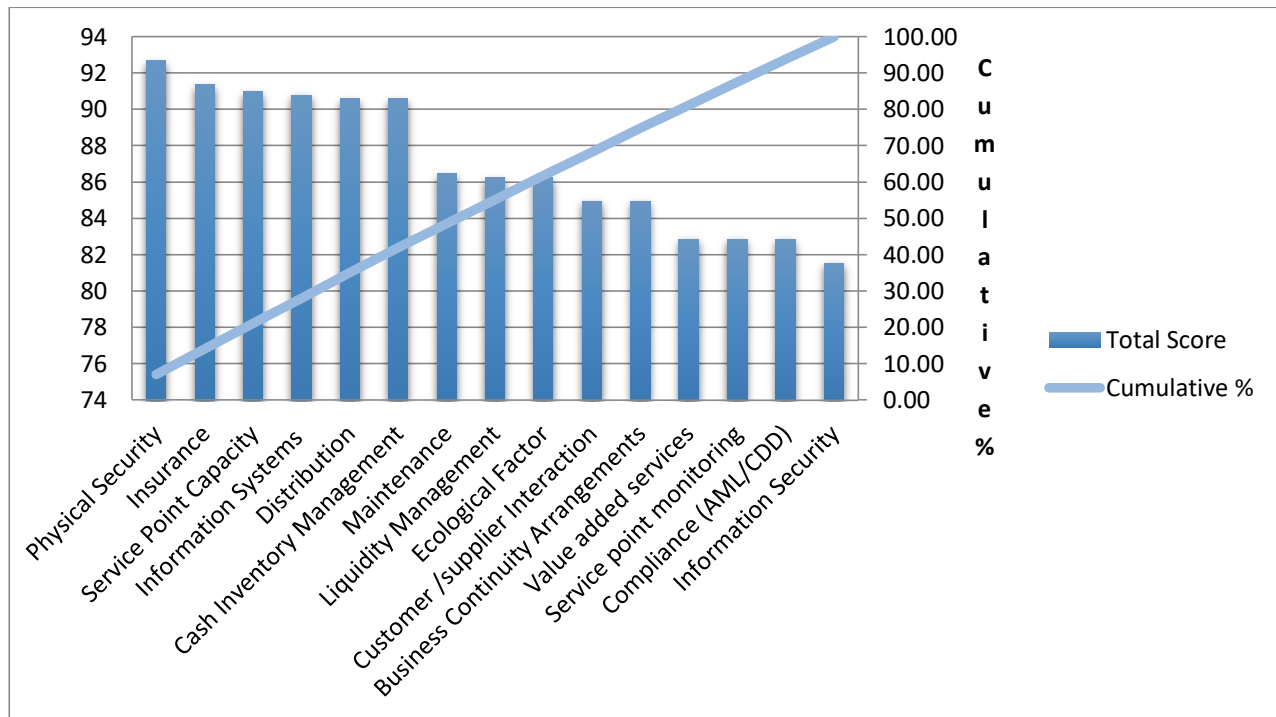


Figure 4.5: Pareto Analysis for Key Functional Areas to be Further Improved

Source: Author's sample

4.5.3 Analytic Hierarchy Process Analysis

Based on the 10 responses given for pairwise comparison of identified key functional areas, AHP analysis was conducted to prioritize the key functional area to be improved in cash supply chain.

4.5.3.1 AHP – Stage 1 computation of comparison matrix

Table 4-56: Comparison matrixes

Response 1						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	1.00	1.00	0.33	1.00
I	0.33	1.00	1.00	3.00	1.00	0.33
SPC	1.00	1.00	1.00	3.00	3.00	3.00
IS	1.00	0.33	0.33	1.00	0.33	1.00
D	3.00	1.00	0.33	3.00	1.00	1.00
CIM	1.00	3.00	0.33	1.00	1.00	1.00
Total	7.33	9.33	4.00	12.00	6.67	7.33
Response 2						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	1.00	1.00	3.00	0.33
I	0.33	1.00	1.00	0.33	1.00	5.00
SPC	1.00	1.00	1.00	3.00	5.00	0.33
IS	1.00	3.00	0.33	1.00	0.33	0.33
D	0.33	1.00	0.20	3.00	1.00	1.00
CIM	3.00	0.20	3.00	3.00	1.00	1.00
Total	6.67	9.20	6.53	11.33	11.33	8.00
Response 3						
	PS	I	SPC	IS	D	CIM
PS	1.00	1.00	0.33	0.33	0.33	1.00
I	1.00	1.00	1.00	3.00	1.00	0.33
SPC	3.00	1.00	1.00	1.00	0.33	1.00
IS	3.00	0.33	1.00	1.00	1.00	1.00
D	3.00	1.00	3.00	1.00	1.00	5.00
CIM	1.00	3.00	1.00	1.00	0.20	1.00
Total	12.00	7.33	7.33	7.33	3.87	9.33

Response 4						
	PS	I	SPC	IS	D	CIM
PS	1.00	1.00	0.33	3.00	5.00	0.20
I	1.00	1.00	0.33	1.00	3.00	1.00
SPC	3.00	3.00	1.00	0.33	5.00	5.00
IS	0.33	1.00	3.00	1.00	5.00	3.00
D	0.20	0.33	0.20	0.20	1.00	1.00
CIM	5.00	1.00	0.20	0.33	1.00	1.00
Total	10.53	7.33	5.07	5.87	20.00	11.20
Response 5						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	5.00	0.33	1.00	1.00
I	0.33	1.00	0.33	0.33	1.00	0.33
SPC	0.20	3.00	1.00	1.00	3.00	1.00
IS	3.00	3.00	1.00	1.00	5.00	3.00
D	1.00	1.00	0.33	0.20	1.00	3.00
CIM	1.00	3.00	1.00	0.33	0.33	1.00
Total	6.53	14.00	8.67	3.20	11.33	9.33
Response 6						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	5.00	5.00	3.00	5.00
I	0.33	1.00	1.00	3.00	0.33	3.00
SPC	0.20	1.00	1.00	3.00	3.00	3.00
IS	0.20	0.33	0.33	1.00	1.00	3.00
D	0.33	3.00	0.33	1.00	1.00	0.33
CIM	0.20	0.33	0.33	0.33	3.00	1.00
Total	2.27	8.67	8.00	13.33	11.33	15.33
Response 7						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	0.33	5.00	3.00	5.00
I	0.33	1.00	0.33	0.33	1.00	3.00
SPC	3.00	3.00	1.00	3.00	3.00	1.00
IS	0.20	3.00	0.33	1.00	0.33	0.33
D	0.33	1.00	0.33	3.00	1.00	5.00
CIM	0.20	0.33	1.00	3.00	0.20	1.00
Total	5.07	11.33	3.33	15.33	8.53	15.33

Response 8						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	7.00	0.33	3.00	1.00
I	0.33	1.00	1.00	7.00	5.00	3.00
SPC	0.14	1.00	1.00	3.00	5.00	1.00
IS	3.00	0.14	0.33	1.00	1.00	1.00
D	0.33	0.20	0.20	1.00	1.00	3.00
CIM	1.00	0.33	1.00	1.00	0.33	1.00
Total	5.81	5.68	10.53	13.33	15.33	10.00
Response 9						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	3.00	3.00	5.00	1.00
I	0.33	1.00	0.33	0.33	3.00	9.00
SPC	0.33	3.00	1.00	5.00	5.00	3.00
IS	0.33	3.00	0.20	1.00	5.00	1.00
D	0.20	0.33	0.20	0.20	1.00	5.00
CIM	1.00	0.11	0.33	1.00	0.20	1.00
Total	3.20	10.44	5.07	10.53	19.20	20.00
Response 10						
	PS	I	SPC	IS	D	CIM
PS	1.00	3.00	1.00	0.33	3.00	1.00
I	0.33	1.00	1.00	3.00	1.00	5.00
SPC	1.00	1.00	1.00	3.00	3.00	3.00
IS	3.00	0.33	0.33	1.00	1.00	1.00
D	0.33	1.00	0.33	1.00	1.00	0.33
CIM	1.00	0.20	0.33	1.00	3.00	1.00
Total	6.67	6.53	4.00	9.33	12.00	11.33

Source: Author's sample

4.5.3.2 AHP – Stage 2 computation of Normalization Matrix

Table 4-57: Comparison matrixes

Response 1								
	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.14	0.32	0.25	0.08	0.05	0.14	0.98	0.16
I	0.05	0.11	0.25	0.25	0.15	0.05	0.85	0.14
SPC	0.14	0.11	0.25	0.25	0.45	0.41	1.60	0.27
IS	0.14	0.04	0.08	0.08	0.05	0.14	0.53	0.09
D	0.41	0.11	0.08	0.25	0.15	0.14	1.14	0.19
CIM	0.14	0.32	0.08	0.08	0.15	0.14	0.91	0.15
	1.00	1.00	1.00	1.00	1.00	1.00		
Response 2								
	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.15	0.33	0.15	0.09	0.26	0.04	1.02	0.17
I	0.05	0.11	0.15	0.03	0.09	0.63	1.05	0.18
SPC	0.15	0.11	0.15	0.26	0.44	0.04	1.16	0.19
IS	0.15	0.33	0.05	0.09	0.03	0.04	0.69	0.11
D	0.05	0.11	0.03	0.26	0.09	0.13	0.67	0.11
CIM	0.45	0.02	0.46	0.26	0.09	0.13	1.41	0.23
	1.00	1.00	1.00	1.00	1.00	1.00		
Response 3								
	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.08	0.14	0.05	0.05	0.09	0.11	0.50	0.08
I	0.08	0.14	0.14	0.41	0.26	0.04	1.06	0.18
SPC	0.25	0.14	0.14	0.14	0.09	0.11	0.85	0.14
IS	0.25	0.05	0.14	0.14	0.26	0.11	0.93	0.16
D	0.25	0.14	0.41	0.14	0.26	0.54	1.73	0.29
CIM	0.08	0.41	0.14	0.14	0.05	0.11	0.92	0.15
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 4

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.09	0.14	0.07	0.51	0.25	0.02	1.08	0.18
I	0.09	0.14	0.07	0.17	0.15	0.09	0.71	0.12
SPC	0.28	0.41	0.20	0.06	0.25	0.45	1.64	0.27
IS	0.03	0.14	0.59	0.17	0.25	0.27	1.45	0.24
D	0.02	0.05	0.04	0.03	0.05	0.09	0.28	0.05
CIM	0.47	0.14	0.04	0.06	0.05	0.09	0.85	0.14
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 5

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.15	0.21	0.58	0.10	0.09	0.11	1.24	0.21
I	0.05	0.07	0.04	0.10	0.09	0.04	0.39	0.06
SPC	0.03	0.21	0.12	0.31	0.26	0.11	1.04	0.17
IS	0.46	0.21	0.12	0.31	0.44	0.32	1.86	0.31
D	0.15	0.07	0.04	0.06	0.09	0.32	0.74	0.12
CIM	0.15	0.21	0.12	0.10	0.03	0.11	0.72	0.12
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 6

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.44	0.35	0.63	0.38	0.26	0.33	2.38	0.40
I	0.15	0.12	0.13	0.23	0.03	0.20	0.84	0.14
SPC	0.09	0.12	0.13	0.23	0.26	0.20	1.01	0.17
IS	0.09	0.04	0.04	0.08	0.09	0.20	0.53	0.09
D	0.15	0.35	0.04	0.08	0.09	0.02	0.72	0.12
CIM	0.09	0.04	0.04	0.03	0.26	0.07	0.52	0.09
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 7

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.20	0.26	0.10	0.33	0.35	0.33	1.57	0.26
I	0.07	0.09	0.10	0.02	0.12	0.20	0.59	0.10
SPC	0.59	0.26	0.30	0.20	0.35	0.07	1.77	0.29
IS	0.04	0.26	0.10	0.07	0.04	0.02	0.53	0.09
D	0.07	0.09	0.10	0.20	0.12	0.33	0.89	0.15
CIM	0.04	0.03	0.30	0.20	0.02	0.07	0.65	0.11
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 8

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.17	0.53	0.66	0.03	0.20	0.10	1.69	0.28
I	0.06	0.18	0.09	0.53	0.33	0.30	1.48	0.25
SPC	0.02	0.18	0.09	0.23	0.33	0.10	0.95	0.16
IS	0.52	0.03	0.03	0.08	0.07	0.10	0.81	0.14
D	0.06	0.04	0.02	0.08	0.07	0.30	0.55	0.09
CIM	0.17	0.06	0.09	0.08	0.02	0.10	0.52	0.09
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 9

	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.31	0.29	0.59	0.28	0.26	0.05	1.79	0.30
I	0.10	0.10	0.07	0.03	0.16	0.45	0.90	0.15
SPC	0.10	0.29	0.20	0.47	0.26	0.15	1.47	0.25
IS	0.10	0.29	0.04	0.09	0.26	0.05	0.84	0.14
D	0.06	0.03	0.04	0.02	0.05	0.25	0.45	0.08
CIM	0.31	0.01	0.07	0.09	0.01	0.05	0.54	0.09
Total	1.00	1.00	1.00	1.00	1.00	1.00		

Response 10								
	PS	I	SPC	IS	D	CIM	Total	Average
PS	0.15	0.46	0.25	0.04	0.25	0.09	1.23	0.21
I	0.05	0.15	0.25	0.32	0.08	0.44	1.30	0.22
SPC	0.15	0.15	0.25	0.32	0.25	0.26	1.39	0.23
IS	0.45	0.05	0.08	0.11	0.08	0.09	0.86	0.14
D	0.05	0.15	0.08	0.11	0.08	0.03	0.51	0.08
CIM	0.15	0.03	0.08	0.11	0.25	0.09	0.71	0.12
Total	1.00	1.00	1.00	1.00	1.00	1.00		

4.5.3.3 AHP – Stage 3 Pairwise Matrix of 10 responses

Table 4-58: Pairwise Matrix by average

	PS	I	SPC	IS	D	CIM
PS	1.00	2.60	2.40	1.93	2.67	1.65
I	0.38	1.00	0.73	2.13	1.73	3.00
SPC	0.42	1.36	1.00	2.53	3.53	2.13
IS	0.52	0.47	0.39	1.00	2.00	1.47
D	0.38	0.58	0.28	0.50	1.00	2.47
CIM	0.60	0.33	0.47	0.68	0.41	1.00
total	3.30	6.34	5.28	8.78	11.34	11.72

Source: Author's sample

Table 4-59: Pairwise Matrix by Geometric Mean

	PS	I	SPC	IS	D	CIM
PS	1.00	2.41	1.35	1.11	1.92	1.05
I	0.42	1.00	0.64	1.21	1.31	1.72
SPC	0.74	1.55	1.00	2.03	2.95	1.63
IS	0.90	0.82	0.49	1.00	1.17	1.12
D	0.52	0.76	0.34	0.86	1.00	1.62
CIM	0.95	0.58	0.61	0.90	0.62	1.00
total	4.53	7.13	4.43	7.11	8.97	8.14

Source: Author's sample

4.5.3.4 AHP – Stage 4 Normalized Matrix

Table 4-60: Normalized Matrix for Average

	PS	I	SPC	IS	D	CIM	Total	Weights
PS	0.30	0.41	0.45	0.22	0.24	0.14	1.76	0.2940
I	0.12	0.16	0.14	0.24	0.15	0.26	1.06	0.1775
SPC	0.13	0.21	0.19	0.29	0.31	0.18	1.31	0.2188
IS	0.16	0.07	0.07	0.11	0.18	0.13	0.72	0.1201
D	0.11	0.09	0.05	0.06	0.09	0.21	0.61	0.1023
CIM	0.18	0.05	0.09	0.08	0.04	0.09	0.52	0.0872
total	1.00	1.00	1.00	1.00	1.00	1.00	6.00	1.0000

Source: Author's sample

Table 4-61: Normalized Matrix for Geometric Mean

For Geometric Mean								
	PS	I	SPC	IS	D	CIM	total	Weights
PS	0.22	0.34	0.30	0.16	0.21	0.13	1.36	0.23
I	0.09	0.14	0.15	0.17	0.15	0.21	0.91	0.15
SPC	0.16	0.22	0.23	0.29	0.33	0.20	1.42	0.24
IS	0.20	0.12	0.11	0.14	0.13	0.14	0.83	0.14
D	0.12	0.11	0.08	0.12	0.11	0.20	0.73	0.12
CIM	0.21	0.08	0.14	0.13	0.07	0.12	0.75	0.12
total	1	1	1	1	1	1		

Source: Author's sample

4.5.3.5 AHP – Stage 5 Consistency Analysis

Table 4-62: Consistency Analysis for Average Based Computation

	PS	I	SPC	IS	D	CIM	Weights
PS	1.00	2.60	2.40	1.93	2.67	1.65	0.2940
I	0.38	1.00	0.73	2.13	1.73	3.00	0.1775
SPC	0.42	1.36	1.00	2.53	3.53	2.13	0.2188
IS	0.52	0.47	0.39	1.00	2.00	1.47	0.1201
D	0.38	0.58	0.28	0.50	1.00	2.47	0.1023
CIM	0.60	0.33	0.47	0.68	0.41	1.00	0.0872

For six factors considered (i.e. n=6)

Source: Author's sample

Table 4-63: Decision Table for Average Based AHP

	l	l-h	n-1	CI	RI	Cr
PS	6.564232	0.451514	5	0.090303	1.24	0.07
I	6.458962					
SPC	6.55975					
IS	6.445051					
D	6.374319					
CIM	6.306769					
l max	6.451514					

Source: Author's sample

Table 4-64: Consistency Analysis for Geometric Mean-Based Computation

	PS	I	SPC	IS	D	CIM	Weights
PS	1.00	2.41	1.35	1.11	1.92	1.05	0.2268
I	0.42	1.00	0.64	1.21	1.31	1.72	0.1509
SPC	0.74	1.55	1.00	2.03	2.95	1.63	0.2373
IS	0.90	0.82	0.49	1.00	1.17	1.12	0.1389
D	0.52	0.76	0.34	0.86	1.00	1.62	0.1216
CIM	0.95	0.58	0.61	0.90	0.62	1.00	0.1245

For six factors considered (i.e. n=6)

Source: Author's sample

Table 4-65: Decision Table for Geometric Mean Based AHP

	l	l-h	n-1	CI	RI	Cr
PS	6.293593	0.239482	5	0.047896	1.24	0.04
I	6.229686					
SPC	6.259974					
IS	6.230003					
D	6.218509					
CIM	6.205127					
l max	6.239482					

Source: Author's sample

4.5.3.6 AHP – results

Since the consistency ratio in both approaches (i.e. consideration of average and geometric mean) less than 0.1, we can accept the priority shown by the factor weights. Based on the factor weights derived under AHP analysis, following priorities can be considered for further improvements to six factors identified through 59 responses.

Table 4-66: Average based AHP results

Key functional area	Factor weight
Physical Security	0.2940
Service Point Capacity	0.1775
Insurance	0.2188
Information Systems	0.1201
Distribution	0.1023
Cash Inventory Management	0.0872

Source: Author's sample

Table 4-67: Geometric mean based AHP results

Key functional area	Factor weight
Physical Security	0.2268
Service Point Capacity	0.1509
Insurance	0.2373
Information Systems	0.1389
Cash Inventory Management	0.1216
Distribution	0.1245

Source: Author's sample

5 DISCUSSION OF FINDINGS

Physical security is an inherent requirement of the cash supply chain as there is a significant increase in the risk of fraud especially during the pandemic. According to the general understanding, cash in transit in remote areas and remote ATMs are more vulnerable to fraud risk than the security threats to branch premises. As per the observations, 36% of the respondents do not agree that the prevailing physical security infrastructure is adequate. As a management strategy in private banks, 50% use a combination of security services from the bank and the private service providers. However, 32% of private banks have fully outsourced the service while the percentage of the government banks is only 4%.

Comparatively 82% of private banks stated that the available facilities are sufficient. This might be due to the customer base of the private banks which is more e-friendly than government banks. When the customers prefer for ATM cards and internet banking services, the requirement for physical existence of service points would be reduced. However, even though the customers prefer to pay by cards, small-scale vendors preferred to make cash sales due to the bad economic condition due to the pandemic. Further, the staff allocation was a problem during the period where travel restrictions were imposed due Covid-19 pandemic. With regard to business continuity perspective, banks used mobile ATMs to improve service point capacity. Until a significant portion of customers and businessmen get used with e-based transactions, service point capacity would be a critical issue that needs to be addressed.

Only 69% made positive responses for prevailing insurance limit in terms of both branches and ATMs. In some situations, ATM customer services get interrupted due to restricted insurance limits. Excess cash inventory also caused to have forgone income in missing the intraday investment opportunities. Insurance limits are decided by banks, considering the tradeoff between insurance cost and the daily cash flow requirement in ad hoc basis. This is because unlike in the global cash supply chain management practices, banks do not use decision supportive cash inventory models for optimizing decisions which are directly linked with demand forecasting.

Information management flow is a key flow in any supply chain. With regard to the information systems used in the global context, information sharing is embedded in their process effectively. It addresses all information related requirement of all supply chain partners as a seamless

integration that facilitates proactive and effective decision making. The study shows that around 40-45% of effective usage of information systems relevant to the cash supply chain while private banks show 60-76%.

With regard to cash distribution, banks mainly use three methods. Banks which has outsourced services or having a central cash processing unit shows more than 80% satisfaction level of their cash distribution. Although borrowing money from another bank in the same area is possible, it would cost more than 5% of total cash borrowed. Globally the cash supply chain has significant developments with regard to cash logistics function. This considers cash transportation with root optimization, cash inventory management with optimum cash flow management which directly links with demand forecasting and optimum warehouse management with adequate security functions.

In countries like Brazil and China, state of art hubs for currency distribution has been implemented with significant involvement of their central banks and with collaboration of multiple supply chain partners to minimize the cost factor in the cash supply chain.

6. CONCLUSION AND FUTURE DIRECTIONS.

6.1 Introduction

The purpose of this study is to study the cash supply chain management practices in Sri Lankan context and to identify the key functional areas that to be further improved related to cash supply chain in Sri Lanka. The strategies used in cash supply chain management in Sri Lankan banks are discussed below in line with the findings of the research.

6.2 Summary of findings

Satisfaction in regard to IT systems to communicate up stream, Information systems related to ALM function, Information security, Business continuity Arrangement is different between private banks and government banks under 95% confidence level. Lower Mean rank in Government banks show overall lower satisfactory level compared to private banks.

Overall level of satisfaction of the cash supply chain management of the branches was captured from 59 branch managers and there was no significant difference between government banks and private banks under 95% level of confidence. Summary statistics shows that there is 59.32% of overall level of satisfaction in the sample. Therefore, confidence level for satisfied category is computed under 95% level of confidence and the proportion of the satisfied category can be varied approximately between 47% and 72%.

According to the AHP analysis, it is revealed that Physical Security, Service Point Capacity, Insurance, Information Systems, Distribution and Cash Inventory Management are the key functional areas that need to be focused as strategies to further development of the cash supply chain. The importance priority of 6 factors are as per the order given in the below table. The priority level of the Cash Inventory Management and Distribution have interchanged in two approaches

Table 6-1: Summary results of AHP Analysis

Average based AHP results		Geometric mean based AHP results	
Key functional area	Factor weight	Key functional area	Factor weight
Physical Security	0.2940	Physical Security	0.2268
Service Point Capacity	0.2188	Service Point Capacity	0.2373
Insurance	0.1775	Insurance	0.1509
Information Systems	0.1201	Information Systems	0.1389
Distribution	0.1023	Cash Inventory Management	0.1245
Cash Inventory Management	0.0872	Distribution	0.1216

Source: Author's sample

6.3 Limitations and further research.

Since the sample size of this research was limited to 59, the insights that could be gained from them on the research area were limited.

It is statistically identified that satisfactory level of some key elements, i.e. IT systems to communicate up stream, Information systems related to ALM function, Information security and Business continuity Arrangement are significantly different in private banks and government banks though the overall satisfaction is not different between two groups. Similarly, asset based, business volumes with regard to savings might impact to create differences in implementation of supply chain strategies and satisfactory levels related to cash supply chain. Further, banks can be classified based on implementation of key elements in cash supply chain to formulate a road map to uplift the service area in the country. Cash supply chain can be considered from customers' perspective in future researches

In line with the strategic supply chain management and sustainability concepts, there are ample of optimization opportunities in cash supply chain in the Sri Lankan context. Application of distribution models, strategic collaborations, demand forecasting and cash inventory models, supply chain integrations and data science are some of the key research area to be considered by future researchers since financial modeling and optimization of AML functions are being considered by mainly financial management professionals.

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APPENDIX

Appendix I : Questionnaire – I



“A study on Cash Supply Chain in Banking Sector, Sri Lanka” Research survey questionnaire:

Scope: Local currency circulation

Target group: Branch Managers of licensed Banks of Sri Lanka.

All information collected by this survey will be treated as strictly confidential data. Individual information will not be released to third parties.

Thank you in advance.

JLP Manjula

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MBA in Supply Chain Management

DEPARTMENT OF TRANSPORT & LOGISTICS MANAGEMENT

University of Moratuwa

* Required

Service Point Capacity

Branch Vault, ATM/CRM & Counter, Staff

1.1 Vault condition/capacity at branch is at satisfactory level for current cash storing requirement *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

1.2 Sufficient number of counters, ATMs/CRMs are allocated based on the transaction volumes *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

1.3 Sufficient number of competent staff are allocated for all related sections in cash management, i.e. counters, ATMs/CRMs, vault handling staff etc. based on the business volumes *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

Liquidity Management

Monitor treasury operations and liquidity management prudently

2.1 Asset and Liability Management Committee together with Risk Management, Compliance and Audit functions ensure the management of overall cash flow management in the bank as per the policies such as Asset and Liability management Policy, Risk Management Policies. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree
- ☐ Not Aware

2.2 Branch staff is adequately guided with well-set procedures on End of the Day (EOD) cash excess/shortages management *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

2.3 Robust demand forecasting systems is in place for more accurate predictions *

- ☐ True
- ☐ False

Insurance

Insurance limit related restrictions

3.1 Insurance limit related to Branch Cash position is reviewed adequately and timely for the current trend *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

3.2 Insurance limit related to ATMs/CRMs cash positions are review adequately and timely review for the current trend *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

Cash Inventory Management

cash ordering restrictions, reorder levels for cash inventory

4.1 Possible frequency of cash ordering *

- ☐ Daily
- ☐ Two times per week
- ☐ Three times per week
- ☐ Weekly
- ☐ Once in two weeks
- ☐ Twice a month
- ☐ Monthly
- ☐ Other: _____

4.2 System based models are used to determine reorder levels for reliable cash replenishments (usage of inventory models) *

- ☐ True
- ☐ False

Compliance

Anti Money Laundering (AML) and Customer Due Diligence (CDD) requirements

5.1 The bank effectively implemented procedures, policies and central monitoring mechanism with regard to Customer Due Diligence (CDD) & Anti Money Laundering (AML) related regulatory requirements *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Physical Security

Protection of the premises and staff, Security of Cash in Transit (CIT)

6.1 Adequate number of security personnel is available to ensure the protection of the branches *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

6.2 Physical security related infrastructure/equipment are installed adequately in branches and service points (ATMs/CRMs/Mobile ATMs) to mitigate the risk of fire, fraud and natural disasters. *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Distribution

Distribution of currency and coins

7.1 Cash transportation is handled by *

- ☐ only the Bank
- ☐ Both bank and Private service providers
- ☐ Outsourced

7.2 Cash transportation security is handled by *

- ☐ only the Bank
- ☐ Both bank and Private service providers
- ☐ Outsourced

7.3 Cash distribution administration *

- ☐ The bank
- ☐ The Bank - Central cash processing unit
- ☐ Outsourced

7.4 Availability of cash Distribution Centers (bank own or Outsourced company) *

- ☐ Yes
- ☐ No
- ☐ Not Outsourced

7.5 Satisfactory level of Cash Distribution *

- ☐ Dissatisfied
- ☐ Slightly Dissatisfied
- ☐ Neutral
- ☐ Slightly Satisfied
- ☐ Satisfied

Value added services

Sub processes to quality and convenient service delivery, reverse logistic

8.1 If the bank has already outsourced the cash logistics function, do they provide following value added services

	The Bank not considered	Yes	No	Not aware
Cash sorting	☐	☐	☐	☐
cash disinfection/cleaning	☐	☐	☐	☐
ATM cash replenishments	☐	☐	☐	☐
cash bundling as per the requirements	☐	☐	☐	☐
process unfit cash	☐	☐	☐	☐

Service point monitoring

Real time ATMs/CRMs monitoring support service and real time alerting

9.1 The Bank has properly established dedicated 24*7 ATM monitoring support unit and automatic alerting mechanism *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

Information Systems

capturing and sharing the information in an integrated manner

10.1 Information systems are effectively used to capture and timely share information with respective participants (i.e. cash distribution administration, outsourced parties, internal customers/inter departments) in cash supply chain. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

10.2 IT systems are effectively use to manage daily cash position of the branch supporting banks ALM function (bulk cash transferring facilities and treasury systems), both branch and ATM reconciliations for financial consolidations and state of the art MIS. *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Maintenance

Maintenance of ATMs/CRMS, Power sources (generators), IT Infrastructure, Telecommunication and other equipment

11.1 To ensure the uninterrupted customer service, preventive maintenance is in place in regard to ATMs/CRMS, Counting Machines, Power sources, IT infrastructure, telecommunication etc. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Information Security

Availability, Integrity and Confidentiality of business information

12.1 The bank has effectively implemented Information security measures related to cash management processes covering both staff, customer and third party involvement (eg. password protected Information systems, available for authorized users, restricted functions and authorized user on need to know basis, access controls such as two factor authentication where it is necessary, information security policies-including Acceptable use policy, controls for information sharing storing printing, information classification as critical information etc., frequent system user reviews, timely system user activation and deactivation, review and monitoring of system access privileges, system audit trails/logs, incident reporting mechanism, PCI DSS, ISMS) *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Customer and supplier Interaction

effective communication with customers & suppliers

13.1 Channels are adequate (24*7 call center, other social media live chat, dedicated telephone lines, customer/supplier notifications & alerts, intranet, updated corporate website). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

13.2 Specific key procedures available for communicate Customers and suppliers are effective and adequate (e.g. customer awareness on ATM/CRM procedures, evaluation procedures for customer satisfaction, performance of all parties engaged to cash supply chain (internal staff, third parties), Non-Disclosure Agreements (NDA), Service level Agreements (SLA), whistle blowing procedure, customer charter, complaint handling procedures, internal circular instructions, staff trainings on customer relationship management etc) *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Business Continuity Arrangements

cash distribution arrangements by banks/ outsourced service providers

14.1 Cash distribution related Business Continuity Arrangements are effectively executed during the pandemic. *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree
- ☐ Not outsourced

14.2 What are the methods/business continuity arrangements used to improve customer service during the pandemic related to cash management functions and service availability for deposit acceptance and cash withdrawals etc. *

Your answer _____

Ecological Factor

strategies towards environmental protection

15.1 Environmental friendliness - The Bank has taken effective measures to reduce ecological footprint in cash supply chain. *

	Effectively use	Use but not effective	Not use	Not aware
Encourage for slipless ATM usage	☐	☐	☐	☐
Steps taken to use more digitalize information than hard copies	☐	☐	☐	☐
Measure carbon foot print of transportation, AC usage	☐	☐	☐	☐
Measure Electricity consumption of Branches, Distribution Centers, ATMs	☐	☐	☐	☐
Use reusable energy sources (eg. solar powered ATMS, Branches)	☐	☐	☐	☐
Measure Water consumption of Branches, Distribution Centers	☐	☐	☐	☐
Use ecofriendly disposable material or degradable bagages/covers	☐	☐	☐	☐

16. Overall satisfactory level of the Cash supply chain management *

☐ Dissatisfied

☐ Satisfied

31. Please mark the important level of need for further improvement in the following key functional areas of the cash supply chain. *

Mark only one oval per row.

	Extremely Important - for further improvements	Very Important - for further improvements	Important - for further improvements	Slightly Important - for further improvements	Neither Important nor Unimportant - for further improvements	Slightly unimportant - for further improvements	unimportant - for further improvements	Highly unimportant - for further improvements	Extremely Unimportant - for further improvements
Cash inventory management	☐	☐	☐	☐	☐	☐	☐	☐	☐
Physical Security	☐	☐	☐	☐	☐	☐	☐	☐	☐
Information Systems	☐	☐	☐	☐	☐	☐	☐	☐	☐
Customer and supplier Interaction	☐	☐	☐	☐	☐	☐	☐	☐	☐
Liquidity Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
Distribution	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐	☐	☐	☐	☐
Service point capacity	☐	☐	☐	☐	☐	☐	☐	☐	☐
Value Added services	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insurance	☐	☐	☐	☐	☐	☐	☐	☐	☐
Information Security	☐	☐	☐	☐	☐	☐	☐	☐	☐
Service point monitoring	☐	☐	☐	☐	☐	☐	☐	☐	☐
Business Continuity Arrangements	☐	☐	☐	☐	☐	☐	☐	☐	☐
Compliance (AML/CDD)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ecological factor	☐	☐	☐	☐	☐	☐	☐	☐	☐

Title (Optional) *

☐ MS

☐ MR

Your Name or short Name (Optional)

Your answer

Bank Name (Optional)

Your answer

Bank Category *

☐ Government

☐ Private

District of the branch attached *

Your answer

Branch Experience in years *

Your answer

Suggestions for improvement

Your answer

Other opinions, queries

Your answer

Email

Your answer

Appendix II : Questionnaire – II (AHP)

“A study on Cash Supply Chain in Banking Sector, Sri Lanka” Research survey questionnaire:

Scope: Local currency circulation

Target group: Branch Managers of licensed Banks of Sri Lanka.

All information collected by this survey will be treated as strictly confidential data. Individual information will not be released to third parties.

Thank you in advance.

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Note: This is an extension to the Questionnaire previously answered under the caption of “A study on Cash Supply Chain in Banking Sector, Sri Lanka”.

Following six functional areas have been identified as the most important areas for further improvements in cash supply chain in Sri Lanka.

1. Physical Security
2. Insurance
3. Service Point Capacity
4. Information Systems
5. Distribution
6. Cash Inventory Management

Based on your knowledge / experience on how important it is to improve one key functional area over another key functional area, you are supposed to make a pair wise comparison between the key functional areas mentioned above.

Use the following scale to mark (X) the level of importance in AHP response Table.

Preference factor	Degree of preference	Explanation
1	Equally important	both key functional areas are equally important for further improvement
3	Slightly important	Judgment slightly favor towards one key functional area when considering the importance for further improvement
5	Important	One key functional area is important than other when considering the importance for further improvement
7	Very Important	One key functional area is very important than other when considering the importance for further improvement
9	Extremely Important	One key functional area is extremely important than other when considering the importance for further improvement

AHP response Table

LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance
Physical Security										Service Point Capacity
Physical Security										Information Systems
Physical Security										Distribution
Physical Security										Cash Inventory Management
Insurance										Service Point Capacity
Insurance										Information Systems
Insurance										Distribution
Insurance										Cash Inventory Management
Service Point Capacity										Information Systems
Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management
Information Systems										Distribution
Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management

Appendix III: Summary of data – Questionnaire I

	Bank Category	District of the branch attached	Gender	Branch Experience in years		Bank Category	District of the branch attached	Gender	Branch Experience in years
1	Private	Gampaha	MS	5	38	Private	Colombo	MS	7
2	Government	Colombo	MR	8	39	Private	Kurunegala	MS	6
3	Government	Kandy	MS	10	40	Private	Colombo	MS	7
4	Government	Ampara	MR	7	41	Private	Colombo	MS	16
5	Government	Galle	MS	6	42	Government	Colombo	MR	10
6	Private	Galle	MS	8	43	Government	Colombo	MR	11
7	Government	Colombo	MR	9	44	Government	Colombo	MR	6
8	Private	Kandy	MS	10	45	Private	Colombo	MS	7
9	Private	Vavuniya	MS	5	46	Government	Polonnaruwa	MS	5
10	Private	Ampara	MR	5	47	Government	Colombo	MS	7
11	Private	Galle	MR	20	48	Private	Colombo	MR	14
12	Private	Kandy	MR	12	49	Government	Gampaha	MR	15
13	Private	Colombo	MR	15	50	Government	Matara	MS	7
14	Private	Colombo	MR	7	51	Government	Matara	MS	16
15	Private	Badulla	MR	8	52	Government	Gampaha	MS	7
16	Government	Colombo	MS	16	53	Private	Colombo	MS	5
17	Government	Galle	MR	5	54	Private	Colombo	MR	11
18	Private	Nuwaraeliya	MR	7	55	Private	Kalutara	MR	10
19	Private	Nuwaraeliya	MR	19	56	Private	Colombo	MR	10
20	Government	Galle	MR	6	57	Private	Colombo	MS	5
21	Government	Badulla	MR	5	58	Private	Galle	MR	5
22	Government	Kalutara	MS	6	59	Private	Kalutara	MR	10
23	Private	Anuradhapura	MS	5					
24	Private	Colombo	MR	16					
25	Private	Colombo	MR	10					
26	Government	Badulla	MR	10					
27	Government	Colombo	MR	6					
28	Government	Colombo	MS	12					
29	Government	Kandy	MR	10					
30	Private	Polonnaruwa	MR	10					
31	Private	Colombo	MR	8					
32	Private	Colombo	MR	6					
33	Government	Colombo	MR	15					
34	Private	Colombo	MR	17					
35	Government	Kurunegala	MR	10					
36	Private	Colombo	MR	7					
37	Private	Colombo	MR	12					

	Service Point capacity			Liquidity Management		
	1.1 Vault condition/capacity	1.2 counters, ATMs/CRMs allocation	1.3 competent staff are allocation	2.1 Management Oversight	2.2 EOD Cash position Management	2.3 demand forecasting systems
1	Strongly disagree	Strongly agree	Strongly agree	Agree	Agree	TRUE
2	Strongly disagree	Strongly disagree	Agree	Strongly Agree	Strongly Agree	FALSE
3	Agree	Agree	Agree	Agree	Agree	FALSE
4	Strongly agree	Agree	Neutral	Strongly Agree	Strongly Agree	FALSE
5	Agree	Agree	Agree	Neutral	Agree	FALSE
6	Neutral	Agree	Neutral	Strongly Agree	Strongly Agree	FALSE
7	Agree	Agree	Agree	Agree	Neutral	FALSE
8	Agree	Agree	Strongly disagree	Strongly Agree	Agree	FALSE
9	Agree	Agree	Neutral	Strongly Agree	Agree	FALSE
10	Strongly agree	Neutral	Strongly disagree	Agree	Agree	FALSE
11	Strongly agree	Agree	Agree	Agree	Strongly Agree	FALSE
12	Agree	Agree	Disagree	Agree	Agree	FALSE
13	Neutral	Neutral	Disagree	Neutral	Neutral	FALSE
14	Agree	Agree	Neutral	Not Aware	Agree	FALSE
15	Agree	Agree	Agree	Strongly Agree	Strongly Agree	FALSE
16	Agree	Agree	Agree	Agree	Agree	FALSE
17	Agree	Disagree	Neutral	Agree	Neutral	FALSE
18	Agree	Agree	Agree	Agree	Agree	FALSE
19	Agree	Agree	Neutral	Agree	Disagree	FALSE
20	Disagree	Disagree	Neutral	Disagree	Neutral	FALSE
21	Agree	Agree	Agree	Strongly Agree	Agree	FALSE
22	Agree	Agree	Neutral	Neutral	Agree	FALSE
23	Strongly agree	Agree	Neutral	Not Aware	Strongly Agree	TRUE
24	Agree	Agree	Agree	Agree	Agree	TRUE
25	Disagree	Agree	Strongly agree	Strongly Agree	Agree	FALSE
26	Agree	Agree	Agree	Agree	Agree	FALSE
27	Neutral	Neutral	Neutral	Neutral	Neutral	FALSE
28	Strongly agree	Disagree	Disagree	Strongly Agree	Agree	FALSE
29	Disagree	Neutral	Agree	Disagree	Neutral	FALSE
30	Agree	Agree	Agree	Agree	Agree	FALSE
31	Agree	Neutral	Agree	Agree	Neutral	FALSE
32	Strongly agree	Agree	Agree	Not Aware	Neutral	FALSE
33	Agree	Disagree	Neutral	Neutral	Disagree	TRUE
34	Agree	Agree	Agree	Agree	Agree	FALSE
35	Disagree	Strongly agree	Disagree	Strongly Agree	Agree	TRUE

	Service Point capacity			Liquidity Management		
	1.1 Vault condition/capacity	1.2 counters, ATMs/CRMs allocation	1.3 competent staff are allocation	2.1 Management Oversight	2.2 EOD Cash position Management	2.3 demand forecasting systems
36	Agree	Agree	Agree	Agree	Agree	TRUE
37	Disagree	Agree	Disagree	Agree	Agree	TRUE
38	Strongly agree	Agree	Agree	Agree	Agree	TRUE
39	Agree	Agree	Agree	Agree	Agree	TRUE
40	Neutral	Agree	Agree	Agree	Agree	TRUE
41	Agree	Agree	Agree	Agree	Neutral	FALSE
42	Strongly agree	Neutral	Agree	Strongly Agree	Agree	TRUE
43	Agree	Agree	Agree	Agree	Agree	TRUE
44	Agree	Agree	Agree	Agree	Agree	FALSE
45	Disagree	Agree	Disagree	Neutral	Agree	FALSE
46	Neutral	Disagree	Neutral	Agree	Agree	FALSE
47	Agree	Agree	Agree	Strongly Agree	Neutral	FALSE
48	Agree	Agree	Agree	Neutral	Agree	FALSE
49	Agree	Agree	Agree	Neutral	Neutral	FALSE
50	Agree	Agree	Agree	Agree	Agree	FALSE
51	Agree	Strongly agree	Agree	Agree	Neutral	FALSE
52	Agree	Agree	Agree	Agree	Neutral	TRUE
53	Agree	Agree	Agree	Neutral	Neutral	FALSE
54	Strongly agree	Strongly agree	Strongly agree	Agree	Agree	FALSE
55	Disagree	Disagree	Disagree	Neutral	Agree	FALSE
56	Agree	Agree	Agree	Agree	Neutral	FALSE
57	Agree	Agree	Agree	Agree	Agree	FALSE
58	Neutral	Disagree	Neutral	Agree	Neutral	FALSE
59	Disagree	Neutral	Disagree	Neutral	Agree	FALSE

	Insurance		Cash Inventory Management		Compliance	Physical Security	
	3.1 Insurance limit -Branch Cash position	3.2 Insurance limit - ATMs/CRMs	4.1 Possible frequency of cash ordering	4.2 Cash inventory models	5.1 AML/CDD	6.Adequcy of security personnel	6.2 Physical security related infrastructure
1	Disagree	Disagree	Once in two weeks	FALSE	Agree	Agree	Agree
2	Strongly Agree	Strongly agree	Daily basis	FALSE	Agree	Strongly Agree	Neutral
3	Agree	Neutral	Three times per week	FALSE	Agree	Neutral	Neutral
4	Disagree	Disagree	Once in two weeks	FALSE	Agree	Strongly Agree	Strongly Agree
5	Agree	Agree	Weekly	FALSE	Strongly Agree	Agree	Agree
6	Strongly Disagree	Strongly disagree	Once in two weeks	FALSE	Strongly Agree	Agree	Agree
7	Agree	Agree	Monthly	FALSE	Agree	Agree	Agree
8	Disagree	Disagree	Other	FALSE	Strongly Agree	Disagree	Disagree
9	Agree	Agree	Once in two weeks	FALSE	Strongly Agree	Strongly Agree	Strongly Agree
10	Strongly Agree	Strongly agree	Once in two weeks	FALSE	Strongly Agree	Agree	Agree
11	Disagree	Disagree	Once in two weeks	FALSE	Strongly Agree	Agree	Agree
12	Agree	Agree	Weekly	FALSE	Agree	Agree	Agree
13	Agree	Agree	Weekly	FALSE	Agree	Agree	Agree
14	Strongly Agree	Disagree	Twice a month	FALSE	Strongly Agree	Strongly Agree	Strongly Agree
15	Agree	Agree	Monthly	FALSE	Agree	Agree	Strongly Agree
16	Disagree	Disagree	Three times per week	FALSE	Agree	Agree	Agree
17	Strongly Agree	Strongly agree	Three times per week	FALSE	Agree	Agree	Neutral
18	Agree	Neutral	Two times per week	FALSE	Agree	Agree	Agree
19	Agree	Agree	Two times per week	FALSE	Neutral	Neutral	Neutral
20	Strongly Agree	Strongly agree	Daily	FALSE	Agree	Agree	Agree
21	Neutral	Neutral	Two times per week	FALSE	Agree	Neutral	Neutral
22	Agree	Agree	Three times per week	FALSE	Agree	Agree	Agree
23	Agree	Agree	Three times per week	FALSE	Agree	Agree	Agree
24	Agree	Agree	Two times per week	FALSE	Agree	Agree	Strongly Agree
25	Neutral	Neutral	Two times per week	FALSE	Neutral	Neutral	Agree
26	Agree	Agree	2 times per month	FALSE	Agree	Strongly Agree	Neutral
27	Agree	Agree	Twice a month	FALSE	Agree	Disagree	Disagree

	Insurance		Cash Inventory Management		Compliance	Physical Security	
	3.1 Insurance limit -Branch Cash position	3.2 Insurance limit - ATMs/CRMs	4.1 Possible frequency of cash ordering	4.2 Cash inventory models	5.1 AML/CDD	6.Adequacy of security personnel	6.2 Physical security related infrastructure
28	Agree	Agree	Weekly	FALSE	Neutral	Agree	Agree
29	Agree	Agree	Once in two weeks	FALSE	Agree	Agree	Neutral
30	Agree	Agree	Weekly	FALSE	Neutral	Disagree	Disagree
31	Strongly Agree	Agree	Once a week	TRUE	Agree	Disagree	Agree
32	Neutral	Neutral	Weekly	FALSE	Neutral	Neutral	Disagree
33	Strongly Disagree	Disagree	Daily	FALSE	Agree	Strongly Agree	Neutral
34	Agree	Agree	Weekly	FALSE	Agree	Agree	Agree
35	Agree	Agree	Once in two weeks	FALSE	Strongly Agree	Agree	Disagree
36	Agree	Agree	Twice a month	FALSE	Agree	Agree	Agree
37	Agree	Agree	Daily	FALSE	Strongly Agree	Agree	Agree
38	Agree	Agree	Two times per week	FALSE	Agree	Disagree	Strongly disagree
39	Agree	Agree	Net cash lender	FALSE	Agree	Neutral	Agree
40	Neutral	Agree	Three times per week	FALSE	Agree	Agree	Agree
41	Agree	Agree	Monthly	FALSE	Agree	Agree	Agree
42	Agree	Agree	One time per week	FALSE	Neutral	Agree	Agree
43	Neutral	Agree	Three times per week	FALSE	Agree	Neutral	Neutral
44	Agree	Agree	Three times per week	FALSE	Agree	Agree	Agree
45	Strongly Agree	Strongly agree	once per two weeks	FALSE	Agree	Strongly Agree	Strongly Agree
46	Strongly Agree	Strongly agree	Two times per week	FALSE	Agree	Agree	Agree
47	Neutral	Neutral	Two times per week	FALSE	Neutral	Agree	Neutral
48	Strongly Agree	Agree	One time per week	FALSE	Agree	Strongly Agree	Agree
49	Agree	Agree	Once a week	FALSE	Agree	Neutral	Neutral
50	Agree	Agree	Once a month	FALSE	Neutral	Agree	Agree
51	Agree	Agree	Other	FALSE	Agree	Agree	Agree
52	Disagree	Disagree	Once in two weeks	FALSE	Agree	Disagree	Disagree
53	Disagree	Neutral	Daily	FALSE	Agree	Neutral	Neutral
54	Agree	Agree	Two times per week	FALSE	Agree	Agree	Agree
55	Agree	Agree	Daily	FALSE	Strongly Agree	Agree	Agree
56	Neutral	Neutral	Once in two weeks	FALSE	Agree	Disagree	Agree
57	Neutral	Agree	Daily	FALSE	Neutral	Agree	Disagree
58	Neutral	Neutral	Weekly	FALSE	Agree	Disagree	Neutral
59	Agree	Agree	Weekly	FALSE	Agree	Agree	Agree

	Distribution				
	Cash transportation is handled by	6.4 Cash transportation security is handled by	Cash distribution administration	Availability of Distribution Centers by the bank/Outsourced company	Satisfactory level of Cash Distribution
1	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Dissatisfied
2	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Dissatisfied
3	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Satisfied
4	only Bank	Bank only	The Bank - CCPU	No	Satisfied
5	only Bank	Bank only	The Bank - CCPU	Yes	Satisfied
6	Both Bank & Private	Both Bank & Private	The Bank - CCPU	Yes	Neutral
7	only Bank	Bank only	The Bank	Yes	Satisfied
8	Outsourced	Both Bank & Private	The Bank	No	Slightly Satisfied
9	Both Bank & Private	Bank only	The Bank	No	Slightly Satisfied
10	only Bank	Bank only	The Bank	No	Satisfied
11	only Bank	Outsourced	The Bank - CCPU	Yes	Slightly Satisfied
12	only Bank	Both Bank & Private	The Bank - CCPU	Yes	Satisfied
13	only Bank	Both Bank & Private	The Bank - CCPU	No	Slightly Satisfied
14	Outsourced	Outsourced	Outsourced	Yes	Satisfied
15	Outsourced	Outsourced	Outsourced	No	Slightly Satisfied
16	Both Bank & Private	Bank only	The Bank	Yes	Satisfied
17	Both Bank & Private	Both Bank & Private	The Bank	No	Neutral
18	Both Bank & Private	Both Bank & Private	The Bank	Yes	Satisfied
19	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Satisfied
20	only Bank	Bank only	The Bank	Yes	Slightly Satisfied
21	Both Bank & Private	Both Bank & Private	The Bank	No	Slightly Satisfied
22	Both Bank & Private	Both Bank & Private	The Bank	No	Slightly Satisfied
23	Both Bank & Private	Both Bank & Private	The Bank - CCPU	Yes	Satisfied
24	Both Bank & Private	Both Bank & Private	The Bank - CCPU	Yes	Slightly Satisfied
25	Both Bank & Private	Bank only	The Bank	Yes	Slightly Dissatisfied
26	Both Bank & Private	Bank only	The Bank - CCPU	No	Slightly Dissatisfied
27	Both Bank & Private	Bank only	The Bank - CCPU	No	Dissatisfied
28	Both Bank & Private	Bank only	The Bank - CCPU	Yes	Satisfied
29	only Bank	Both Bank & Private	The Bank	Yes	Neutral
30	Both Bank & Private	Both Bank & Private	The Bank	No	Dissatisfied
31	Outsourced	Both Bank & Private	The Bank	No	Dissatisfied
32	Both Bank & Private	Bank only	The Bank	Yes	Slightly Satisfied
33	Outsourced	Outsourced	Outsourced	Yes	Dissatisfied

	Distribution				
	Cash transportation is handled by	6.4 Cash transportation security is handled by	Cash distribution administration	Availability of Distribution Centers by the bank/Outsourced company	Satisfactory level of Cash Distribution
34	Outsourced	Outsourced	Outsourced	No	Slightly Dissatisfied
35	only Bank	Bank only	The Bank	No	Slightly Satisfied
36	Outsourced	Outsourced	Outsourced	No	Slightly Dissatisfied
37	Both Bank & Private	Outsourced	Outsourced	Yes	Satisfied
38	Outsourced	Outsourced	Outsourced	No	Slightly Satisfied
39	Both Bank & Private	Outsourced	Outsourced	No	Slightly Satisfied
40	only Bank	Both Bank & Private	The Bank	No	Slightly Satisfied
41	Both Bank & Private	Bank only	The Bank	Yes	Satisfied
42	only Bank	Bank only	The Bank	Yes	Slightly Satisfied
43	only Bank	Bank only	The Bank	No	Dissatisfied
44	only Bank	Bank only	The Bank	Yes	Satisfied
45	only Bank	Both Bank & Private	The Bank	Yes	Slightly Dissatisfied
46	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Satisfied
47	only Bank	Both Bank & Private	The Bank	No	Slightly Satisfied
48	Outsourced	Both Bank & Private	The Bank	No	Satisfied
49	Both Bank & Private	Bank only	The Bank	Yes	Slightly Satisfied
50	only Bank	Both Bank & Private	The Bank	Yes	Slightly Dissatisfied
51	Both Bank & Private	Bank only	The Bank - CCPU	Yes	Satisfied
52	Both Bank & Private	Bank only	The Bank - CCPU	No	Slightly Dissatisfied
53	Both Bank & Private	Both Bank & Private	The Bank	No	Slightly Dissatisfied
54	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Dissatisfied
55	Both Bank & Private	Both Bank & Private	The Bank	Yes	Slightly Satisfied
56	Both Bank & Private	Outsourced	The Bank	Yes	Satisfied
57	only Bank	Bank only	The Bank	Yes	Slightly Satisfied
58	Both Bank & Private	Outsourced	The Bank - CCPU	Yes	Dissatisfied
59	Both Bank & Private	Outsourced	The Bank - CCPU	Yes	Satisfied

	Value Added Service					Service Point Monitoring	Information Systems	
	[Cash sorting]	[cash disinfection/ cleaning]	[ATM cash replenishments]	[cash bundling/ Denominations]	[process unfit cash]	9.1 ATM monitoring support unit	10.1 a. share information	10.2 b. IT systems
1						Agree	Agree	Disagree
2						Agree	Strongly Agree	Neutral
3						Agree	Neutral	Agree
4						Neutral	Strongly Disagree	Agree
5						Agree	Neutral	Agree
6						Strongly agree	Strongly Disagree	Strongly Agree
7						Agree	Agree	Neutral
8						Strongly agree	Disagree	Agree
9						Agree	Neutral	Strongly Agree
10						Strongly agree	Strongly Agree	Agree
11						Strongly agree	Disagree	Agree
12						Agree	Agree	Agree
13						Agree	Agree	Agree
14	Yes	Yes	Bank Not considered	Yes	Yes	Strongly agree	Disagree	Agree
15	Yes	Yes	Bank not considered	Yes	Yes	Strongly agree	Agree	Disagree
16						Agree	Agree	Neutral
17						Agree	Agree	Agree
18						Agree	Neutral	Neutral
19						Neutral	Agree	Disagree
20						Agree	Neutral	Agree
21						Agree	Neutral	Agree
22						Strongly agree	Neutral	Agree
23						Disagree	Agree	Agree
24						Strongly agree	Agree	Agree
25						Neutral	Neutral	Neutral
26						Strongly disagree	Strongly Disagree	Disagree
27						Agree	Disagree	Disagree
28						Agree	Disagree	Neutral
29						Agree	Disagree	Neutral
30						Agree	Agree	Agree
31						Strongly agree	Agree	Agree
32						Neutral	Neutral	Neutral
33	Yes	No	Yes	Yes	Yes	Agree	Strongly Disagree	Strongly disagree
34	Yes	No	Yes	Yes	Yes	Agree	Neutral	Agree

	Value Added Service					Service Point Monitoring	Information Systems	
	[Cash sorting]	[cash disinfection/ cleaning]	[ATM cash replenishments]	[cash bundling/ Denominations]	[process unfit cash]	9.1 ATM monitoring support unit	10.1 a. share information	10.2 b. IT systems
35						Agree	Disagree	Strongly Agree
36	Yes	No	Bank not considered	Yes	No	Agree	Agree	Agree
37	Yes	Yes	Yes	Yes	Yes	Agree	Agree	Agree
38	Yes	No	Bank not considered	Yes	No	Agree	Agree	Agree
39	Yes	Not awa re	Yes	Yes	Yes	Neutral	Neutral	Agree
40						Disagree	Agree	Agree
41						Agree	Agree	Agree
42						Agree	Neutral	Neutral
43						Neutral	Neutral	Neutral
44						Agree	Disagree	Neutral
45						Strongly agree	Strongly Agree	Agree
46						Strongly agree	Neutral	Agree
47						Agree	Neutral	Agree
48						Agree	Agree	Agree
49						Agree	Disagree	Neutral
50						Agree	Disagree	Neutral
51						Agree	Disagree	Neutral
52						Agree	Agree	Neutral
53						Neutral	Disagree	Neutral
54						Agree	Agree	Agree
55						Agree	Agree	Agree
56						Agree	Neutral	Agree
57						Neutral	Neutral	Neutral
58						Disagree	Neutral	Agree
59						Agree	Agree	Agree

	Maintenance	Information Security	Customer Supplier Iteration		Business Continuity
	11.1 maintenance of ATMs/CRMs, Counting Machines, Power sources, IT infrastructure etc.	12.1 Information security	13.1 Channels	13.2 key procedures available to communicate Customers and suppliers	14.1 Cash distribution related Business Continuity Arrangements
1	Strongly Agree	Strongly Agree	Agree	Agree	Agree
2	Strongly Agree	Agree	Strongly Agree	Agree	Neutral
3	Strongly Agree	Agree	Agree	Agree	Neutral
4	Strongly Agree	Agree	Neutral	Agree	Agree
5	Agree	Agree	Agree	Neutral	Agree
6	Strongly Agree	Agree	Agree	Neutral	Neutral
7	Neutral	Neutral	Agree	Agree	Agree
8	Strongly Agree	Agree	Disagree	Disagree	Neutral
9	Agree	Strongly Agree	Agree	Agree	Strongly agree
10	Strongly Agree	Agree	Neutral	Agree	Strongly agree
11	Strongly Agree	Agree	Agree	Agree	Agree
12	Agree	Agree	Agree	Strongly Agree	Agree
13	Agree	Agree	Agree	Agree	Agree
14	Agree	Strongly Agree	Strongly Agree	Agree	Strongly agree
15	Neutral	Neutral	Agree	Strongly Agree	Agree
16	Agree	Neutral	Disagree	Agree	Neutral
17	Agree	Agree	Neutral	Agree	Neutral
18	Agree	Agree	Agree	Neutral	Agree
19	Neutral	Agree	Agree	Agree	Neutral
20	Neutral	Agree	Agree	Agree	Strongly agree
21	Neutral	Agree	Agree	Neutral	Disagree
22	Strongly Agree	Agree	Agree	Agree	Agree
23	Agree	Strongly Agree	Agree	Neutral	Agree
24	Agree	Strongly Agree	Neutral	Neutral	Strongly agree
25	Neutral	Neutral	Agree	Neutral	Neutral
26	Disagree	Neutral	Disagree	Agree	Agree
27	Disagree	Agree	Agree	Neutral	Agree
28	Agree	Agree	Agree	Agree	Neutral
29	Agree	Agree	Neutral	Agree	Agree
30	Agree	Agree	Agree	Agree	Neutral
31	Strongly Agree	Agree	Agree	Agree	Agree
32	Neutral	Neutral	Neutral	Neutral	Neutral
33	Agree	Agree	Agree	Disagree	Neutral
34	Agree	Agree	Agree	Agree	Agree

	Maintenance	Information Security	Customer Supplier Iteration		Business Continuity
	11.1 maintenance of ATMs/CRMs, Counting Machines, Power sources, IT infrastructure etc.	12.1 Information security	13.1 Channels	13.2 key procedures available to communicate Customers and suppliers	14.1 Cash distribution related Business Continuity Arrangements
35	Strongly Agree	Strongly Agree	Neutral	Agree	Neutral
36	Agree	Agree	Agree	Strongly Agree	Agree
37	Agree	Agree	Agree	Strongly Agree	Agree
38	Neutral	Agree	Agree	Strongly Agree	Strongly agree
39	Neutral	Agree	Neutral	Strongly Agree	Agree
40	Agree	Agree	Agree	Agree	Agree
41	Agree	Agree	Agree	Agree	Agree
42	Neutral	Agree	Neutral	Agree	Neutral
43	Neutral	Agree	Agree	Agree	Agree
44	Strongly Agree	Agree	Agree	Neutral	Agree
45	Strongly Agree	Agree	Strongly Agree	Agree	Agree
46	Agree	Neutral	Agree	Neutral	Neutral
47	Neutral	Neutral	Neutral	Agree	Neutral
48	Strongly Agree	Agree	Agree	Agree	Strongly agree
49	Agree	Agree	Agree	Agree	Agree
50	Strongly Agree	Agree	Agree	Neutral	Agree
51	Agree	Neutral	Disagree	Neutral	Agree
52	Agree	Agree	Agree	Neutral	Agree
53	Disagree	Agree	Neutral	Neutral	Neutral
54	Agree	Strongly Agree	Agree	Agree	Strongly agree
55	Agree	Strongly Agree	Agree	Agree	Agree
56	Agree	Strongly Agree	Agree	Agree	Agree
57	Agree	Neutral	Agree	Neutral	Agree
58	Strongly Agree	Agree	Strongly Agree	Agree	Neutral
59	Agree	Agree	Agree	Agree	Agree

	Ecological Factor						
	15.1 [Encourage for slip less ATM usage]	15.1 [Steps taken to use more digitalize information than hard copies]	15.1 [Measure carbon foot print of transportation, AC usage]	15.1 [Measure Electricity consumption of Branches, Distribution Centers, ATMs]	15.1 [Use reusable energy sources (eg. solar powered ATMS, Branches)]	15.1 [Measure Water consumption of Branches, Distribution Centers]	15.1 [Use ecofriendly disposable material or degradable baggage/covers]
1	Effectively use	Effectively use	Effectively use	Use but not effective	Not use	Not use	Effectively use
2	Effectively use	Effectively use	Use but not effective	Use but not effective	Not use	Effectively use	Use but not effective
3	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective
4	Effectively use	Effectively use	Use but not effective	Use but not effective	Not use	Effectively use	Use but not effective
5	Effectively use	Use but not effective	Not use	Not use	Not aware	Not use	Not aware
6	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective
7	Effectively use	Use but not effective	Use but not effective	Use but not effective	Use but not effective	Not use	Not use
8	Use but not effective	Use but not effective	Use but not effective	Effectively use	Use but not effective	Effectively use	Not use
9	Use but not effective	Effectively use	Not use	Not use	Not aware	Use but not effective	Use but not effective
10	Effectively use	Effectively use	Use but not effective	Use but not effective	Not use	Effectively use	Use but not effective
11	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective
12	Use but not effective	Effectively use	Effectively use	Effectively use	Not use	Not use	Not use
13	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective
14	Use but not effective	Use but not effective	Effectively use	Not use	Not use	Effectively use	Effectively use
15	Effectively use	Use but not effective	Not use	Not use	Not aware	Not use	Not aware
16	Effectively use	Use but not effective	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use
17	Not aware	Use but not effective	Effectively use	Not use	Not use	Effectively use	Not use
18	Use but not effective	Use but not effective	Not use	Not use	Not use	Not use	Not use
19	Effectively use	Use but not effective	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use
20	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Use but not effective
21	Not aware	Use but not effective	Effectively use	Not use	Not use	Effectively use	Not use
22	Use but not effective	Effectively use	Not aware	Not use	Not use	Not use	Not use
23	Use but not effective	Effectively use	Not use	Not use	Not use	Effectively use	Not use
24	Use but not effective	Effectively use	Not use	Not use	Not use	Effectively use	Not use
25	Use but not effective	Use but not effective	Use but not effective	Use but not effective	Not use	Not use	Not use
26	Use but not effective	Use but not effective	Effectively use	Effectively use	Use but not effective	Use but not effective	Not use
27	Effectively use	Not use	Use but not effective	Use but not effective	Not use	Not use	Not use
28	Effectively use	Effectively use	Effectively use	Effectively use	Not use	Not use	Not use
29	Use but not effective	Use but not effective	Not use	Not use	Not use	Not use	Not use
30	Not use	Use but not effective	Use but not effective	Use but not effective	Use but not effective	Use but not effective	Use but not effective
31	Use but not effective	Effectively use	Effectively use	Effectively use	Not use	Effectively use	Effectively use
32	Effectively use	Not use	Use but not effective	Use but not effective	Not use	Not use	Not use
33	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Effectively use
34	Effectively use	Effectively use	Use but not effective	Not use	Use but not effective	Use but not effective	Use but not effective
35	Effectively use	Effectively use	Effectively use	Effectively use	Not use	Effectively use	Effectively use
36	Effectively use	Effectively use	Effectively use	Effectively use	Not use	Not use	Not use
37	Effectively use	Effectively use	Not aware	Use but not effective	Not use	Not use	Use but not effective
38	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Effectively use

	Ecological Factor						
	15.1 [Encourage for slipless ATM usage]	15.1 [Steps taken to use more digitalize information than hard copies]	15.1 [Measure carbon foot print of transportation, AC usage]	15.1 [Measure Electricity consumption of Branches, Distribution Centers, ATMs]	15.1 [Use reusable energy sources (eg. solar powered ATMS, Branches)]	15.1 [Measure Water consumption of Branches, Distribution Centers]	15.1 [Use ecofriendly disposable material or degradable baggage/covers]
39	Effectively use	Effectively use	Not aware	Use but not effective	Not use	Not use	Not use
40	Effectively use	Effectively use	Not aware	Effectively use	Not use	Not use	Use but not effective
41	Use but not effective	Effectively use	Effectively use	Effectively use	Not use	Effectively use	Effectively use
42	Effectively use	Effectively use	Not aware	Effectively use	Not use	Not use	Use but not effective
43	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Effectively use
44	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Effectively use
45	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use	Effectively use	Effectively use
46	Use but not effective	Effectively use	Effectively use	Use but not effective	Not use	Effectively use	Effectively use
47	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective	Effectively use	Effectively use
48	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use
49	Use but not effective	Not use	Use but not effective	Use but not effective	Not use	Not use	Not use
50	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use
51	Effectively use	Effectively use	Effectively use	Use but not effective	Use but not effective	Effectively use	Effectively use
52	Use but not effective	Effectively use	Effectively use	Use but not effective	Not use	Effectively use	Effectively use
53	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use
54	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use
55	Use but not effective	Effectively use	Effectively use	Use but not effective	Use but not effective	Effectively use	Effectively use
56	Use but not effective	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use	Effectively use
57	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Use but not effective	Effectively use
58	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use
59	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use	Effectively use



	Overall Satisfaction
	16. Overall satisfactory level of the management of Cash supply chain management
1	Satisfied
2	Dissatisfied
3	Satisfied
4	Dissatisfied
5	Satisfied
6	Satisfied
7	Satisfied
8	Satisfied
9	Satisfied
10	Satisfied
11	Satisfied
12	Satisfied
13	Satisfied
14	Satisfied
15	Satisfied
16	Satisfied
17	Satisfied
18	Satisfied
19	Satisfied
20	Dissatisfied
21	Dissatisfied
22	Satisfied
23	Satisfied
24	Satisfied
25	Dissatisfied
26	Dissatisfied
27	Dissatisfied
28	Dissatisfied
29	Dissatisfied
30	Dissatisfied

	Overall Satisfaction
	16. Overall satisfactory level of the management of Cash supply chain management
31	Dissatisfied
32	Dissatisfied
33	Dissatisfied
34	Satisfied
35	Dissatisfied
36	Dissatisfied
37	Satisfied
38	Dissatisfied
39	Dissatisfied
40	Dissatisfied
41	Dissatisfied
42	Satisfied
43	Satisfied
44	Satisfied
45	Satisfied
46	Satisfied
47	Dissatisfied
48	Dissatisfied
49	Dissatisfied
50	Dissatisfied
51	Satisfied
52	Satisfied
53	Dissatisfied
54	Satisfied
55	Satisfied
56	Satisfied
57	Satisfied
58	Satisfied
59	Satisfied

Score	Importance level for further improvement of the factor
9	Extremely Important - for further improvements
8	Very Important - for further improvements
7	Important - for further improvements
6	Slightly Important - for further improvements
5	Neither Important nor Unimportant - for further improvements
4	Slightly unimportant - for further improvements
3	Unimportant - for further improvements
2	Highly unimportant - for further improvements
1	Extremely Unimportant - for further improvements

Cash Inventory Management	Physical Security	Information Systems	Customer & Supplier Interaction	Liquidity Management	Distribution	Maintenance	Service Point Capacity	Value added services	Insurance	Information Security	Service point monitoring	Business Continuity Arrangements	Compliance (AML/CDD)	Ecological Factor
9	6	7	8	8	9	8	8	8	9	9	9	8	8	8
9	9	9	9	8	9	9	9	6	9	6	6	9	7	7
9	9	9	9	9	9	9	9	9	9	9	8	8	6	6
9	9	9	9	9	8	9	9	8	9	6	7	7	7	9
7	9	9	7	7	7	7	7	7	8	8	8	5	6	7
9	8	9	9	9	9	9	8	9	9	9	9	6	8	8
8	9	9	9	8	8	9	9	5	9	9	9	9	9	9
8	9	9	9	9	9	9	9	7	9	7	9	9	7	9
8	8	8	5	8	7	8	8	8	7	8	6	7	7	8
4	6	6	8	4	6	6	7	6	9	2	1	1	5	9
9	8	9	7	9	9	9	9	9	9	9	9	9	9	9
8	9	8	8	7	8	7	8	6	8	6	7	7	7	9
9	9	9	7	9	9	6	9	9	9	9	4	9	9	9
8	7	7	7	7	7	7	7	7	7	7	7	7	7	7
9	9	9	7	8	9	9	9	9	9	6	9	9	9	9
8	8	8	6	6	5	7	8	7	8	8	8	9	8	7
8	9	9	8	9	8	9	8	9	8	8	8	7	8	9
7	8	8	8	8	8	8	8	6	8	9	8	8	7	7
9	9	8	8	8	9	8	8	5	8	8	8	7	6	6
9	9	8	9	8	8	8	9	5	9	8	8	8	8	8
8	7	7	5	6	5	6	5	4	2	4	1	7	3	9
9	9	8	8	9	9	6	9	9	9	8	9	9	5	9
7	9	7	7	7	7	7	9	7	9	8	8	7	8	7

Cash Inventory Management	Physical Security	Information Systems	Customer & Supplier Interaction	Liquidity Management	Distribution	Maintenance	Service Point Capacity	Value added services	Insurance	Information Security	Service point monitoring	Business Continuity Arrangements	Compliance (AML/CDD)	Ecological Factor
8	9	9	7	8	9	7	9	8	8	7	9	9	8	8
8	9	9	7	8	9	9	9	8	9	6	8	6	8	8
9	7	7	8	7	8	8	7	6	8	7	8	8	8	8
8	8	7	7	7	8	7	7	7	7	8	9	8	8	7
6	7	6	6	6	9	6	6	6	6	6	6	6	6	6
9	9	8	8	8	8	8	8	8	8	7	8	6	8	9
9	8	9	8	8	9	7	8	8	8	8	8	8	9	7
9	9	9	8	7	9	9	9	8	9	6	8	9	7	8
9	9	9	8	9	9	9	9	5	9	7	6	8	8	7
9	9	8	8	9	9	8	9	8	9	9	9	8	9	8
7	8	9	6	7	9	7	8	7	7	7	8	8	8	7
7	7	7	9	8	8	8	8	6	8	7	9	9	9	8
7	7	7	7	7	7	7	7	7	7	7	9	9	7	8
8	9	8	8	8	8	8	8	8	8	4	1	6	8	7
7	7	8	7	7	7	7	7	7	7	9	9	6	8	9
8	9	9	8	8	9	8	8	8	8	8	9	7	7	8
9	9	9	9	9	9	9	9	6	9	9	4	8	9	8
7	7	7	7	7	7	7	7	7	7	8	6	7	9	9
9	9	9	9	8	9	9	9	9	9	2	1	7	5	8
7	9	8	8	8	7	7	7	7	9	8	8	9	8	5
9	6	3	5	4	7	1	4	8	7	7	9	9	8	1
9	8	9	8	8	9	8	9	9	9	7	8	9	9	9
9	9	8	7	9	8	8	9	8	9	6	8	9	9	9
9	9	9	6	8	8	7	9	9	9	8	9	9	6	8
9	9	9	7	8	9	9	9	8	9	9	9	9	7	8
9	9	9	9	8	8	9	9	9	9	9	9	9	8	7
9	8	9	7	7	9	9	9	9	8	7	9	5	7	8
8	9	8	7	8	9	8	9	5	9	6	9	7	5	7
7	7	7	7	7	7	7	7	7	7	7	7	8	7	7
8	9	9	8	8	8	7	9	8	8	6	9	7	8	9
8	9	9	9	8	9	9	9	9	9	9	9	9	5	5
8	8	8	8	8	8	7	8	8	8	8	5	8	6	8
7	9	9	8	8	8	9	9	9	9	8	5	7	9	9
7	9	8	8	9	8	9	9	8	8	8	9	8	8	8
7	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	8	9	9	9	9	9	9	9	6	9	9

Appendix IV: Responses – Questionnaire II (AHP)

1 Response												2 Response										
LHS	9	7	5	3	1	3	5	7	9	RHS		LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than		is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance		Physical Security										Insurance
Physical Security										Service Point Capacity		Physical Security										Service Point Capacity
Physical Security										Information Systems		Physical Security										Information Systems
Physical Security										Distribution		Physical Security										Distribution
Physical Security										Cash Inventory Management		Physical Security										Cash Inventory Management
Insurance										Service Point Capacity		Insurance										Service Point Capacity
Insurance										Information Systems		Insurance										Information Systems
Insurance										Distribution		Insurance										Distribution
Insurance										Cash Inventory Management		Insurance										Cash Inventory Management
Service Point Capacity										Information Systems		Service Point Capacity										Information Systems
Service Point Capacity										Distribution		Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management		Service Point Capacity										Cash Inventory Management
Information Systems										Distribution		Information Systems										Distribution
Information Systems										Cash Inventory Management		Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management		Distribution										Cash Inventory Management

3 Response												4 Response										
LHS	9	7	5	3	1	3	5	7	9	RHS		LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than		is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance		Physical Security										Insurance
Physical Security										Service Point Capacity		Physical Security										Service Point Capacity
Physical Security										Information Systems		Physical Security										Information Systems
Physical Security										Distribution		Physical Security										Distribution
Physical Security										Cash Inventory Management		Physical Security										Cash Inventory Management
Insurance										Service Point Capacity		Insurance										Service Point Capacity
Insurance										Information Systems		Insurance										Information Systems
Insurance										Distribution		Insurance										Distribution
Insurance										Cash Inventory Management		Insurance										Cash Inventory Management
Service Point Capacity										Information Systems		Service Point Capacity										Information Systems
Service Point Capacity										Distribution		Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management		Service Point Capacity										Cash Inventory Management
Information Systems										Distribution		Information Systems										Distribution
Information Systems										Cash Inventory Management		Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management		Distribution										Cash Inventory Management

5 Response												6 Response										
LHS	9	7	5	3	1	3	5	7	9	RHS		LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than		is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance		Physical Security										Insurance
Physical Security										Service Point Capacity		Physical Security										Service Point Capacity
Physical Security										Information Systems		Physical Security										Information Systems
Physical Security										Distribution		Physical Security										Distribution
Physical Security										Cash Inventory Management		Physical Security										Cash Inventory Management
Insurance										Service Point Capacity		Insurance										Service Point Capacity
Insurance										Information Systems		Insurance										Information Systems
Insurance										Distribution		Insurance										Distribution
Insurance										Cash Inventory Management		Insurance										Cash Inventory Management
Service Point Capacity										Information Systems		Service Point Capacity										Information Systems
Service Point Capacity										Distribution		Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management		Service Point Capacity										Cash Inventory Management
Information Systems										Distribution		Information Systems										Distribution
Information Systems										Cash Inventory Management		Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management		Distribution										Cash Inventory Management

7 Response												8 Response										
LHS	9	7	5	3	1	3	5	7	9	RHS		LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than		is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance		Physical Security										Insurance
Physical Security										Service Point Capacity		Physical Security										Service Point Capacity
Physical Security										Information Systems		Physical Security										Information Systems
Physical Security										Distribution		Physical Security										Distribution
Physical Security										Cash Inventory Management		Physical Security										Cash Inventory Management
Insurance										Service Point Capacity		Insurance										Service Point Capacity
Insurance										Information Systems		Insurance										Information Systems
Insurance										Distribution		Insurance										Distribution
Insurance										Cash Inventory Management		Insurance										Cash Inventory Management
Service Point Capacity										Information Systems		Service Point Capacity										Information Systems
Service Point Capacity										Distribution		Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management		Service Point Capacity										Cash Inventory Management
Information Systems										Distribution		Information Systems										Distribution
Information Systems										Cash Inventory Management		Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management		Distribution										Cash Inventory Management

9 Response												10 Response										
LHS	9	7	5	3	1	3	5	7	9	RHS		LHS	9	7	5	3	1	3	5	7	9	RHS
is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than		is	Extremely Important	Very Important	Important	Slightly important	Equally important	Slightly important	Important	Very Important	Extremely Important	than
Physical Security										Insurance		Physical Security										Insurance
Physical Security										Service Point Capacity		Physical Security										Service Point Capacity
Physical Security										Information Systems		Physical Security										Information Systems
Physical Security										Distribution		Physical Security										Distribution
Physical Security										Cash Inventory Management		Physical Security										Cash Inventory Management
Insurance										Service Point Capacity		Insurance										Service Point Capacity
Insurance										Information Systems		Insurance										Information Systems
Insurance										Distribution		Insurance										Distribution
Insurance										Cash Inventory Management		Insurance										Cash Inventory Management
Service Point Capacity										Information Systems		Service Point Capacity										Information Systems
Service Point Capacity										Distribution		Service Point Capacity										Distribution
Service Point Capacity										Cash Inventory Management		Service Point Capacity										Cash Inventory Management
Information Systems										Distribution		Information Systems										Distribution
Information Systems										Cash Inventory Management		Information Systems										Cash Inventory Management
Distribution										Cash Inventory Management		Distribution										Cash Inventory Management