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Role of Information Sharing In Supply Chain Management to Enhance the Capabilities of a Defense Firm in the UAE: The Case of Tawazun Subsidiaries.

Majida Abdou Saeed Ahmed Alazazi

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جامعة الإمارات العربية المتحدة
United Arab Emirates University

United Arab Emirates University

College of Business and Economics

ROLE OF INFORMATION SHARING IN SUPPLY CHAIN
MANAGEMENT TO ENHANCE THE CAPABILITIES OF A
DEFENCE FIRM IN THE UAE: THE CASE OF TAWAZUN
SUBSIDIARIES

Majida Abdou Saeed Ahmed Alazazi

This dissertation is submitted in partial fulfilment of the requirements for the degree
of Doctorate of Business Administration

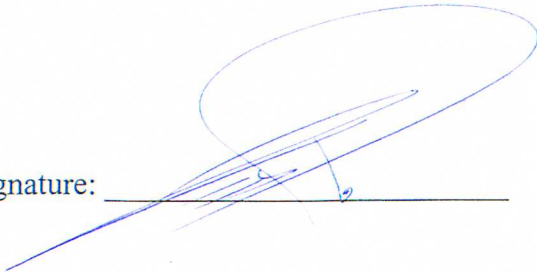
Under the Supervision of Dr. Younes Hamdouch

November 2017

Declaration of Original Work

I, Majida Abdou Saeed Ahmed Alazazi, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this dissertation, entitled "*Role of Information Sharing in Supply Chain Management to Enhance the Capabilities of a Defence Firm in the UAE: The Case of Tawazun Subsidiaries*", hereby, solemnly declare that this dissertation is my original research work that has been done and prepared by me under the supervision of Dr. Younes Hamdouch, in the College of Business and Economics at the UAEU. This work has not previously formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources, whether published or unpublished and relied upon or included in my dissertation have been properly cited and acknowledged in accordance with appropriate academic conventions. I also declare that there is no potential conflict of interest in conducting this study regarding research topic, data collection, and the presentation of findings, authorship, and publishing of this dissertation.

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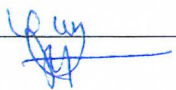
The following Examining Committee Members approved this Doctorate dissertation:

- 1) Advisor (Committee Chair): Dr. Younes Hamdouch

Title: Associate Professor

Department of Business Administration

College of Business and Economics

Signature:  _____

Date: 19 November 2017

- 2) Member: Prof. Taoufik Zoubeidi

Title: Professor

Department of Statistics

College of Business and Economics

Signature:  _____

Date: 19 November 2017

- 3) Member: Mohamed Adel Serhani

Title: Associate Professor

Department of Information Systems and Security

College of Information Technology

Signature:  _____

Date: 19 November 2017

- 4) Member (External Examiner): Dr. Rajesh Piplani

Title: Associate Professor

School of Mechanical and Aerospace Engineering

Faculty of Engineering

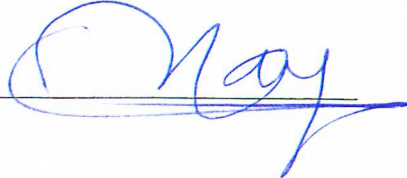
Institution: Nanyang Technological University (NTU), Singapore

Signature:  _____

Date: 19 November 2017

This Doctorate Dissertation is accepted by:

Acting Dean of the College of Business and Economics: Professor Mohamed Madi

Signature  Date 21/12/2017

fa Dean of the College of Graduate Studies: Professor Nagi T. Wakim

Signature  Date 27/12/2017

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Advisory Committee

- 1) Advisor: Younes Hamdouch
Title: Associate Professor
Department of Business Administration
College of Business and Economics

- 2) Co-advisor: Rihab Khalifa
Title: Associate Professor
Department of Accounting
College of Business and Economics

- 3) Member: Youssef Boulaksil
Title: Assistant Professor
Department of Business Administration
College of Business and Economics

Abstract

The manufacturing firms and service delivery vendors in the UAE have recently realised the importance of supply chain management (SCM) applications, but they are still not entirely used for improving firms' performance, capability, and market competitiveness. This study highlights the capacity of information sharing in supply chain management to enhance the capabilities of Tawazun's subsidiaries as key players in the UAE defence industry. Personal interviews were conducted with (20) top and senior managers working in four of these subsidiaries. The qualitative analysis of their statements revealed that information sharing across different SCM departments is strategically important in enhancing firms' capability, together with the creation of effective Supply Chain Integration (SCI) using the available communication channels. However, the dominance of the viewpoints and perceptions of the top managers, whose background is military, seemed to have a heavy impact on the quantity and type of information to be shared. A questionnaire survey was also distributed to (115) junior staff from 3 Tawazun SCM departments; (86) completed the questionnaire to yield a return rate of 74.78%. The quantitative analysis of the collected survey data using the statistical package for the Social sciences (SPSS) and Excel revealed that the junior staff' involvement in information sharing is limited, which impacts on their ability to fulfil their departmental capabilities. The study findings provide a roadmap for establishing and employing a reliable SCM, particularly in a defence industry firm, where many departments are involved in supply chain activities. The implications are that to guarantee effective SCM practice, the policymakers in SCM should encourage internal integration and the smooth flow of information between the firm's employees.

Keywords: Defence industry, supply chain management, supply chain integration, information sharing, firm capability, Tawazun Economic Programme, the UAE.

Title and Abstract (in Arabic)

دور تبادل المعلومات في إدارة سلسلة التوريد لتعزيز قدرات شركات الصناعات الدفاعية في دولة الإمارات العربية المتحدة: دراسة حالة لمجموعة شركة توازن

المخلص

حديثاً، أدركت معظم المنظمات العاملة في القطاعين الخدمي والصناعي في دولة الإمارات العربية المتحدة أهمية إدارة سلسلة التوريد في تعزيز أعمالهم الخدمية والصناعية. ومع ذلك، فهي لا تزال تجهل كيفية تطبيق هذا النهج بالطريقة المثلى، والاستفادة منه في تحسين أداء الشركات وقدرتها التنافسية في السوق. تسلط هذه الدراسة الضوء على قدرة تبادل المعلومات في إدارة سلسلة التوريدات لتعزيز قدرات الشركات التابعة لـ "توازن" كجهة رئيسية في صناعة الدفاع في دولة الإمارات العربية المتحدة. وقد أجريت المقابلات الشخصية مع (20) من كبار المديرين العاملين في أربع شركات صناعية تابعة لها. وكشف التحليل النوعي لبياناتهم أن تقاسم المعلومات عبر مختلف الإدارات عامل مهم واستراتيجي لتعزيز قدرات الشركات، جنب إلى جنب مع إنشاء إدارة سلسلة توريدات فعالة باستخدام قنوات الاتصال المتاحة. مع ذلك يبدو أن هيمنة وجهات نظر وتصورات كبار المديرين (ذو الخلفية العسكرية) قد أثر تأثيراً كبيراً على كمية ونوعية المعلومات المسموح بتقاسمها داخل المنظمة، وهذا بدوره قد أثر على عمليات التصنيع وإدارة الإنتاج بتلك الشركات. كما تم توزيع (115) نسخة من الاستبيان على صغار الموظفين في ثلاث إدارات تابعة لتلك الشركات بغرض الحصول على فهم أوضح حول الدور المؤثر لتبادل المعلومات فيما بينهم في تحسين أداءهم الوظيفي لإنجاز المهمات: ومن ثم تم جمع عدد (86) استبيان فقط أي ما يعادل 74.78% من إجمالي عدد الاستبيانات. وكشف التحليل الكمي لبيانات المسح التي تم جمعها باستخدام برنامجي حزمة التحليل الإحصائي للعلوم الاجتماعية واكسل والذي جاء فيه ألا تزال هناك بعض القيود على مشاركتهم في تبادل المعلومات مع الأعضاء داخل المؤسسة، وإبقائهم كمستقبلين ليس إلا، وهذا بدوره أثر على قدرتهم لإنجاز مهامهم في الوقت المحدد. وتقدم هذه الدراسة خارطة طريق لكيفية إنشاء وتوظيف إدارة سلسلة توريد حديثة وموثوق بها في مجال التصنيع؛ ولا سيما في شركات الصناعات الدفاعية، حيث العديد من الإدارات التشغيلية تدرج وتشارك بأنشطة سلسلة التوريد. كما توضح لكبار المديرين التنفيذيين وأصحاب القرار الآثار المحتملة من تسهيل التكامل الداخلي في شركاتهم وذلك من خلال التدفق السلس للمعلومات ذات الصلة وتشجيعهم لمشاركتها مع موظفيهم للحصول على إدارة سلسلة توريد ذات كفاءة وفاعلية.

مفاهيم البحث الرئيسية: الصناعات الدفاعية، إدارة سلسلة التوريد، التكامل في سلسلة التوريد، وتبادل المعلومات، قدرة الشركة، مجموعة توازن، الإمارات العربية المتحدة.

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I declare my sincere appreciation to my beloved family members for their encouraging support and cheerful smiles.

Dedication

To my great country, the UAE that I am proud to belong to, and to its great leaders HH Sheikh Mohamed bin Zayed Al Nahyan and HH Sheikh Mohamed bin Rashid Al Maktoum, whose insightful vision and future focus will push the country to assume the foremost position amongst advanced countries “We do not accept any but the first place” HH Mohamed bin Rashid said. This motto pushed me to make my research outdo the first in the region

To my father who passed away very soon after my birth, but whose soul stayed to give me enthusiasm for exploring the unique and the new.

To my mother, enormous grateful appreciation. She was a spring of kindness, who wrapped me with her genuine love and precipitated me into a deep interest in continuing learning from early childhood.

To my family and my best friend Khuloud Al Shamsi, whose care and encouragement have pushed me forward throughout this DBA programme.

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List of Abbreviations

ADDED	Abu Dhabi Department of Economic Development
CEO	Chief Executive Officer
COO	Chief Operations Officer
DCC	Defence Contractors Council
EDIC	Emirates Defence Industry Company
ERP	Enterprise Resources Planning
GCC	Gulf Cooperation Council
GHQ	General Headquarters of the Armed Forces
GP	Government Procurement
HCSZ	Higher Corporation for Specialized Economic Zones
ICT	Information and Communication Technology
AIDS	Abu Dhabi Industrial Development Strategy
IS	Information Sharing
KIZAD	Khalifa Industrial Zone Abu Dhabi
LRA	Linear Regression Analysis
MES	Manufacturing Execution System
MRP	Manufacturing Resources Planning
R & D	Research and Development
SCC	Supply Chain Capability
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCP	Supply Chain Performance
UAE	United Arab Emirates
UAEU	United Arab Emirates University

Chapter 1: Introduction

1.1 Preamble

The term 'supply chain management' (SCM) was first introduced in 1982 to meet the new developments in the operation of warehouse, transportation and distribution services. Since then, empirical research on SCM has rapidly advanced to include all the activities and processes covering the planning, modelling, coordination, and control of the SC system (Cooper & Lambert, 2000). This has heightened the importance of SCM in recent years and sparked a keen interest in manufacturing and service-based organisations to adopt and implement a fit-for-purpose SCM. Thus, the business domains where SCM is applicable consider SCM approaches as a useful tool for streamlining their industrial and operational activities, maximising productivity and enhancing marketing capability (Flynn & Flynn, 2004).

The key function of modern SCM is keeping up the momentum of external and internal supply chain activities and their dependable integration. Such supply chain integration (SCI) enhances seamless information sharing across the external and internal domains. The SCM professionals have incorporated integration as a new function in the SC. The SCI approach is not only in the interests of an individual firm but benefits all members of the supply chain network by improving the supply chain's capability (Dyer & Singh, 1998; Swink et al., 2007). Thus, managing capabilities and resources across a firm's SCM departments have become increasingly significant and turned to be a key factor in the company's business strategy. Moreover, most manufacturing firms have begun to consider incorporating SCI in their production agendas (Fabbe-Costes & Jahre, 2007). However, it has not hitherto received full recognition from production engineers and managers in the military industries.

One of the main elements of SCI is information sharing (IS); this has been heightened as a crucial component in catalysing the internal integration of various SC activities, as well as improving SC performance, reducing operational and raw material cost. To get most benefits from information sharing requires the efficient use of available information and a data set containing the full requirements and market trends for sharing among its stakeholders. Nevertheless, employing different communication channels is necessary for the practice to incorporate information sharing as one of the SCM functions.

A large body of SCM literature has focused on the factors that might affect the performance of SCM application in various business and industrial activities. However, only a few researchers have studied firm capability from a supply chain perspective. Moreover, many professionals in manufacturing and industrial business organisations confuse *capability* with *performance* or use the two terms interchangeably. The literature in this field has focused more on SC performance rather than investigating SC capability, though the latter has recently received more attention, particularly in the production, services, logistics, and supply chain domains. Regarding performance indicators, many manufacturing organisations are measuring the *performance* of their departments, relative to their past performance. In contrast, the *capability* of departments measures both their performance and their compatibility with each other, as well as assessing their capacity to perform future tasks and meet customers' requirements. It would appear that organisations should pay more attention to measuring capability in each department/unit separately.

A business organisation with good performance indicators, however, does not necessarily meet the requirements of all customers, because it may lack the core

components of business success, such as adequate finance, information, equipment, and market experience. Nevertheless, the measurement of capability includes all these components to provide the organisation with all its essential requirements for accomplishing tasks and strengthening its capability by improving its short- and long-term operations. Thus, I have become genuinely interested in investigating the capability of Tawazun's subsidiaries, as key players in the UAE defence industry. This research is an attempt to offer proper recommendations and solutions for enhancing supply chain capability to increase the competitiveness of military products in the local and international market.

The genuine intention of Tawazun is to improve its business and marketing capability through improving the activities of its SCM departments. Despite the significant role of information in promoting the business activities of manufacturing organisations, this role encountered many objections, representing typical SCM challenges in military defence production. Tawazun represents a strategic industrial investment and route to relocating advanced military technology and modern SCM approaches, which would boost the long-term development of military industries in the Emirate of Abu Dhabi.

The core role of Tawazun's supply chain is to provide a fast track for information sharing, data exchange, and material flow through reliable and secure channels to guarantee the on-time delivery of military products to the target customers and the market. This dissertation focuses on investigating the importance of information sharing among the intra-organisational members of SCM in the firms of the defence industry (such as Tawazun), which have so far received sparse attention from the SCM

research community worldwide. The study also seeks to identify the relevant capability indicators in three of Tawazun's SCM departments.

1.2 Research Intention

The SCM has traditionally played many significant operational roles in the automotive and heavy industries such as defence production. The concern for cost reduction, product quality, firm capability and market competitiveness has brought SCM applications into the limelight. Moreover, the complexity of manufacturing advanced mechanical products has introduced a welcome acknowledgement of information sharing in the supply chains of the production processes. Thus, the role of information sharing in the SCM, as a catalyst for supply chain integration and enhancing capability is the focus of this empirical study.

1.2.1 Motivation, Statement, Aim, Objectives, and Research Questions

Motivation: Despite the proven importance of information in business and manufacturing firms, there is an apparent lack of awareness amongst the staff of Tawazun concerning the significant role of information and related sharing practices in enhancing their firm's business success. This low awareness is my issue of interest, which sparked a genuine motivation to investigate more deeply the potential role of SCM interdepartmental information sharing between the four Tawazun subsidiaries in enhancing their capabilities. The dissertation tests Cooper and Lambert's advanced definition of the SCM concept (1997) in the context of Tawazun's military business strategy. Cooper and Lambert's definition aims at integrating of all components of the flow of information, raw material and money from down-stream (suppliers) to up-stream (customers) through intra-organisational SCM, and the subsequent impact of it

on establishing intra-organisational integration and improving the competitiveness of Tawazun's military products in the global defence market. The study attempts to fill the knowledge gap in the literature concerning: i) the role of communication channels in intra-organisational information sharing to support SCM activities, ii) the role of information sharing in boosting the capability and increasing the competitiveness of manufacturers in defence, worldwide

Statement: Today's business ecosystems are becoming increasingly susceptible to unpredictable changes and fluctuations in the global market and economy. The UAE's national economy is no exception but organically aligns itself with global businesses. Although the UAE economy has witnessed business diversity and intensive investment, particularly in the defence industrial sector, the application of modern SCM tools in this area is still in its infancy. The low profile of SCM in Tawazun was behind my taking on this study. I thought that more should be known about the roles that SCM tools might take in enhancing the capability of Tawazun's military production through effective intra-organisational information-sharing practices among the SC departments.

Aim: This research study aims to assess the impact of issues related to information sharing (e.g., willingness, confidentiality, frequency, right information at the right time) on enhancing SCM capability and integration involving all possible communication channels. The study also focuses on the information-sharing patterns of SCM members across the intra-organisational SCM departments. This role aims at breaking the barriers between the supply chain members in the defence industry workplace, increasing the transparency, and minimising the risks that may be

associated with the core activities of the Operations, Procurement, and Inventory departments.

Objectives: The research objectives of my study are as follows:

- 1) Assessing the integration of SC activities through a continuous flow of material and information.
- 2) Identifying the main capability indicators of Tawazun to meet the customers' demands and maintain market competitiveness through sharing information/data among SCM members.
- 3) Determining the communication channels preferred by the SCM members in information sharing.
- 4) Implementing an innovative intra-organisational sharing information framework to enhance Tawazun's capability through improving its SCM related practices.
- 5) Recommending the best SCM practices and applicable approaches to the policy-/decision-makers in the defence industry.

Research Questions:

The idea behind this dissertation derives from the issues which I have been faced with my practical experience of working as senior manager in supply chain management since 2012 in different Tawazun firms - in the defence sector. The overarching research questions of this DBA dissertation are as follows:

- 1) *How is the modern SCM concept successfully implemented in a defence industries firm?*

- 2) *What are the important roles of intra-organisational information sharing for enhancing SC capability in a defence industries firm?*
- 3) *How do intra-organisational communication channels impact on SC capability in a defence industries firm?*
- 4) *What are the main indicators for assessing SC capabilities in a defence industries firm?*

The dissertation proposed four research questions to fulfil the research objectives. The first question aims to test the new SCM concept and to examine the implementation of this concept in a defence firm. The second question is concerned with investigating the ability of SC members in defence firms to share intra-organisational information in their community, and the role of information sharing in their capability. The third question is concerned with assessing the preferred communication channels in practising SC interdepartmental information sharing and pursuing any impact this might have on their capability. The fourth question focuses on investigating the primary indicators of the SC capability.

1.2.2 Research Approach

The dissertation places particular emphasis on the role of intra-organisational information sharing in enhancing supply chain capabilities. The following core tasks were undertaken to address the proposed research aim, questions, and study objectives:

A. Literature review - A wide-ranging literary search was carried out to:

- 1) Review SCM and SCI theories, standards, and models.
- 2) Investigate the internal roles of SCI in supporting firms' capability.
- 3) Explore the characteristics of SCM and SCI in defence industries firms.

- 4) Learn more about the information sharing concepts adopted by Tawazun's employees at all job levels.
- 5) Investigate the key roles of information sharing in the SCI field.
- 6) Study the economic profile of the UAE as one of the GCC countries engaged in the pursuit of business and industrial diversity.
- 7) Investigate supply chain capability through exploring the use of indicators in the three SCM departments (Operations, Procurement, and Inventory).

B. *Research Methodology* The study merged qualitative and quantitative methods purposely to collect the required data and information from SCM staff groups. The participants drawn from the four Tawazun subsidiaries represented two lines of employees. The qualitative approach collected data from the senior managers' line (20 participants) to gauge the meaning of their concepts, views, and attitudes to information sharing and its impact on SC capability. The expression of such views revealed their talent in surmounting the management barriers and deficiencies about internal information sharing and flow across Tawazun supply chain system. The collected data were analysed by employing NVIVO software.

The quantitative approach gathered supportive information from junior staff (86 participants), which revealed their awareness of the value of information sharing and communication channels for boosting the capability of the supply chain departments. A drop-off distributed the questionnaires, and pick-up method and the collected data were analysed by employing SPSS software and Excel.

1.2.3 Study Justification and Significance

The related search in the literature suggests that little has been written about the impact of the inter-relationship between the SCM paradigm and intra-organisational information sharing on the capability of Tawazun, as a defence industry firm in the UAE. Therefore, the significance of this research study gains from the shortcomings of research studies on SCM so far, and from professional applications of the supply chain. The study sought to move beyond upstream or downstream relations to consider the triadic relationship of upstream-firm-downstream that is monitored and controlled by SCM tools and sustained by information sharing practices. Moreover, the study highlights the significant roles of communication channels in facilitating the intra-organisational information sharing practices by SCM members and in supporting SCM departments as a key component of their success and increased the firm's capability.

Applying the SCM approach to the four Tawazun subsidiaries would constitute a typical case for investigating the above two shortcomings in a defence industry context. Thus, developing a new framework would define the pathway along which the supply chain system is internally integrated, by incorporating an information-sharing (content and quality) paradigm. This information pattern, in turn, would justify the study and the motivation for conducting it. The generated findings can be used in restructuring Tawazun's SCM system and increasing its capabilities by removing the barriers from the channels of information sharing by the firm's members to meet customers' expectations.

1.2.4 Glossary

- a. *Information Sharing (IS)*- “The process of information exchange and flow in the supply chain system across the firm. The content of shared information relevant to the supply chain tasks” (Christopher, 2005).
- b. *Supply Chain (SC)*- “A network of multiple organisations sharing in producing, handling, and distributing certain products or services to bring the different SC partners to taking on the outsourcing of desired goods or services” (Ellram & Cooper, 2014).
- c. *Supply Chain Integration (SCI)*- “The degree to which a firm can strategically collaborate with the supply chain members, and cooperatively manage intra- and inter- the company SC processes” (Flynn et al., 2010).
- d. *Supply Chain Management (SCM)*- “The management approach to gain useful relationships between customers and suppliers to deliver better value at less cost in the SC network” (Jüttner et al., 2007)

1.3 Dissertation Structure and Layout

This dissertation is set in conformity with the standard template designed by the College of Graduate Studies at the United Arab Emirates University (UAEU).

Figure 1 illustrates the physical structure of the dissertation body which is divided into eight chapters, as described below.

❖ **Chapter 1: Introduction**

This chapter outlines the core theme of the dissertation focus and includes a background to the subject of SCM, SCI, the role of information sharing, and a note on the studies conducted on SCM applications in business sectors. The chapter also covers i) a research statement, aim, study objectives and research questions; ii) the research approach (literature review, research methodology), iii) the study justification and significance, and iv) a glossary and v) a summary.

❖ **Chapter 2: Defence Industries in the UAE Context**

This chapter gives a historical background to the strategic and economic importance of the national military defence industries in the UAE. The Abu Dhabi Government established the Tawazun Economic Programme to oversee the manufacturing processes of its army equipment and the vehicles and transfer of defence technology. This chapter also covers other entities that have recently been created and that are involved in defence industries, such as EDIC.

❖ **Chapter 3: Literature Review**

This chapter reviews the existing body of scholarly work on the SCM from theoretical and applied perspectives. The literature review aimed at highlighting a possible gap in the SCM research domain. The literature search revealed that the issue of the role of information sharing in enhancing SC capabilities has not so far been adequately tackled, pointing to a knowledge gap in this area.

❖ **Chapter 4: Research Methodology**

This chapter presents a justification for the selection and adoption of a research methodology. The research incorporated qualitative and quantitative research methods for data collection and analysis, with interviewees (senior managers) and questionnaire respondents (junior staff). They supplied data on the role of information sharing in enhancing SC capabilities in Tawazun's subsidiaries.

❖ **Chapter 5: Information Sharing: Perception, Value and Reliability- Analysis and Discussion**

This chapter discusses the perception of the senior managers in Tawazun's four subsidiaries of the importance of practising information sharing as a social phenomenon and of human interaction between the supply chain workers. The series of interviews concentrated on the potential roles and values of information sharing in enhancing the capability of both individual departments and Tawazun. The inquiries extended to investigate how information sharing could maintain the integration achieved in the three SCM departments and the consequent impact on the attainment of Tawazun's business goals. The chapter also presents the findings of a statistical analysis of the survey data received from the SCM juniors regarding the value and frequency of information sharing.

❖ **Chapter 6: Information Sharing and Communication Channels- Analysis and Discussion**

This chapter sought to shed light on the pattern and preferable communication channels of information sharing, along with the use of resource planning systems in

the implementation of intra-/inter-departmental supply chain integration. The required data collected from a series of interviews with the senior managers, and the survey responses of the juniors.

❖ Chapter 7: Information Sharing and Supply Chain Capability – Discussion and Analysis

This chapter presents the results generated from both the Seniors' interviews and juniors' surveys about the significant role of information sharing in enhancing the capability of the three SCM departments in the context of Tawazun's manufacturing activities. It also asks how supply chain capability can be measured in the Tawazun context and the key capability indicators can be identified to meet customer demands and maintain market competitiveness through the sharing of information/data among SCM members.

❖ Chapter 8: Conclusion and Practical Implications

Chapter 8 brings the research to a conclusion in which the success of the study is assessed, and recommendations and practical implications are offered for the efficient management of internal supply chain integration, and the activation of information sharing flows along all communication channels to boost the capabilities of the supply chain. The chapter discusses the study's contribution to the topic of SCM, its usefulness in defence manufacturing firms and the limitations of the research study.

1.4 Summary

The various roles of information sharing in SCM-related activities, in the context of manufacturing business have received much attention from researchers into the management of production, services, and the supply network. However, little has been written about information sharing practices in defence manufacturing ecosystems, even in the countries whose defence industries are major players in their national economy. This makes supply chain information sharing in a defence manufacturing business, in this case, a UAE-based defence company an attractive research topic which has not so far been explored.

The Abu Dhabi Emirates launched the Tawazun Economic Programme as an embryo of the defence manufacturing business, and as a hub for future expansion of this type of economic activity. This study takes on Tawazun as a case study for investigating the role of information sharing in integrating and enhancing the capability of its SCM departments. The present case study research was undertaken to reveal the concepts, attitudes, and willingness of Tawazun staff (senior managers and junior staff) from a professional perspective when it came to information sharing as a new phenomenon and the impact of human interaction in the workplace. It was thought that the development of an SCM paradigm proper to Tawazun's manufacturing activities would be useful for designing efficient information sharing and its requisite channels, as a way of interfacing between supply chain capability and product quality to meet customers' expectations.

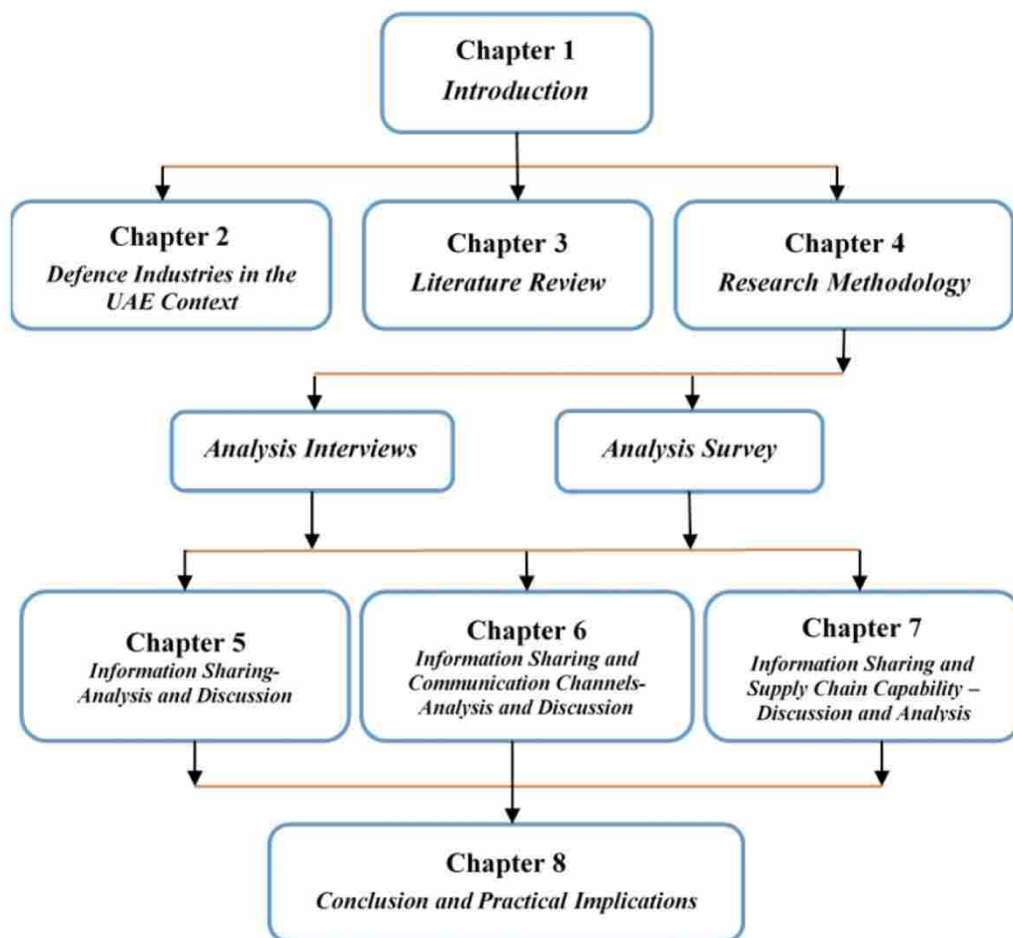


Figure 1: Flowchart of dissertation structure

(Source: Developed for the present research)

Chapter 2: Defence Industries in the UAE Context

2.1 Introduction

This chapter presents a detailed account of the UAE's defence industry and its potential contributions to the national economy and its strategy of business diversity. The Tawazun Economic Programme, which is a backbone project of the UAE defence industries, is particularly emphasised.

The UAE is a federated state that established on 2nd December 1971 through the unification of seven emirates, which used to be known as the *Trucial Coast states*. The economic history of this area gives pearling as the significant activity and pearl products the primary raw materials for export, whereas consumer goods (e.g., foodstuff, textiles, medicines, and home appliances), machinery and building materials were the main imported items. These products represented its foreign trading with the neighbouring region and Asian countries, notably, India and Iran.

The economic history of the UAE is impressive and has witnessed sound socioeconomic transitions during the state's development. Until 1973, the UAE was one of the least developed countries, with hydrocarbon resources as the leading providers of the national income. However, the skyrocketing price of oil in 1974, due to the Middle East war in October 1973, fuelled the economy with significant amounts of petrodollars to allow it to be remodelled according to a free market-based paradigm. Such substantial oil revenues have accelerated the improvement of living standards and community-oriented services, and have significantly opened the door to many new industries (Delgado, 2016; pp.17-19).

In the last thirty or more years, the abundance of hydrocarbon resources has enhanced the accumulation of enormous oil revenues which have enabled the UAE to shortcut the usually challenging and lengthy process of accumulating the necessary capital for macroeconomic development. Thus, during the oil-producing era, the UAE chose resource-based industries (RBI) as an industrial strategy based on the conversion of hydrocarbons in the petrochemical and related industries.

Although the UAE is still a young state, it has made unprecedented investments in the expansion of its infrastructure and social welfare services and has divided its economy into two segments (i.e., oil and non-oil), embarking upon diversification in the spheres of business and industry. Moreover, the UAE has kept pace with the digital revolution and switch to ICT-based paradigms, such as e-commerce, e-government, e-media, and e-learning. It has also been expanding in the social welfare and tourism industries (Deleure, 2016; pp.7-15). Recently, the UAE economy has welcomed the advent of advanced technologies, such as military/defence, aerospace, and nano-technologies (i.e., in preparation for the UAE to enter the nanotechnology era), which have been launched with the international partnership. The non-oil sector was able to sustain the UAE's economic development through minimising the potential risks of oil-sector dependence, (e.g., depletion, price fluctuation, high competition cost, and climate change restrictions) (Al-Hashemi, 2016; pp.236-266).

The new economic policy has achieved a favourable degree of political stability, social welfare, and business promotion, which underpin the UAE as an active member of many regional and international organisations, as has its provision of peace and cooperation as essential elements in its foreign relations.

This chapter examines the bundle of economic initiatives and strategic plans proposed by the Abu Dhabi Emirate, whose Executive Council (representing its government) set broad guidelines and top priorities in 2008 within its policy agendas, known as the *Abu Dhabi Vision 2030*, for socioeconomic and technological advancement. The defence industry has received particular attention in these agendas, as well as supported financially and institutionally. The Tawazun Economic Programme is an exemplary product of this international cooperation in the defence industry. The socioeconomic progress achieved by business and economic diversification has increased the UAE income per capita, which is now amongst the highest in the world.

2.2 Economic Profile of the Abu Dhabi Emirate

2.2.1 Background

Currently, the UAE's industrialisation strategy has broadened the base of its diversified economy despite the limited amounts of raw material other than hydrocarbons. However, the latter is found in abundance in Abu Dhabi, accounting for more than 80% of the oil and gas from the UAE's oil-producing Emirates. The accumulated petrodollars of the Emirate have treated industrial expansion as a priority of the national economy for the development agenda.

The Abu Dhabi Executive Council (hereafter referred to the Council) is in charge of promoting the priority of industrial growth in this Emirate. The Council set up in 2004 the Higher Corporation for Specialized Economic Zones (HCSZ), also known as the Zones Corp, to manage industrial zones in the Emirate, together with the primary business organisations, such as Sena'at, Mubadala and numerous other partnerships between public and private business entities. Moreover, the Abu Dhabi Department of

Economic Development (ADDED), under the auspices of the Council, has entered a consultative process with the significant public and private stakeholders in the Emirate's manufacturing sector to produce a focused and coherent blueprint for industrial development.

The Council also proposed the 2011-2015 Abu Dhabi Industrial Development Strategy (AIDS) to be a vital reference and framework for the economic strategy behind the business diversification. The Emirate's AIDS focuses mostly on ten industrial sectors and clusters as its primary goals, namely, petrochemicals, advanced plastic products, renewable energy resources, composite material, engineered metals, mechatronics, healthcare, defence products, aerospace, and smart transportation (Al-Raqbani, 2013). Supporting this strategy, the Zones Corp has established many industrial colonies across the Abu Dhabi Emirate and has recently set up the Khalifa Industrial Zone Abu Dhabi (KIZAD).

KIZAD is a blueprint for creating a focused and coherent framework for industrial planning to sign bilateral cooperation agreements with reputable international companies in specific areas. This collaboration would help the Emirate to maintain its non-oil industries and raise their GDP contribution from 41% in 2005 to 64% by the year 2030 through reducing the reliance on the oil industry, which is subject to price volatility, would make it easier to maintain steady long-term growth (Council, 2009).

After experiencing an unprecedented period of economic growth during the boom in oil prices, the Emirate is looking to invest the deposited petrodollar revenues in developing a sustainable and lively economy for future generations. The Abu Dhabi Emirate follows a course of new strategies by which to attain the proposed goals in two distinct stages:

- i) ***Building a sustainable economy***: according to major economic indicators, the Emirate currently enjoys an enviable position, shown by its accelerating economic growth, income per capita (one of the highest in the world), and the high standards of social welfare enjoyed by its citizens. The Emirate's primary economic resource, hydrocarbons, is enjoying a period of unprecedented demand, securing high prices on the international market. Such global oil circumstances have given it a financial boost that will ensure its long-term economic viability, sustainable development, and social welfare. Nevertheless, the nation must seek alternative routes for introducing new business and industrial activities to contribute sufficiently to its revenues.
- ii) ***The need for business diversification***: its hydrocarbon resources have been the primary source engine of the Emirate's socioeconomic development since the late 1930s, and the accumulated petrodollars have provided a sovereign fund of billions of Dirhams. These revenues have been invested in a wide range of economic projects locally and globally in the Emirate's strategy of the business and industrial diversification. To achieve this, the Emirate has carried out a comprehensive reassessment to identify the areas of its economic interest and correspondingly restructure its economy through improvements and adjustments (Low, 2012; pp. 23-57).
- iii) A press interview with the Director-General of the AD Council of Economic Development (ADCED), HE Fahad Al Raqbani (August 2013), who argues that there is an apparent link between business diversification and economic sustainability such that the route to sustainability starts with the initiation of business diversification. However, the Abu Dhabi Emirate, to de-couple

overall growth from volatile oil receipts, seeks to diversify in the economic and business activity by stimulating industry-based and export-oriented business outside oil/gas production. In the *Economic Vision 2030*, the business and increasing productivity will benefit from a focused approach to competitive advantage.

The Policy Agenda 2007/2008 of the AD Council defines a set of the top requirements as national policy. These requirements are in line with the Emirate's core goals, particularly citizens' safety and sense of security in the community but still maintain a dynamic and attractive free economic environment. Thus, the Council (Council, 2009) has identified nine social, political and economic areas that shape the nation's future in the arenas, as follows:

- 1) Sustainable knowledge-based economy.
- 2) An optimal, transparent, and regulatory public administration.
- 3) Continuum of robust and diverse international mutual relationships.
- 4) Optimisation of the Emirate's natural resources and infrastructure assets.
- 5) Premium education and research
- 6) Healthcare and social work provision
- 7) Job opportunities for the future generations.
- 8) Contribution to international and home security of the UAE state.
- 9) Maintaining Abu Dhabi's values, culture and heritage.

The areas mentioned above are concentrated in five key groups: **i)** Local business development, **ii)** Infrastructure development and environmental sustainability, **iii)** Human resources and socioeconomic development, **iv)** Optimisation of government operations, and **v)** partnership with an empowered private sector. Thus, the

government's drive to make the economy more sustainable and diversified is intended to reduce its heavy dependence on oil production and export. The urge to diversify the business, in turn, led the government to give urgent attention to the quality of its educational arrangements and to associate them with the job market options.

The level of GDP is determined at present by large enterprises, suggesting that there is room for improvement in the productivity of small and medium-sized businesses (SMEs). Developing the SME sector will bring Abu Dhabi into line with its benchmarks, and at the same time reduce the economy's exposure to risks, encourage innovation and create jobs. Therefore, the planned diversification aims to include the enterprise base and increases the number of economically active SMEs by spreading and fragmenting this risk, thus reducing the adverse effects of shocks to the national economy as a whole.

Standard and Poor's financial services (Reuter & Rohde, 2015) recorded that the Emirate of Abu Dhabi is among the wealthiest economies in the world, with economic growth running annually at above 6% since 2011, despite the consequences of the post-2008 global financial crisis. The UAE has become one of the fastest growing and emerging economies worldwide, as shown in Figure 2.

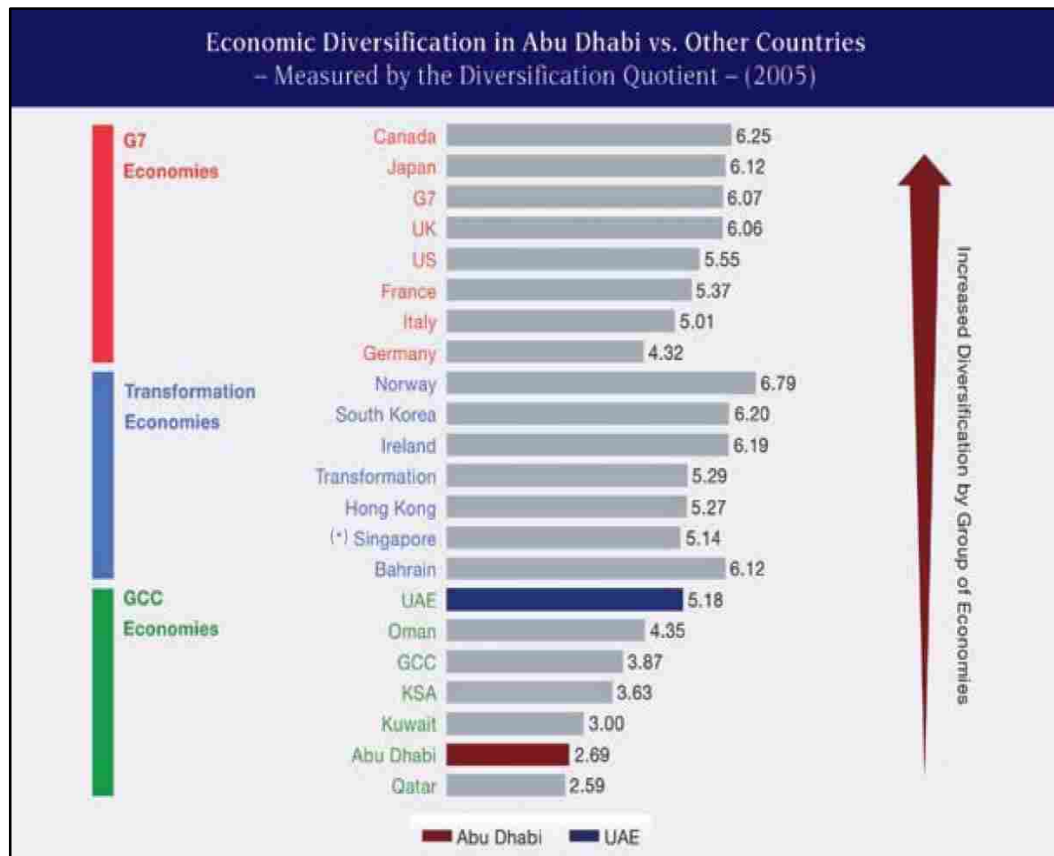


Figure 2: Economic ranking of the Abu Dhabi Emirate

(Source: AD Council, 2009)

The defence industries in the UAE were established to increase its satisfaction of military and defence products and capabilities in response to the new challenges raised by recent changes in the regional geopolitical and security environment.

2.2.2 Abu Dhabi Economic Vision 2030

This Emirate wants to be sure that its target success will dynamically continue to develop and grow. To keep up its economic momentum and sustainability, the Emirate declared in 2008 a set of ambitious economic projects known as the *Abu Dhabi Vision 2030* (hereafter, the Vision) which incorporates the economic diversification discussed

above. The strategic location of the Emirate at one of the world's busiest maritime and oil exporting routes simplified the expansion of its industrial base and enabled it to become the primary export and manufacturing hub in the region. Moreover, a better-educated workforce will help to raise the relatively low productivity rates found in many of its enterprises. *Vision 2030* picks out the areas that might be improved to improve the economy and raise the Emirate's power to compete with its rivals and meet international benchmarks.

Vision 2030 should, therefore, be of particular concern in business legislation, labour policy, fiscal and monetary policies since they are key regulatory and policy levers that can be manipulated to improve the overall business environment. *Vision 2030* is seen as a 22-year strategy to attain the target objectives and to make sure that all the stakeholders in the Emirate's economy act in harmony, with the same long-term goals. Considering these proposed guidelines as the evaluative parameters of the economic plan, *Vision 2030* was composed in active consultation with the private sector.

Vision 2030 sets out to tackle the current global economic situation and future ones by identifying the domains that must be improved before the goals set out in the Policy Agendas can be attained, as follows:

- ❖ *First*, an analysis of the available macroeconomic information has been enough to guarantee the status of the Emirate's economy. *Vision 2030* asks which sectors and types of enterprise could contribute significantly to the future economic output and growth, and which regions show most significant growth. In these areas, various opportunities have been identified as capable of furnishing the desired economic diversity, sustainability, and equality throughout the regions.

- ❖ *Second*, the current business in local and global context is examined by *Vision 2030* to identify the primary strengths that the Vision could enhance by efficiently promoting economic initiatives among domestic enterprises and competitiveness between them, as well as with international rivals. In particular, *Vision 2030* considers the business legislation, labour insurance, transparent fiscal and monetary policy to be the core regulatory and policy levers that could be controlled to improve the business environment overall.

- ❖ *Finally*, the nature of *Vision 2030* is to consider the Emirate's natural and human resources and the necessary measures to ensure that they can accommodate future economic growth. Infrastructure, including energy, transport and ICT, is a critical area that requires continued investment if it is to satisfy a growing population and increased economic activity. The development of human capital and the workforce is another crucial task that is crucial to the long-term success of the Emirate's economic activities, ensuring that financial capital could be employed safely and confidently in developing and extending the economic system.

Vision 2030 proposed nine sectors for development to symbolise the typical business and economic diversity, which aims primarily at minimising reliance on non-renewable hydrocarbon resources and establish the Abu Dhabi Emirate as an attractive centre for advanced technology and business diversification. These sectors are:

- 1) Education delivery, learning, and research resource.
- 2) Energy- Hydrocarbon natural resources and renewable energy.
- 3) Petrochemicals and metals industries.
- 4) Aviation, aerospace, and defence industries.

- 5) Pharmaceuticals, Biotechnology, and Biosciences (agriculture and livestock).
- 6) Public health, and healthcare equipment and services.
- 7) Financial services and investment facilities.
- 8) Media and telecommunication services.
- 9) Transportation infrastructure, logistics, trade, tourism.

Vision 2030 considers aviation, aerospace, and defence industries strategic sectors because of their national security dimension added to its techno-economic impact on the promotion of the advanced industries associated with this sector, such as electronics, mechatronics, and composite material; these will all advance the research and development (R&D) activities. Thus, *Vision 2030* contains the key element of building sustainable economic growth through promoting business diversification.

The purpose of this business diversification is three-fold: **i)** to reduce GDP volatility; **ii)** to enlarge the business base, and **iii)** to enhance competitiveness. In conclusion, fostering a broad-based economic growth in the Abu Dhabi Emirate has required an efficient planning system to be set at the centre of the governmental machinery, linked to population increase, expansion of the infrastructure and environmental concern.

2.3 Defence Industry – the Economic Contribution

2.3.1 An Overview

Unquestionably, the rapid expansion in the defence industry has become one of the active industrial and manufacturing tasks of the UAE's national economic strategy. Moreover, the Council has placed much concern on establishing a series of defence industries relevant to the development and manufacturing defence products, and to take on a significant part in the technological contribution to its economic development

of the Abu Dhabi Emirate. Moreover, the Emirate launched an International Defence Exhibition (IDEX) to be held biennially in Abu Dhabi as an international showroom of the latest defence technology and products.

The presence of hundreds of UAE-based defence companies in IDEX gives them an ideal opportunity to sign many contracts with international defence manufacturers in the West and Asia, which involve, for example, licensing, technology and experience transfer in this area. Likewise, IDEX gives international companies a chance to learn more about the capabilities and capacity of the UAE defence industry, which may generate many opportunities for partnership cooperation, given the common interests of the two sides.

The strategic importance of defence industries is not only that they demonstrate industrial and technological progress, but also that they are a vital pillar of national security, providing the essential needs of a nation's armed forces and supporting a margin of political manoeuvrability in exercising its independence from foreign influences. At the same time, the economic importance of the defence industry can be represented as a qualitative addition to the national economy through the expansion of the export base and the building of bilateral cooperation with other countries. From this perspective, a marketing base for the UAE's defence production should be in line with its proposed plans, namely "*shield home*", which is a crucial development seeking to highlight the strategic objectives and dimensions of defence industry projects.

2.3.2 Emirates Defence Industries Company (EDIC)

Since the supply chain system of a defence manufacturing company is the concern of the present research, a brief history of its establishment may be helpful at this point.

Eleven subsidiaries from Mubadala Development, The Tawazun Holding, and the Emirates Advanced Investment Group (all owned by the government of Abu Dhabi) finalised the establishment of the Emirates Defence Industries Company (EDIC) on 2 December 2014, which would commence trading and business activities in the following January.

EDIC demonstrates the spirit of collaboration among the leading actors in the UAE's defence industry. Thus, the mission of EDIC is to be able to fully operate and run a world-leading defence industry in the region. Therefore, it is strategically essential for EDIC to maintain close industrial ties with firms that are world leaders. EDIC operates with sixteen UAE-based defence manufacturers under its umbrella, which focus on localising, manufacturing, servicing and testing core elements of their supply chains (EDIC, 2015). EDIC is now one of the most significant defence business and manufacturing organisations in the Arabian Gulf region, employing more than ten thousand people in manufacturing and services over air, land, and sea.

EDIC functions as a central body looking after the development and strength of the industry, while establishing bilateral relationships with international partners with the same or a similar focus. These relationships aim to look beyond assembly and share in the local manufacture of some mechanical parts; thus facilitating the relationships with international OEMs (original equipment manufacturers). EDIC's companies will highlight innovations from its group of enterprises.

One of the major components of EDIC is the Tawazun Programme, which represents its interest in being more independent. It is keen to amass a core collection of defence equipment, as well as introducing advanced defence technologies. Since its inception in 1992, the Tawazun Programme has been working to fulfil the vision of the UAE in

line with the leaders' directives. Thus, the Tawazun Programme aims primarily to achieve comprehensive and sustainable socio-economic and technological development which puts more focused effort into securing a diversified and knowledge-driven economy.

The Tawazun Programme has shared in making the Emirate a regional centre for the exceptional growth of defence and kindred industries. This can be seen from the creation of new ventures in sectors that are of national interest, and from its establishing and promoting a secure business environment, robust industrial partnerships, capacity building, technology localisation, and technical knowledge transfer. The Tawazun Programme is therefore expected to create plenty of job opportunities for UAE citizens in advanced technical fields and also for national business organisations.

This will compel the Abu Dhabi-based defence firms to reassess and restructure their defence production lines by introducing effective management tools, such as a systematic supply chain, optimised inventory management and a collaborative relationship between suppliers and management, to deal with the complexity of this new business and manufacturing environment. Some areas that manufacturing firms can target to achieve this are supply chain market intelligence, demand planning, the management of supplier-customer relationships, and the supply talent and technology.

Moreover, EDIC is set to help drive the UAE's defence industry by providing manufacturing, training, logistics, communications, technological development, and maintenance, repair and operations services for air, land and sea equipment. In this way, EDIC is the seed for growing an advanced national defence industry.

2.4 The Tawazun Economic Programme

2.4.1 The Initiative

The Tawazun Economic Programme (hereafter, Tawazun), which is overseen by the Tawazun Economic Council (hereafter Tawazun Council), provides a way for the UAE's industries to derive economic value from the country's extensive defence procurement programme. Since 1992, Tawazun has worked actively to diversify the UAE economy by creating new ventures in sectors of national importance. Tawazun symbolises the new track for alternative business activity that helps to minimise dependence upon hydrocarbon revenues alone.

The intention of the Abu Dhabi Executive Council is to make the Tawazun Economic Programme one of the best industrial ventures in any developing country by focusing on, and investing in, skilled and dedicated people. Introducing innovative technology and scientific practices would play a crucial role in building a competitive, smart business, which would be the backbone of the UAE's fast-growing diversified economy. Thus, Tawazun acts in the higher national interest using self-dependent defence firms which have a two-fold function, to conserve national security, and to maintain the UAE's position in the international defence market.

To achieve the ultimate goals of Tawazun in local defence manufacturing, the Abu Dhabi government created various entities dedicated to providing the necessary support to Tawazun's principal partners. Moreover, the Programme established numerous public-private partnerships to give the private sector organisations (e.g., Mubadala, Sana'a, and the Zones Corp) room to share in the implementation of the defence industry's strategy and Tawazun's contributions to *Vision 2030*. This

intensive business and industrial activities need innovative management approaches, as supply chain market intelligence, to support quality production and market competitiveness.

The supply chain market intelligence is the process of acquiring and analysing information to gain a better understanding of current and future market trends in support of a firm's parallel sourcing and market sector strategies. Such forecasting information enables Tawazun's subsidiaries to anticipate changes in the marketplace better and react to defence market trends before others do. Thus, sufficient supply chain market intelligence can help Tawazun to deal with the challenges facing the strategic supply chain, such as constrained capacity, infrastructure, and volatile markets. It also contributes to making the right decisions about which markets to buy from, how to determine the right price to pay and what benchmarks and targets will provide a competitive edge.

Tawazun has collaborated with internationally reputed contractors, brought investments and the latest technologies into the UAE, generated knowledge-based jobs for UAE nationals and created business opportunities for the UAE defence companies. It has six key objectives: **i)** Build a critical national defence industry, **ii)** Create a knowledge-based economy, **iii)** Diversify the UAE's economy by expanding the industrial base, **iv)** Create business opportunities for UAE citizens in the private sector, **v)** Generate high-value exports and expand foreign trading, and **vi)** Create job possibilities for the UAE citizens in hi-tech fields.

The Government Defence Procurement (GDP) body and Tawazun start their processes simultaneously. Thus, a defence contractor is often informed of the requirement to enter into the Tawazun Agreement during the bidding process and needs clearance

from Tawazun before a government defence contract can be awarded. The selection process for a contract is linked to the agreement of Tawazun to add its signature and to make sure that defence contractors are aware of the industrial participation requirements (IPR) and have enough time to plan the identification and execution of a fair project that will satisfy all obligations.

Any foreign defence contractor/supplier to UAE with a deal involving more than US\$ 10 million over a five-year period must participate in Tawazun. The foreign contractor generates obligations through the sale of goods and services to the UAE. Tawazun has established formal guidelines to the areas of interest, mechanics and process where these obligations must be met. The primary aim of Tawazun is to continue to catalyse new projects that comply with the objectives listed above.

2.4.2 Defence Contractors Council

The Defence Contractors Council (DCC) was created with the purpose of generating ongoing open dialogues among defence contractors and the Tawazun Council. The DCC provides a forum for sharing views and highlights appropriate ways for improving transparency among the Council members. The Tawazun Council has opened two-way communication channels with the target defence contractors and invited their feedback; it also wants to ensure that they are actively engaged in all the supply chain activities, which could enable the Tawazun Council to review and upgrade its policies continuously; this serves its mandate and supports its defence contractors in fulfilling their obligations as they should.

The Council is made up of representatives from Tawazun and defence contractors (e.g., defence-product manufacturers and suppliers) to the UAE Armed Forces, along

with any third parties that Tawazun Council views as valuable contributors to the DCC's primary objectives, which are as follows:

- 1) To serve as an open platform to further enhance communications with defence contractors and Tawazun Council.
- 2) To enable a clear understanding of Tawazun's requirements.
- 3) To create business opportunities for the partners.
- 4) To facilitate the establishment of a business network among possible Emirati partners and international defence contractors
- 5) To facilitate the technology transfer, the exchange of professional experience, the conception of future potential projects, and suggestions.
- 6) To highlight and monitor the performance of so-called venture projects implemented under the Tawazun Programme.

2.5 Tawazun Subsidiaries (Firms)

While the present research was being conducted, Tawazun consisted of seven defence firms, namely; NIMR Automotive, Caracal Light Ammunition, Caracal International, Burkan Munitions Systems (BMS), Tawazun Precision Industries (TPI), Tawazun Dynamics and ADASI, along with related companies supporting the transfer of manufacturing and defence technology (e.g., Rabadan Academy, Tawazun Industrial Park (TIP)) The present study chose four factories in which to conduct the survey and data collection, namely, *Tawazun Dynamics*, *NIMR*, *Caracal Ammunition*, and *Burkan*. EDIC has since acquired the last three of these. Each of them focuses on a specific domain of advanced defence technology either the defence sector or the independent systems sector, to be distinguished as follows:

- *The Defence sector* is concerned with manufacturing products for defence purposes and uses.
- *The Autonomous Systems sector* is concerned with manufacturing robotics-based systems for both defence and civilian purposes.

The sustainability of the various activities of the two sectors needs specific capabilities from the workers. Therefore, Tawazun has been striving to introduce innovative knowledge and skills to catch up with the standards of workers in other countries in:

- 1) Mechanical designing, engineering management and technology
- 2) Electronics and Mechatronics
- 3) Software engineering and computing programmes
- 4) Systems integration and assembly management
- 5) Manufacturing engineering, testing and total quality management
- 6) Project and portfolio management
- 7) Maintenance, repairs, and overhaul (MRO).

The Tawazun Council established Tawazun Holding in 2007 to develop many co-ventures as strategic added-value investments of the Abu Dhabi Emirate across several areas, particularly defence and, automotive, munitions, metals technology; this was done through entering long-term partnerships with reputable manufacturers of defence equipment and vehicles. The Tawazun Programme has collaborated with a hand-picked selection of world-class market leaders to build skills, expertise, products, and systems in the UAE. The following subsections provide an overview of the four Tawazun subsidiaries under study.

2.5.1 NIMR Automotive

NIMR Automotive LLC (NIMR) is a major automotive manufacturer of light and medium-weight defence vehicles in the UAE. It also provides a portfolio of products to address the various needs of armed forces and internal security organisations. NIMR has grown by adopting international defence industry standards across all its business functions. It is committed to augmenting the UAE's capacity to manufacture and deliver high-quality defence vehicles to its customers.

NIMR vehicles have gained a sound reputation for the brand which has been attributed to their advanced design, versatility, ruggedness, and exceptional performance in tropical and desert conditions. NIMR vehicles have multi-purpose functions that can be employed in different situational scenarios: they can work as armament carriers, logistics vehicles, ambulances, or mobile command and control centres. These attractive specifications provide the tactical mobility required to meet a diverse range of operational requirements on the modern battlefield and have allowed these vehicles to serve many armed forces across the MENA countries.

2.5.2 Caracal Light Ammunition

Caracal Light Ammunition (CLA) produces a range of diversified calibres and variants of small arms ammunition (SAA) for both defence and particular security purposes, such as policing. Today, CLA remains the favourite for most SAA users due to its NATO-compatible specifications for ammunition of many calibres, as well as shotgun shells and pyrotechnics. Through relentless effort, CLA has succeeded in building a brand of market trust and becoming a firm of choice for customers in the small arms ammunition sector, both across the region and elsewhere.

One of Caracal's CEO made a statement reflecting the genuine mission of the CLA: *“Since its establishment in 2012, CLA has consistently been working on developing its products to meet the highest standards of quality; thus, it has taken teamwork, perseverance and dedication to achieve this prosperity and success”* (personal communication).

2.5.3 Burkan Munitions Systems

Burkan Munitions Systems (BMS) was founded in 2007 to be the primary subsidiary in manufacturing, assembling and testing a broad range of bombs and related ammunition products for use by infantry troops and tank crews, in artillery and defence aircraft. In 2009, Burkan added a new line of production by manufacturing 40mm low-velocity rounds and starting demilitarisation operations. Nowadays, Burkan is one of the leading munitions manufacturers in the GCC, with international standards of technology and the capacity to turn industrial challenges into competitive advantages.

2.5.4 Tawazun Dynamics

Tawazun Dynamics concentrates on manufacturing precision-guided munitions (PGM), offering a continuum of processes, ranging from design and manufacture, through to supply chain and maintenance. This subsidiary is a strategic co-venture between Tawazun Holding (51%) and the South Africa-based Denel Dynamics (49%). Since its inception, Tawazun Dynamics has expanded its core competencies to be able to design, develop, create, assemble, sub-assembly and manufacture products through collaboration with local suppliers, the mastering of technical expertise and deployment of the latest technologies.

Tawazun Dynamics conceived with the primary objective of developing capabilities in the UAE. Thus, the firm seeks to sustain a continuous track of creativity, innovation, and advanced enterprise, leading it to be a self-sustaining, fully-operational unit across its fields of specialisation. The Tawazun subsidiaries are working integrally to cover a broad range of defence and defence products to satisfying local needs and looking forward to foreign markets.

2.6 Summary

The Abu Dhabi Emirate has connected its sustainable growth, wealth, and high standard of social welfare with an ambitious, visionary economic plan that will extend until 2030. To the end, the Emirate introduced in 2008 a long-range vision planning approach with timeline horizon ending in 2030. This plan demands a multi-dimensional strategic planning framework to help guide future patterns of national development. The ultimate objectives of *Vision 2030* would be to broaden the enterprise base of the Emirate across a range of sectors and to take steps to improve the competitiveness of the local private-sector organisations.

Among the advanced industries with which the Emirate is much concerned are the defence industries. Over twenty years of business partnerships with world-class players in advanced technologies, the Programme successfully continues its mission of establishing strong defence industrial business links between national and international contractors to create commercially viable, profitable, and sustainable partnerships.

The UAE unsparingly sustains the momentum of its economic growth and has recovered with minimum risks from the 2008 financial global crisis, as well as from

the current economic uncertainty in its region. The consequences of the crisis were reflected obviously in the sound business performance of the defence firms which are managed by EDIC and the Tawazun Economic Programme. The UAE government has encouraged these firms in various ways – financially, politically, and morally – and also by promising it a percentage of the defence contracts awarded.

In conclusion, the Tawazun Economic Programme has created several successful multi-million dollars economic and defence industrial joint ventures, which have significantly helped to build diversity-oriented business across several essential manufacturing areas. These, in turn, have driven the economic development of the defence and related industries in the UAE and turned them into modern, state-of-the-art, concerns.

Chapter 3: Literature Review

3.1 Introduction

The advent of supply chain management (SCM) in manufacturing and community services as a research field has been rapidly evolving, with a geometric growth in the number of scholarly publications. Thus, the scope of SCM literature is vast, the variety of its definitions is overwhelming, and there is too little agreement in the existing literature on central issues and concepts to review them adequately.

This chapter nonetheless considers the research on SCM to highlight its aspects and current applications. The search of the literature concentrated on peer-reviewed journals about the supply chain and related subjects, such as production, logistics, operations research and marketing. To review the literature constitutes the initial stage of the research process. Selecting, reading and evaluating the work related to the researched topic is an on-going core activity (Tranfield et al., 2003). The review should reveal something of the current state, as well as a future inquiry into SCM research as a discrete discipline. The primary task of the literature search is to retrieve and re-examine related studies, particularly those on information-sharing patterns, integration and capabilities in SCM and practices in the defence industries.

A literature review follows a hierarchical order; it starts by introducing the debate over terminology and definitions; next, it examines (in this case) the major components of SCM, including traditional SCM, modern and future trends in SCM, SCI, firm capability, information-sharing and communication channels. Current SCM concepts and practices in various contexts from the existing published sources can guide the SC

managers and practitioners to understand the intra-organisational and inter-functional challenges facing different levels of supply chain involvement.

The search of the literature was not limited to online resources but also included an extensive search of the relevant publication available in the digital libraries of recognised publishers such as IEEE, Elsevier, ACM, and the like. Most of the resources included in this review concentrate on one or more elements of information-sharing which lead to strategic changes in the producers and suppliers, the type of information shared (demand, inventory, production) and the mechanism applied for data interchange. The present review of the literature revealed an apparent scarcity of research studies investigating the capabilities of the supply chain (Operations, Procurement and Inventory), which have recently found their way to scholarly attention.

The aspects of the literary search responded to the questions are shown in Figure 3:

- *Identifying Areas:* The research questions help to name the areas where relevant literature may be found.
- *Searching for and viewing the abstracts in various e-resources:* After finalising the literature review, search with keywords/key phrases to find the relevant papers. Retrieve the full text in case the work is related.
- *Sorting the Literature for Review:* Once the research papers are available, the returns can be distributed according to the theme.
- *Reviewing:* The papers are then used to support answers to the research questions and thus fill the gap identified in the literature.

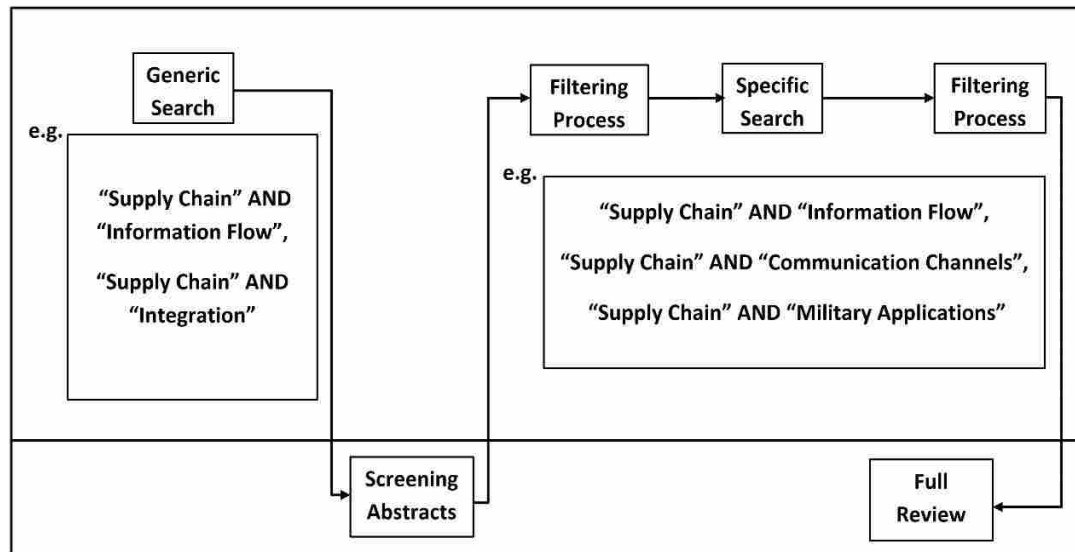


Figure 3: Steps in the literature review

(Source: Developed by the author)

The generated findings of this study are expected to fill the knowledge gap in SC information-sharing in the defence firms, and the impact of the SC integration (SCI) on developing robust capability in these firms the review of the retrieved documents argue that the role of information-sharing in SCM is still debatable. Moreover, most of the articles discuss the impact of information-sharing on supply chain performance and only a few authors study the effect of information-sharing on supply chain capabilities.

The following subsections deal with various SCM-related themes including a brief history of the evolution of the term ‘SCM’, supply chain integration (SCI), information-sharing patterns and channels, information-sharing in the defence industry, and supply chain capabilities. The chapter then ends with a summary.

3.2 Supply Chain and the Birth of SCM

3.2.1 A Brief History

The concept of the supply chain has evolved more quickly in some eras than others. It is currently well grounded in the management and engineering literature. Forrester (1961) introduced the first supply chain model to represent the object of the forthcoming SCM, created by (Oliver & Webber, (1982); Ellram & Cooper, (2014)). It was seen as a more efficient way to manage resources and assets. In the early 1990s, SCM was initially described from a theoretical standpoint to highlight its appreciable differences from more traditional approaches (Stadtler, (2008; Ellram & Cooper, 2014).

Liu et al. (2016) state that since its emergence in management practices in the 1980s, many business and industry-based firms have considered SCM one of the most efficient ways to improve their competitive advantage. SCM was also active in enhancing a firm's competitiveness and performance (Li et al., 2006), maintaining business stability, growth and wealth (Harrison & New, 2002).

The progressive coordination of multiple relationships across the SC system is the chosen method of SCM. Generally speaking, the SC is not a ribbon of businesses with face-to-face or business-to-business relationships, but a network of business interests in multiple relationships. The supply chain represents a "*Network of organisations that are involved, through upstream and downstream linkages, in the different processes to build up specific values regarding quality products and services*" (Christopher, 2005).

In a broad sense, a typical supply chain consists of a network of legally separated entities involved directly or indirectly in the flow of material, information and financial assets. These organisations may be manufacturers, distributors, wholesalers, retailers or logistic service providers leading finally to end-customers. In a narrow sense, the term 'supply chain' may also be applied to a large firm with several subsidiaries often located in different countries with overseas operations. (Stadtler & Kilger, 2008)

Indicate that many large industrial firms face the management challenges of efficiently coordinating material, information and financial flows manner along the production line. The SC was purposely designed to establish many links between external suppliers, customers and the firm's demands (Marshall, 2015).

Over the past few decades the use and application of SCM in various domains, particularly in industry, seem to have evolved. In this sense, SCM deals with the entire process of introducing a new approach to manage various business activities and relationships amongst the links in the supply chain (Cooper & Lambert, 2000). It is well-known in engineering management that SCM is the evolutionary product of blending the organisation's traditional functions of purchasing, operations and logistics in different contexts (Cooper & Lambert, 2000).

The multifaceted features of typical traditional SCM have been shown as a *House*. Stadtler (2005) interprets the building blocks of this *House* as follows:

- ❖ The roof stands for the end-goal of SCM (e.g., competitiveness and customer satisfaction). Competitiveness could be improved by reducing costs and increasing flexibility to changes in customer demands or by providing better products and service delivery (pre-transaction, in transaction and post-transaction).

- ❖ The roof stays on two columns representing the two principal elements of SCM, namely, i) the integration of a network of governing bodies and ii) the coordination of information, material and financial flows. The figure also shows that the SCM foundations have been formed in an interdisciplinary way (e.g., ICT, logistics, operations, marketing and customer service) .
- ❖ The two main constituents, which have some level of uniqueness, are split into their building blocks. First, forming a supply chain requires the selection of suitable partners for a midterm partnership. Second, becoming a successful network organisation, which consists of legally separate organisations calls for inter-organisational collaboration. Third, for an interorganisational SC, the new concepts of leadership aligning to partners' strategies are significant.
- ❖ The multiple flows along the supply chain system can be coordinated efficiently by using state-of-the-art ICT. The advent of ICT allows the processes to be executed automatically. Overall, the SC activities at the interface of two entities can be inspected, while the duplicated activities can be split into discrete process orientation. Next, the new process and advanced planning process can begin.

Other related components (e.g., HRD, project management, market trends analysis, ICT applications, software enhancement (ERP and e-GP)) can be involved and accommodated to the SCM House where appropriate. Stock and Boyer (2009) indicate that at present SCM is an umbrella term for a variety of processes involved in managing a product or service development. The overarching benefits are added value, maximised profitability through efficiencies and customer satisfaction, as shown in Figure 4.

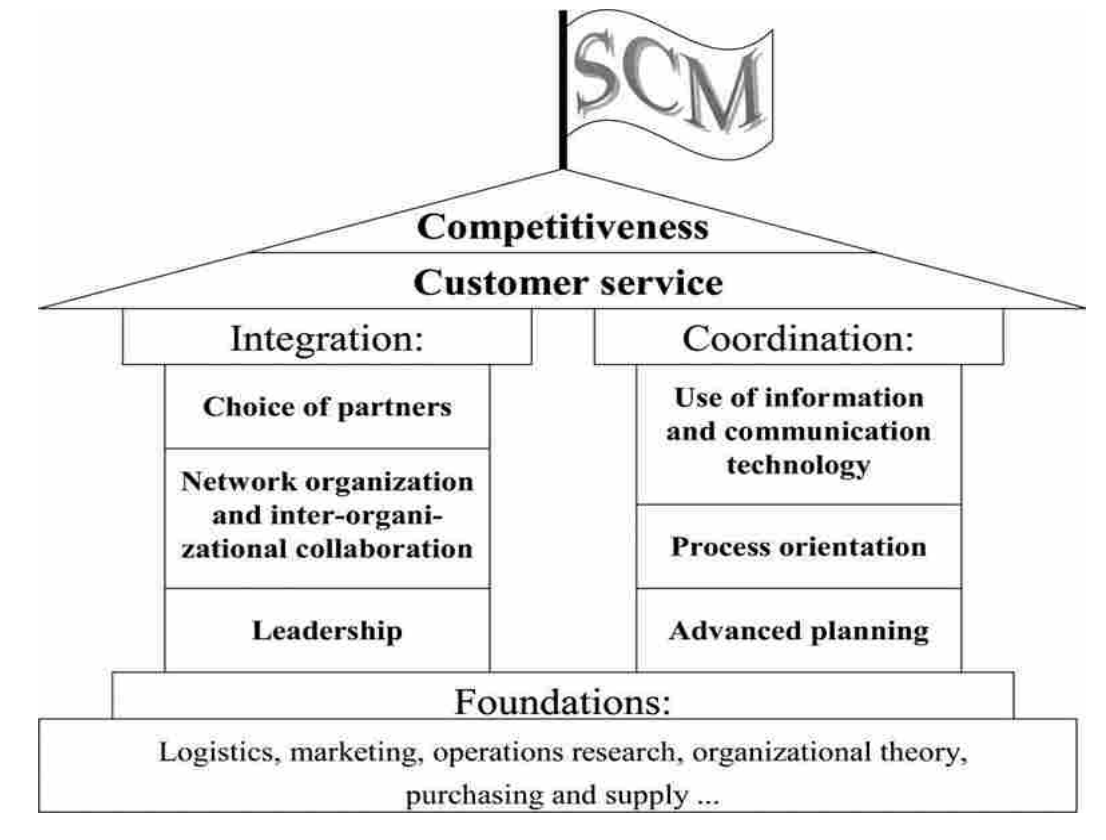


Figure 4: SCM House building blocks

3.2.2 SCM Definitions

The proper definition of SCM is still the most debated issue in almost every industry (manufacturing, construction, aerospace, factory farming, medical outreach, customer services and so on). As such, SCM is a most widely used and misused term in the literature on SCM functions (Maqsood & Akintoye, 2002). The variations in the SCM definitions may be attributed to its multidisciplinary origin and the nature of the domains where SCM applications are appropriate, such as operations, logistics, purchasing and marketing. The broad perspective and coverage of SCM have made it difficult to study as a discrete discipline holding particular problem areas (Tan, 2001).

Lummus and Vokurka (2000) comment on the evolution of the various concepts of SCM; these have received increasing attention because business has been able to achieve many significant benefits as a result of implementing collaborative relationships both within and beyond their organisations. Christopher (2005) further argues that active SCM has shown itself to be a powerful tool in earning cost advantages and favourable outcomes for all parties in the supply chain network.

Regarding SCM involvement with business processes, many authors discuss this issue from different standpoints. Forker et al. (1997) point out that SCM entails closer coordination and configuration of the business process between suppliers and customers. Liu et al. (2010) discuss the role of SCM implementation in enhancing the relationship between upstream (the suppliers) and downstream (the customers). Modern SCM practices suggest that close coordination between supply chain members is required to sustain competitiveness, fulfil the client need to leverage the firm's capabilities (Zacharia et al., 2014). Develop some of the advantages of sustainable competitiveness for the whole supply chain (Baihaqi & Sohal 2013).

The SCM concept has suffered from a confusion of overlapping terminology and meanings. This is because many labels referring to both supply chain and SCM applications have been generated. Controversy over the pattern and functions of information-sharing has resulted in a variety of definitions. Among these interchangeable terms are integrated purchasing strategy, supply chain synchronisation, integration, suppliers-alliances network and value stream (Maqsood & Akintoye, 2002). While each term addresses elements of the phenomenon, these terms for SCM are the most widespread but are sometimes misused to describe a particular SCM application (Tan, 2001) The definitions reflect the evolutionary trends

of SCM regarding its functions and involvements, as seen in Table 1 (Parkhi et al., 2015).

Table 1: Definitions of SCM

Source	SCM Definition
Chang et al. (2013)	Supply chain management now has a new strategic dimension to it which is e-Procurement.
Dubey & Ali (2013)	The management approach of upstream and downstream associations with vendors and customers to provide the better customer with some values at least cost to the supply chain.
Machowiak (2012)	A methodology for improving the business processes, making them more resilient, agile and competitive. Its primary function is to improve the product or service competitiveness.
Randii & Mello (2012)	Incorporating the supply chain and demand management inside and across firms.
Dubey et al. (2012)	As a concept manages the flow of material, information and funds end to end, i.e. from upstream to downstream members. It also deals with the material disposal after the consumption as per the environmental norms. SCM tries to achieve this at the lowest cost with maximum efficiency.
Meinyk et al. (2009)	It is primarily responsible for managing the buying, and the flow. Today all the related aspects such as improving customer service, mitigating chain risk, reducing wastes, improving new product design process and enhancing product service quality are treated as an integral part of the supply chain management
Parkan & Dubey (2009)	SCM is defined from the cost aspect, which could be divided into two broad categories: i) Distribution cost: which is logistics cost, ii) Inventory value and inventory holding costs: which mainly consist of cost of inventory and cost of keeping inventory in the storage location
Wadhwa et al. (2008)	The challenge of SCM is to identify and implement strategies that minimise cost while maximising flexibility in an increasingly competitive and complex market.
Christopher (2005)	The management process of the relationships between different customers and suppliers to deliver better value at less cost to the supply chain. Accordingly, a supply chain system consists of a production network of partner organisations involved through upstream and downstream linkages in the different processes that deliver value in the form of products and services to end users

Table 1: Definitions of SCM (continued)

Source	SCM Definition
Gibson et al. (2005)	The art of planning management of all activities involved in sourcing and Procurement, and all logistics management activities. It also includes a sort of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.
Sachan & Datta (2005)	SCM should not be studied alone, and its interest should not be only industrial development. Concepts such as market orientation, relationship marketing should be explored with SCM. There is a need for new boundaries of SCM which can incorporate all these ideas into SCM.
Kuei C. et al. (2002)	A holistic and strategic approach to Demand, Operations, Procurement, and logistics process management.
Mentzer et al. (2001)	It is the orderly and strategic coordination of the traditional business functions, as well as the tactics across these business functions within the supply chain, to improve the long-term capability of the individual firm and the supply chain.
Cooper et al. (1997)	The integration of business process from the customer through primary suppliers that provides products, services, and information that add value for customers.
Harland (1996)	Supply chain management integrates two business functions, it manages direct relationships with suppliers, and it is also integrating chain of suppliers and a customer's customers and so on. It is the management of interconnected business involved in the last provision of products and service packages required by end users.

Among the variety of SCM definitions, I prefer the definition by Cooper et al. (1997), which provides a modern concept and amends SCM definitions by integrating the core business processes from the reception of raw materials to the finished products and thence delivery to customers. This definition fits well with my research because SC integration ensures the continuity of interdepartmental flows of goods, services and information and enhances the supply chain capabilities within Tawazun's subsidiaries.

3.2.3 Current State of SCM

Since its introduction in 1984, the field of SCM has undergone numerous transformations to its theoretical and practical aspects. SCM has become a prevailing notion in scholarly research beyond the traditional engineering and management fields, invading healthcare, education and sports; therefore, several diverse disciplines claim ownership of it. Given the continuous evolution of SCM in concept and practice, there is still little agreement on the nature of the SCM domain, on a unifying theory or an acceptable definition. Therefore, a re-examination of the published SCM related literature has been the focus of many works since 2000, yielding new areas that have been invaded by some SCM practices.

Burgess et al. (2006) conducted a structured literature review of articles retrieved from 100 refereed journals indexed in the ProQuest™ database. The search used various clusters of keywords and phrases to produce about 10,000 articles which the authors reviewed. These articles were categorised by domain (i.e., industries and businesses), concept (i.e., definitions and conceptual schema) and construct (i.e., performance and execution) of SCM. The prevalent industries were, among others, agriculture and food, construction, energy, mining, manufacturing, transportation and other related ones. The definitions and conceptual schema illustrated various concepts among the researchers, while the SCM construct included leadership intra-organisational relationships, information systems and data sharing.

The continuous expansion in SCM studies has encouraged many researchers to look for updated advances in the SCM domain over various periods. For instance, Asgari, Nikbakhsh et al. (2016) report that more than 40,000 scholarly works (e.g., articles, conference papers, books and dissertations) have been published since the debut of the

term in 1982. They conducted a comprehensive screening and bibliometric analysis of the body of SCM associated literature that appeared between 1982 and 2015 to understand better how to manage security, insourcing, sustainability, competition, risk, disruption and human behaviour within supply chain systems in various contexts. Their review revealed that there is still a lack of research in healthcare, the defence industries, small and medium-sized enterprises, disaster control and humanitarian operations.

Some issues have recently become associated with various SCM practices and gradually increase in the SCM literature linking to emerging issues, such as corporate social responsibility (CSR), sustainability, and environmental concern. These linkages are recognised as “*Management of material, information, and capital, and enhancing of cooperation along the SC lines while the firms are taking their goals from the economic, environmental and social dimensions, which derived from the customers and other stakeholders*” (Yawar & Seuring, 2015).

The new field of green and sustainable SCM has evolved rapidly with a proliferation of academic publications; however, an exact definition of this term “green SCM” does not yet exist. Several literature reviews have been published focusing on specific aspects of green and sustainable SCM from an environmental standpoint. Fahimnia et al. (2015), and Fahimnia, Sarkis et al. (2015) presented a bibliometric approach through content analysis of the writings on the topic, identifying over 1000 published documents. The systematic mapping of the reviewed sources demonstrates that the publications on green SCM developed rapidly gaining researchers’ interest and *suggesting possible directions for future studies.*

The future trends of SCM applications and research have attracted the attention of many scholars. Wieland et al. (2016) propose two research questions before re-examining previously published works. The questions are i) *What are the future dominant research themes in SCM?*, and ii) *What are the most fruitful research areas linking these different topics?* To answer these questions, they interviewed 253 researchers and practitioners working in SCM-related domains and quantitatively analysed their input data. The interviewees suggested about thirty-five areas as suitable areas of research to address in the context of current developments and proposed applications, which were deemed to be the most important in the next ten years. Table 2 lists the future areas of SCM research and related applications according to their weighted importance.

Table 2: Selected future areas of SCM research

Research Theme	Weight
Human factors in SCM applications	0.65
<i>Ethical issues in information-sharing and data exchange</i>	0.63
<i>Internal integration between the departments (intra-organisation)</i>	0.44
Transparency, accountability and visibility	0.39
Talented human capital and SCM competitiveness	0.39
Humanitarian-related issues	0.30
Reverse logistics	0.27
City logistics	0.25
Sustainability (e.g., economic, natural resources, social issues)	0.22
Disaster control, relief, emergency management	0.22
Innovation and research and development (R & D)	0.18
Environmental and green SCM	0.18
<i>Capability and flexibility</i>	0.18
External integration between firms (e.g., consortium and cartel)	0.10
Healthcare	0.08
Information security, big data analytics and network	0.30

Nevertheless, Wieland and his co-authors ignore the application of SCM in the defence industries. However, they include three areas of future research interest, which represent the core themes of the present study, which are shown in highlighted italics. Consequently, their findings precipitated a profound interest in investigating SCM research areas not previously tackled.

Tawazun should focus on the implementation of the core functions and practices of SCM to enhance its capability and to meet defence market competitiveness by removing any administrative and cultural barriers that might hamper information-sharing through preferred communication channels. The timely flow of information would motivate Tawazun's SCM members to be responsive and eager to support staff coordination and integration with the supply chain. Coordination and collaboration in supply chains by information sharing among the supply chain members is the research theme of many works (e.g., Lee et al., 1997; Christopher, 1998; Mentzer et al., 2001). As observed by Lotfi et al. (2013), sharing information among supply chain members may bring some benefits to industries.

3.3 Supply Chain Integration (SCI)

Supply Chain Integration (SCI) has been in the limelight of SCM empirical research over the past decade. SCI is recognised as a key factor in a firm's improving various activities and market competitiveness (van Donk & van der Vaart, 2016) and as a key concern of the supply chain (Romano, 2003) ultimately capable of revitalising global competition; particularly among industry-based organisations (Ketchen & Hult, 2007; Alfalla-Luque et al., 2013). Moreover, many authors agree that integrative practices and a high level of integration have a positive impact on the performance of both the

organisation and its supply chain system (e.g., Van der Vaart et al., 2012; Flynn et al., 2010; Leuschner et al., 2013).

SCI is a relatively new concept in SCM research works, although many have examined the supply chain relationships and collaborative relationships between a manufacturer and customers or between him and suppliers (Chen et al., 2004; Droge et al., 2004). SCI is found to enhance the manufacturing firm in producing diversified and marketable goods to meet the expectations of customers and gain market privileges (Mentzer et al., 2001), increase profitability (Wood, 1997), strengthen the firm's ability to design competitive products of high quality (Ajmera & Cook, 2009) and contribute significantly to the organisation's improvements in service quality and cost efficiency (Cagliano et al., 2006).

In the scholarly literature, SCI has been analysed from different perspectives. Some authors have studied SCI for suppliers and customers (e.g., Salvador, Forza et al., 2001; Kim & Narasimhan, 2002), and its role in upstream integration, or have analysed the integration with suppliers (Das et al., 2006), the development of meaningful relations with buyers (e.g., Fynes et al. 2005; Gimenez et al., 2012).

Firms in business-to-business markets are embedded in a complex network of relationships with suppliers and customers as well as some other stakeholders. Economic actions are influenced by the social context in which they are embedded. The partnership can be structured to achieve cost rationalisation and technical development. The benefits are reductions in the cost of production, transportation and administration (Pohja, 2004). Similarly, Näslund and Hulthen (2012) highlighted the impact of business globalisation on motivating the integration strategy as follows:

“The open market, globalisation, and rapid advancements in the ICT domain have promoted the interest of many firms in adopting the integration strategy for supporting intraorganisational integration of their supply chain to make the process more efficient across the supply chain members”.

The argument of Näslund and Hulthen (2012) referred to the production and business strategy of Tawazun’s subsidiaries for competing in the international defence market. It is urgently necessary for Tawazun to redefine its SCM roles through emphasising the participation and contribution of each SCM department, along with all communication channels and the latest technologies.

3.3.1 SCI Definitions – A Debatable Issue

Over the years, several definitions and measures of SCI have been proposed in different contexts but without resolution. Many of these definitions focus on the relationship between SCI and performance (e.g. Kim & Cavusgil, 2009; Flynn et al., 2010). The meta-analysis of these papers reveals that a vast variety of concepts, variables, scales and models has been developed and used for assessing the effectiveness of the SCI roles and involvement in all the firm’s capabilities (Alfalla-Luque et al., 2013).

Some of the definitions of SCI touch many critical issues in the integration process, such as the business strategy of the firm, as indicated by Flynn et al., (2010): *“many important elements in the supply chain integration internally and externally also highlight the importance of the strategic collaboration that provides both operational and strategic benefits”*. The impact of SCI on information-sharing is considered an

ongoing mutual partnership to achieve beneficial strategic goals for firms while stimulating a mutual trust (Sanders, 2008; Flynn et al., 2010). Table 3 shows some definitions of SCI.

Table 3: Selected SCI definitions

References	SCI Proposed Definition
Näslund & Hulthen (2012)	“The coordination and management of the upstream and downstream product, service, financial and information flow of the core business processes between a focal company and its key supplier (and potentially the supplier’s key suppliers) and its key customer (and possibly the client’s key customers)”.
Flynn et al. (2010)	“The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organizational processes, to achieve effective and efficient flow of products and services, information, money and decisions, to provide maximum value to the customer”.
Kim & Cavusgil (2009)	“The strategy that spans material and product flow from vendors to consumers and encompasses an array of different organisational entities, external (suppliers) and internal (functions)”.
Vaart and Donk (2008)	“The degree to which a firm can strategically collaborate with its SC partners and manage intra-/inter-organisational processes to achieve efficient and efficient flows of products, services, information, money, and decisions to provide the maximum value to the final customer with low costs and high-speed”.
Cagliano et al. (2006)	“The SCI is firmly associated with the mechanisms of coordination processes to implicit that the various business processes should be streamlined and unified the inside and outside within the firm boundaries”.
Droge et al. (2004)	“includes both upstream (supplier integration) and downstream or (customer integration), and horizontal organisational integration”.
Romano (2003)	“The concept of integration is a mechanism that supports business processes across a supply network is closely related to the effort to overcome intra- and inter-organisational boundaries”.
Mentzer et al. (2001)	“A set of three or more entities (<i>organisations</i> or <i>individuals</i>) directly involved the flows of products at upstream and downstream, services, finances, and information from one customer to another and <i>vice versa</i> ”.

In this empirical study, I adopted the SCI definition of Flynn et al. (2010) in investigating the inter-organisation pattern of flow and sharing of information among supply chain members; particularly in the defence industry, which is characterised by its many restrictions, often halting the flow of information-sharing. However, SCI needs both inter- and inter-organisational integration across the entire supply chain system to work as a single entity (Pagell, 2004).

3.3.2 SCI Dimensions – Association of Various Integrations

The integration of SCM systems has recently been under discussion in both the information management and SCM literature. One of the main reasons that many researchers have drawn attention to the importance of information flow in the supply chain is the steady increase in its complexity. Collaboration is no longer a theoretical concept but an essential aspect of SCM in the new complex business environment.

The created body of literature on the analysis and measurement of SCI considered three main dimensions. These were: **i)** external SCI with supplier and customer and internal integration across the organisation, **ii)** process integration, about performance and **iii,)** integration of information/data and physical/material flow (Flynn et al., 2010). A meta-analysis demonstrates various sources of the SCI dimensions, which is a critical approach to understanding the way that particular aspects operate and jointly relate functions since different aspects were used to characterise the SCI concept, as shown in Table 4.

Table 4: SCI associated dimensions

Study by	Dimensions of SCI
Gimenez et al. (2012)	<ul style="list-style-type: none"> ▪ Logistics-production integration ▪ Logistics-marketing integration ▪ External integration
Swink et al. (2007)	<ul style="list-style-type: none"> ▪ Strategic supplier integration ▪ Strategic customer integration
Koufteros et al. (2005)	<ul style="list-style-type: none"> ▪ Internal integration ▪ Customer integration ▪ Supplier product integration ▪ Supplier process integration
Droge et al. (2004)	<ul style="list-style-type: none"> ▪ Strategic design integration ▪ Design-process integration ▪ Supplier integration ▪ Customer integration

Sahin and Robinson (2005) presume that the two primary dimensions are the extent of information-sharing and decision-making coordination. Lee and Whang (2000) outline three aspects of SCI: i) information integration, ii) coordination and resource sharing (CRS) and iii) organisational relationship linkage (ORL). Bagchi et al. (2005) find in SCI five interrelated dimensions; *namely*, i) information-sharing and communication across the supply chain system; ii) collaboration and shared decision-making with network partners; iii) collaboration leading to risk; iv) cost and gain sharing (operational and strategic collaboration); and v) exchanges of skills, ideas and institutional culture and organisation, as shown in Figure 5.

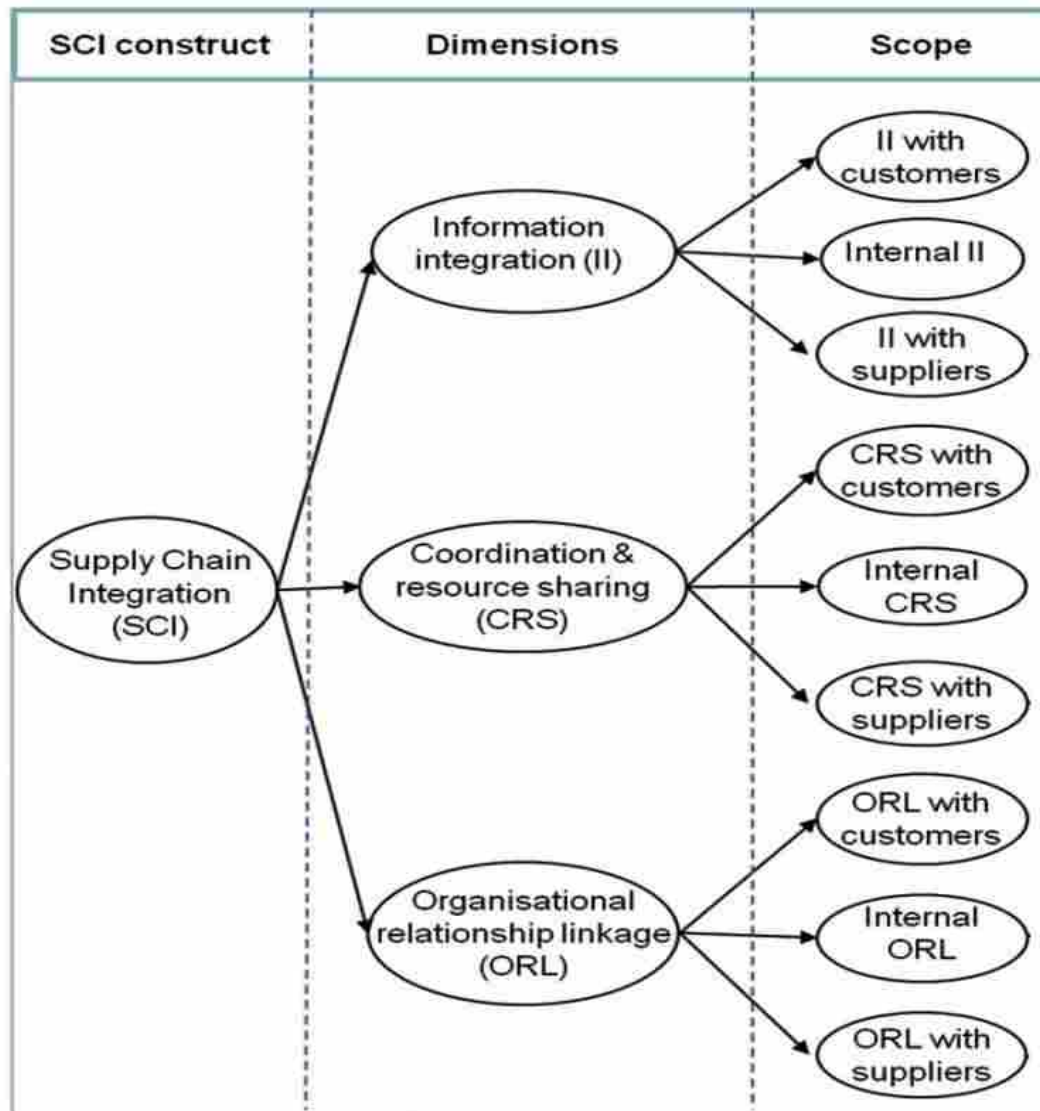


Figure 5: SCI multi-dimension model

(Source : Alfalla-Luque et al., 2013)

Zhao et al. (2011) define the level of integration as the degree to which an industrial firm can partner its core stakeholders. The integration may constitute intra-organisational strategies, professional practices, procedures, and the behaviour of members of collaborative, synchronised and secure processes for rendering customer-centric services and playing various roles in developing the desired strategic capability

of the manufacturer. Although many researchers represent critical dimensions in SCI, there is much overlap between the dimensions which makes it difficult to untangle their inter-relationships. The dimensions can collectively be categorised into two essential aspects: external integration and internal integration (Flynn et al., 2010; Fujun et al., 2012).

Flynn et al. (2010) describe internal integration as the extent to which the various internal functions of a firm can collaborate with one another, strategically coordinate intra-organisational activities and decisions, and form cross-functional integral relationships. Hence, this dimension is used in the present research as a reference when investigating information-sharing in intraorganisational channels. The communication with the suppliers and customers could maintain internal integration through many means: as **i**) information-sharing in the presence of multiple contacts points across the supply chain system; **ii**) employing standardised operational procedures in all supply chain activities, and **iii**) collaboration and shared decision-making with network members.

Integration with downstream customers can, however, be achieved only through a proper trade-off between customers' responsiveness and the efficiency of several drivers of the supply chain, such as facilities, transportation, inventory and information. Moreover, the efficient delivery of products or services while addressing customers' requirements would keep customers to be integrated into the organisation's supply chain (Alfalla-Luque et al., 2013).

The review of SCI literature present that information-sharing is the essential dimension of SCI, which is more efficient when it is associated with other SCI dimensions, such as customer-supplier integration (Cousins & Menguc, 2006). The SCI of an industrial

firm should start with the exchange of information since it is one of the key factors in supply chain improvement. Nevertheless, the existing body of SCM literature treats the possible impact of internal relationships, information flow and sharing on SCM processes as practised in the non-defence industries.

The establishment of SCI aims to achieve adequate interdepartmental information-sharing amongst Tawazun's members and uninterrupted flows of products and services, providing maximum value to the end customer. Many authors discuss the importance of these core functions of SCI (e.g., Vaart & Donk, 2008; Zhao et al., 2008; Näslund & Hulthen, 2012).

3.4 Information Sharing

Tawazun's subsidiaries are striving to achieve a significant competitive advantage through improving the capability of each SCM department. The improvements could be made through facilitating reliable communication channels among SCM members (i.e., twinning capabilities and efficient intra-organisational information-sharing). Moreover, taking an SC teamwork approach in its projects may help Tawazun members to improve their performance and capacity to make decisions thoughtfully, as well as reducing the total cost and maximising the total profit, in turn increasing the capabilities of their firms.

3.4.1 Background

Marshall (2015) summed up the definitions of information-sharing, as many SCM studies acknowledge: *“An exchange of data, information and knowledge among the members of one community through different communication patterns, means or*

techniques used at a given time and shared with the right people under the right environment". It can provide several links between supply chain (SC) members to synchronise all the activities across the supply chain. For example, information-sharing can increase supply chain efficiency by reducing inventories and smoothing production (Baihaqi & Sohal, 2013).

Information-sharing and data exchange in the supply chain (SC) system and across the internal organisation has been studied extensively from various aspects. The investigators agree on its importance in enhancing the decision-making process and the business capability of the firms (Moberg et al., 2002; Forslund & Jonsson, 2007; Holweg et al., 2005) categorise the concept of collaboration in supply chain information-sharing into three dimensions:

- ❖ *Information-sharing* refers to the act of acquiring and disseminating relevant information timely to support the decision makers in controlling SC operations.
- ❖ *Decision synchronisation* relates to collective decision-making processes on the planning in the context of SC operations.
- ❖ *Incentive alignment* refers to the degree to which supply chain members can share information about the costs, risks and benefits to expect.

Smith et al. (1998) differentiate the patterns of information-sharing as follows:

- ❖ *Information coordination and cooperation*: The firm can support the competitive advantages that can be gained from a seamless supply chain.
- ❖ *Information communication*: The content of exchanged information is relevant to the supply chain task because it enables the production activity to be developed for fulfilling customers' demands.

- ❖ *Information collaboration*: The firm can avert increasing uncertainty in the SC system; thus, collaboration creates a shared meaning about a process, product, or an event.

Information-sharing in the workplace is both a social phenomenon and a business process, which can establish a foundation of cooperation and collaboration between the firm's members to accurately identify and efficiently negotiate the consumer requirements across the SC; whereas, it does not enhance a performance unless the shared information is of relevance and its content good enough to be exploited in the decision-making processes for increasing the capacity of various SC activities (Baihaqi & Sohal, 2013). In contrast, an active integration of intraorganisational information sharing can facilitate access to timely and accurate information sources (Attaran & Attaran, 2007; Rajaguru & Matanda, 2013).

Knowledge and information play a critical role in SCM practices and approaches seek to synchronise and merge both intra-firm and inter-firm operational and strategic capabilities into a unified compelling market force. Such unification leads the supply chain members to become mutually dependent and focus on jointly developing solutions in the interests of customer value (Pillai & Min, 2010).

SC competitiveness considers two approaches to increasing information-sharing practices, the information systems used and effective collaboration (Yu et al., 2001). Effective information-sharing in the supplier-customer capability can reduce the operating costs of the supply chain (Lee et al., 2000). Moreover, the effectiveness of both information sharing and supply chain practice is necessary to achieve significant improvement in the supply chain's performance (Zhou & Benton, 2007).

The quality of information (e.g., accuracy, timeliness, adequacy, reliability) is, therefore, a critical element in promoting the paradigm of information-sharing. The model meets the needs of the industrial firm when it can be used sufficiently throughout the supply chains intra-organisational and interorganisational processes (Mason-Jones & Towill, 1997; Huang et al., 2003) indicate that the types of content of the shared information should be pertinent to product, process, resource, inventory and supply.

3.4.2 Information-sharing – the ICT Perspective

The facilitation of information flow and sharing in Tawazun's SCM tools need to employ ICT-based networks for purposes of data exchange, document circulation and reposition, archive organisation, indexing, discovery and retrieval. However, ICT-based defence operations have drastically changed the landscape of using information extensively as a strategic and vital resource in war, as well as the administration of defence personnel.

The capability of the SC system is in the limelight, due to the intervention of other technological factors in supporting SC activities. This factor covers the sharing of information obtained from authorised and authenticated sources (Peng, 2011). Thus, the SC system blends information-sharing with the flow processes of materials, technical data and finance across the members' networks. These information systems enable SCM to facilitate the SC capabilities ground on the ability of an organisation to identify, use and assimilate both internal and external resources and information to enable its entire SC activities that changed the way that the firms to interact with suppliers and customers (Bhatt et al., 2005). Lotfi et al. (2013) note how the

manufacturing sector is required to make the best use of advanced information technologies to share information within their supply chains to increase their competitive advantages and hence survive in today's global economy.

The role of information-sharing in SC capability relies on the genre of data, the purpose of the sharing and personal willingness to be involved in it and the preferred communication channels; it uses the shared information on a professional basis (Fawcett et al., 2007). Nevertheless, the integration of the intra-organisational information systems is identified as a key component in the SC intra-organisational relationships with customers and suppliers, logistics management and market analysis, whereas the integration of interorganisational information system refers to the network that connects the stakeholders (Peng, 2011). While information-sharing is represented as a marketing channel, it could act as the approach by which the effective information is transmitted, the participative decision is made, market trends are forecast, and information exchange patterns are defined in their respective channels (Frazier & Summers, 1984).

3.4.3 Information-sharing - Communications Channels

Many organisations employ several channels to make information-sharing and data exchange quite seamless. Information communication responds to the need to share the firm's information and keep its staff well-informed about the events. Otherwise, managerial regulations may affect them. This information environment may combine a wide variety of experiences, opening dialogue and encouraging the exploration of ideas relevant to innovation (Lee & Whang, 2000; Peng, 2011). At the same time, the assessment of information quality is a function of competence, credibility, accuracy, timeliness and the adequacy of the communication flows (O'Reilly, 1982).

Empirical research shows that the industrial firms in which the members exchange timely, accurate and relevant information to share *sensitive* knowledge are more successful than other firms (Chen et al., 2004). The established communication channels have made it possible for many coordination patterns to act as operational problem-solving approaches (Dobrzykowski et al., 2012). Moreover, those involved actively in information-sharing are characterised by having broad interests, higher levels of collaborative practices and innovative activities (Simatupang & Sridharan, 2005).

Communication channels used in the industrial firms are built as an information network so that the employees can perform different tasks and ensure interaction and clarity. The communication channels used in Tawazun are two categories: i) personal approaches and ii) electronic devices. Some communication channels and processes are employed commonly in information-sharing and transferring of data and knowledge, as detailed as below:

❖ **Meeting and Meeting Minutes**

Gibson and Cohen (2003) claim that meetings are the best ways for staff to gather and personally share information which is either necessary or reasonable; it also gives them a chance to sit in front of each other and be guaranteed access to quality information during meetings at different levels; thus, they encourage staff to share information with their colleagues. The interpersonal attraction and approach may facilitate these group processes efficiently and are likely to lead to the highest efficiency of the team members.

❖ Face-to-Face

Face-to-face interaction is a traditional mode and an essential element for differentiating teams that interact primarily through interpersonal information-sharing (Kirkman et al., 2004), but it is a most useful tool which can support discussion between employees. While getting the information required by other tools, such as telephoning and email, can take some time, face-to-face meetings are an important factor in changing the fundamental features of task accomplishment. They are also considered the safest and most efficient method of information-sharing (Kirkman et al., 2004).

❖ Web-based Email

Web-based messaging has replaced the wiring in the landscape of communication by a wireless paradigm. Using email tools to share information was a significant change in the world of communication, making the exchange of information more convenient and cost-effective. However, some barriers obstruct this channel, limiting it and making it insecure (Conrad, 2014). The widespread use of digital devices and e-media has brought communication beyond physical premises and into unlimited cyberspace.

❖ Phone Calls and Text Messaging

Mobile phone calls are an easy communication tool. Still, it raises some privacy concerns in the defence sector, where confidentiality is required, especially for conversations or text messages. Their advantage is that they keep close contact with decision makers who are not always available to discuss problems face-to-face (Conrad, 2014).

❖ **Enterprise Resource Planning (ERP) System**

The software *Enterprise Resource Planning* (ERP) system has the popular function of a universal e-information system, which business-led organisations have found essential over the last two decades (Akkermans et al., 2003). Its pivotal role is to enhancing transparency and accountability across the users of an SC system, reducing false information and speeding up the flow of information by reducing delays and reducing various forms of corruption (Dawson & Owens, 2008). ERP can significantly improve supply chain (Kim et al., 2005). It subsumes the SC into “a single seamless system”, meaning that it “facilitates integration across multiple functions in a single firm” (Pearcy et al., 2008). Moreover, it “changes the supply chain partner relationships” (Zhou & Benton, 2007). Dawson & Owens (2008) sketch the ERP system as follows, as illustrated in Figure 6.

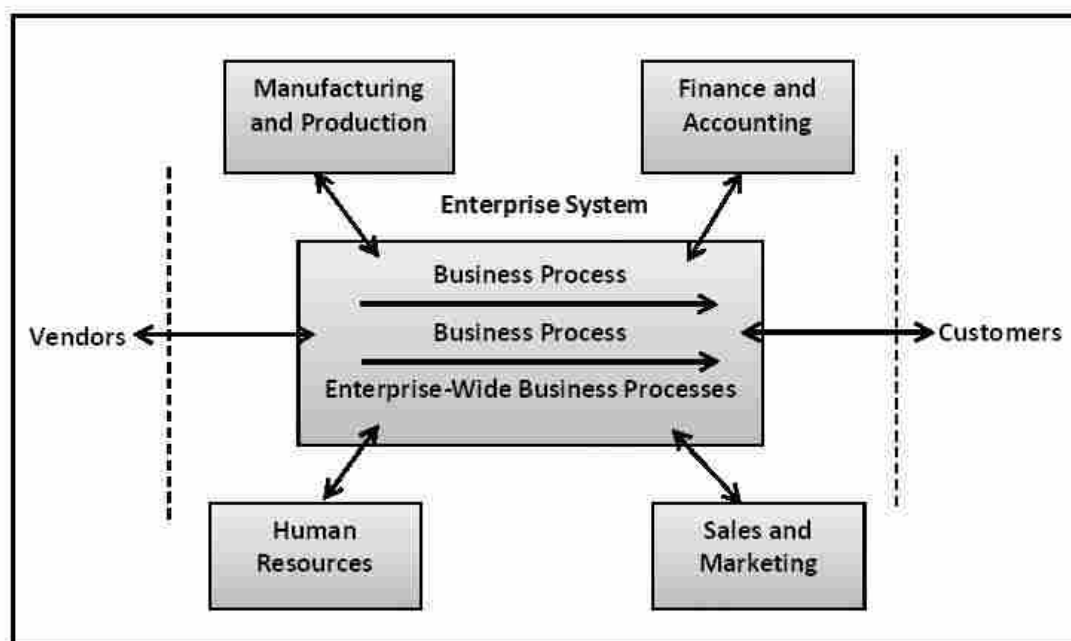


Figure 6: ERP structure and functionalities

(Source: Dawson & Owens, 2008)

❖ Government Procurement (GP) System

The acquisition and procurement of government departments are reflected as the driving business force of a national economy since any government is mainly involved in: i) the production of goods and community-oriented services, ii) the redistribution of the national income and iii) contracting for mega-projects and infrastructure. This volume of government involvement makes government procurement (GP) very important and complex (Thai & Grimm, 2000). The ICT revolution has paved the way for developing an electronic system that can efficiently manage and integrate bulk purchases and procurement by various government departments through a single portal.

The emergence of a Government e-Procurement system (e-GP) was found to have multiple functions. Among these are: **i)** posting procurement policies and procedures, **ii)** providing online tenders and search capability, to find credibly listed contractors, **iii)** notifying procurement opportunities to the vendors and contractors and **iv)** providing the capability of contract e-signature (Concha et al., 2012). The current e-GP challenges include learning how to make the procurement system more effective and efficient; particularly in maintaining SC systems.

Manufacturing firms are also perpetually struggling to reduce costs and response times, increase business profits and improve their market share to gain a competitive advantage in the global economy (Shatat & Udin, 2012); this is what Tawazun's subsidiaries want. Moreover, Tawazun's subsidiaries are beginning to realise the importance of information-sharing amongst their staff and improve their work performance through different communication channels.

However, many new technologies are emerging to connect the members of a supply chain and support information-sharing amongst them, which may improve the supply chain performance. Collaborative planning, forecasting and replenishment allow information to be shared jointly and seamlessly between members of a supply chain. However, the information-sharing practices in defence companies are subject to significant challenges, such as the confidentiality of the information shared, antitrust regulations, the efficiency and cost of informatics and the accuracy of the exchanged information. These challenges may overwhelm the capacity of a company to use shared information efficiently.

3.4.4 Information-sharing and Supply Chain Performance

The performance of organisations in their various business settings is one of the essential constructs in the business management research area. Therefore, much concern has been given to the measurement and metric analysis of organisational performance to determine its pervasive role, by standard criteria, in improving the *capability* of the organisation. Consequently, this construct is seen to be crucial as a goal of modern industrial activities in such areas as manufacturing, operations, supply chain management, marketing, services and business strategy. Thus, measuring it has the aim of quantifying the efficiency and effectiveness of a firm's capacity (Richard et al., 2009; Gopal & Thakkar, 2012).

The term *performance* is widespread in the management studies and related research. However, its concrete structure and definition are discussed rarely. The Business Dictionary (2017) defines 'performance' as "*The accomplishment of a given task measured against predetermined known standards of accuracy, completeness, cost and speed*". The definition of 'organisational performance', however, alters according to the core activities of the organisation, but it may have the standard definition of "*The analysis of the performance of a business organisation's outcomes by the proposed business strategic objectives*".

Richard et al. (2009) reviewed the literature on commonly used metric criteria in performance measurement. They conclude that organisational performance can be determined by analysing the organisation outcomes in four distinct areas (used as indicators). These are:

- Financial performance (e.g., investment, profitability).
- Product marketability performance (e.g., sales, market share,).
- Production capability (e.g., product design, quality, innovation)
- Stakeholder return (e.g., shareholder return, economic added value)

Identifying the possible role of supply chain performance measures is a challenging task; therefore, it needs practical guidelines because many organisations have proposed and adopted different goals, thus making a varied set of standard criteria appropriate (Gopal & Thakkar, 2012). Pittiglio et al. (1995) proposed the first performance measures known as PRTM which were frequently incorporated in measuring the performance of the supply chain (Wong & Wong, 2008). However, monitoring and improving the performance of a supply chain has grown increasingly complex; in particular, in emerging industrial countries such as the UAE, where SCM applications and knowledge are still in their infancy.

Some SCM investigators have proposed different sets of measures depending on the conditions and product-related characteristics of a firm's supply chain. These include its *resources management* (manufacturing, inventory costs and return-on-investment); *output* (customer responsiveness, on-time delivery and product quality); flexibility (communication with suppliers, manufacturers and customers); and *reliability* (ability to meet delivery dates at promised prices). Thus, resources and reliability are aspects of financial performance, whereas output and flexibility are aspects of non-financial performance (Beamon, 1999; van der Vaart & van Donk, 2008). Therefore, supply chain performance is conceived as a formative construct with two kinds of indicator, financial and non-financial.

A considerable body of SCM literature has discussed the impact of information-sharing (the ability of a firm to share knowledge effectively and efficiently with its supply chain members) on the implementation of supply chain performance indicators. Zhao and Simchi-Levi (2002) found that information-sharing and order coordination significantly impact on supply chain performance regarding total costs while demonstrating that sharing demand information encourages greater inventory cost savings.

Flynn et al. (2010) show how suppliers and internal integration can help manufacturers to reduce mistakes and waste through information-sharing and joint planning; this is directly related to business performance. Moreover, information-sharing amongst the supply chain members proved to enhance both financial and non-financial performance through an active exchange of data and required information (Rashid et al., 2010). Moreover, information-sharing may play a mediating role in developing an integrated pattern of performance components (Prajogo & Olhager, 2012). Therefore, effective information-sharing has been identified as one of the crucial abilities that a supply chain may have. *“Both effective information-sharing and effective supply chain practice are necessary to achieve improvement in supply chain performance”* (Zhou & Benton, 2007).

Pandey et al. (2010) described how sharing information could create opportunities for firms to work collaboratively on remedying supply chain inefficiencies and thus has a significant direct impact on the relationship between buyers and suppliers (sharing information appropriately between buyers and suppliers can help to reduce costs and improve customer service levels). It can also let firms take advantage of the increased visibility of sharing information to modify existing actions or plan future operations.

(Mithas et al., 2011) found that “*Information management is a foundational capability' that enhances other organisational capabilities, which in turn affect firm performance*”.

3.4.5 Information-sharing in SCM Defence Firms

Global defence production has increased dramatically over the last two decades, due to the worldwide spread of conflicts and tensions. Thus, the defence industry represents a significant source of income for many countries. Therefore, defence firms are genuinely interested in introducing every management tool or technology that might enhance their capabilities. As highlighted by Oh et al. (2012), systems that implement automated processes to collect, maintain, organise, and analyse information in real time empower businesses to increase their efficiency, resulting in exponentially increased profits. Involving SCI in the production line has been shown to create a significant improvement in the quality of both products and customer services, besides increasing firms' capabilities.

The integration of the supply chain is meant to bring the various SCM activities into a one-stop mechanism for supply chain control, whether the participants in the supply chain are from the commercial or the defence sector. The potential benefits of SCI in the defence industry are many, including i) improving the cycle of product design, development, testing and deployment and ii) reducing costs and leading to win-win outcomes that may open relationships and communications and build trust between partners.

SCI has many existing barriers, including deeply rooted cultural barriers, which have prevented it from developing in the defence sector. Consequently, the implementation

of SCI requires that everyone concerned should use enabling mechanisms, make an organisational commitment to promoting an atmosphere of trust and teamwork spirit. The mechanisms include Integrated Product/Process Development (IPPD).

One of the focal challenges is to redefine SCM by restoring the process whereby e-sourcing improves the accuracy and availability of information on the supply and demand side, facilitates collaboration, and strengthens control and compliance. (Harbison et al., 2000) Indicate that e-sourcing solutions create value by reducing three elements in a company's cost structure: **i)** the transaction, **ii)** the material and **iii)** the flow time. The literature search reveals a surprising scarcity of academic publications concerned with SCI and information-sharing in defence factories. Therefore, knowledge must be drawn from other business fields which investigate and analyse similar problems, such as production operations, the supply chain system, information involvement and logistics operations. Defence logistics comprises the provision of defence equipment and their spare parts, together with the deployment and repatriation of defence systems.

Nowadays, the active debate over the information-sharing phenomenon is not about whether information should be exchanged along the supply chain, but about ways for the right people to share the right information at the right time in a clear format so that the right recipients in the right conditions can maximize the mutual benefits of the supply chain as a whole (Schiefer, 2004). Alberts (2002) splits the information in defence firms in three ways with different contents. These are **i)** *Commands (for directives and guidance)*, **ii)** *Intelligence (for information about the adversary and the environment)* and **iii)** *Doctrine (for ways of doing something)*. Each of these three ways

of conveying information has evolved and been transferred to the defence industries where the defence firms are the owners.

In contrast to commercial logistics services, defence logistics includes all the processes that used to enable the armed forces to continually maintain their facility and readiness to accomplish target missions (Hofmann, 2010). However, the value of the defence industry, lying at the heart of any defence acquisition policy, is in driving long-term and best value for the investment. The markets for the defence industries are characterised as monopsonistic (i.e., only one buyer interacts with many customers or sellers of a particular product). In this regard, the Government entities, such as the army, police and security forces are represented as the only legal clients of the defence products of these companies (Filho et al., 2004).

The British Ministry of Defence devoted its White Paper on industrial defence strategy (2005) to delivering military capability. The White Paper indicated the influence of international policies and the security strategy of the arms-producing countries on the increase of buyers to represent the potential benefits of the defence market, which can be recognised as flowing from a healthy, competitive and dynamic national industry. The defence industries have strategic and security dimensions, with an abundance of national security and a blend of external and internal politics, along with many defence-related policy issues. In this respect, Filho et al. (2004) reported that these defence industries have been attracting much concern and intervention than any other public strategic industries.

Despite the importance of the flow of information and exchange among the staff of an organisation, confidentiality is still a standard requirement in the defence industry as regards the release and sharing of information, whether technical or administrative

nature. The flow and sharing of information in this context faces many barriers, particularly across the various phases of the supply chain. However, the logistics services in the defence organisations need accurate and fresh information. Defence firms should use sound asset management in the supply chain to create a mobile logistic system, which includes: **i)** managing assets individually, **ii)** allowing the right assets to be located, **iii)** furnishing information regarding the current physical status (quality) of an asset (sharing information) and **iv)** keep a documented history of all assets (Oh et al., 2012).

The defence industry organisations, by their particular nature, are cautious about introducing new business models. The revolution of management and smart technology has provided an attractive route whereby organisations can set in motion innovative changes in the way that the business is run. Copley (2007) maintains that it is of the greatest importance to evaluate performance by understanding the environment that soldiers must fight in and implement technologies that allow the real-time collection of data on their position, location and status.

Moreover, the advent of ICTs in manufacturing and production lines has given information-sharing through different communication channels a pivotal role in the process created by SCM. The implementation of modern SCM practices (e.g., SCI and information-sharing) in Tawazun's industrial and business activities must direct the attention of top management and the decision-makers to consider these practices from the perspective of business strategy. Therefore, they should institute a seamless flow of data and information-sharing beyond departmental barriers, which, in turn, would support Tawazun's staff at all levels in achieving the firm's goals and meeting the severe competition from the major players in the defence industries.

3.5 Supply Chain Capability

A search of the scholarly literature on supply chain capability (SCC) from refereed e-resources reveals that the SCC is a new research topic which has attracted little academic writing. For instance, 'Google Scholar' returned only 1130 works of this kind, whereas the search for supply chain performance (SCP) returned 51,700 works. Bharadwaj (2000) defines the SCC as "*The ability of a business organisation to identify, utilise and integrate both internal and external resources /information to enable the entire supply chain activities*". This definition acknowledges the four core components of the SCC as inter-firm resource integration, information-sharing, embedding ICT and supply chain responsiveness (Wu et al., 2006; Yu et al., 2010). Amit and Schoemaker, (1993) define this capability as "*The capacity of an organisation in deploying their resources usually appears in combination using organisational processes to affect the desired end*". Arman (2017) highlighted that optimising the supply chain through supply chain capability leads each partner to better organisational performance.

Day (1994) defines capability as "*The accumulated knowledge and skills that enable a firm to coordinate its activities and deploy resources advantageously*". Ju et al., (2013) offer their particular definition of the topic as follows: "*Deeply rooted in organisational processes and routines, capabilities enable firms to perform value of creating more efficient tasks, as well as to transform organisational resources into valuable offerings in the marketplace*". Capabilities are sometimes used interchangeably with such terms as 'resources' and 'competencies'. Thus, the concept of the SCC is directly relevant to the strategy of the firm's operations, activities and available resources, that is, the company's capacity and all its stocks.

The advent of IT and full automation of production lines have drawn increasing attention in the industrial world and changed the landscape of suppliers' activities and customers' needs. Therefore, the new paradigm of manufacturing production and service businesses (e.g., hotels, hospitals, and the like) has changed the roles, functions and applications of the supply chain simultaneously. Wu et al. (2006) focus on probing the particular set of organisational capabilities that define the mediating role of the SCC between IT-based production resources and business organisation performance.

Likewise, Peng (2011) describes the potential relationship between integration and IT facilities as follows: "*The IT integration across partnering business organisations had become the backbone of the modern SCM through enabled information-sharing. Such integration would enhance organisational flexibility and responsiveness while minimising risk and inventory costs to enhance the firm capability and increase their competency*". Some writers focus on the competitive potential of organisational capabilities, describing them as anything that can be thought of as a firm's strength (e.g., Wernerfelt, 1984; Wu et al., 2006). Thus, the capability can represent the accumulation of knowledge and professional skills that may be embedded in its organisation's processes and routines (Day, 1994).

Some research studies define the direct relationship between competitive capability and firm performance by emphasising the central role of competitive capability between SCI and the firm's performance. Therefore, a firm's capabilities are key internal drivers of its performance. Barney (1991), Teece et al. (1997), and Ju et al. (2013) recognised the firm's dynamic capability as "*The ability of an organisation to perform the integration, building and reconfiguration of the internal competencies to address rapidly changing environments*", while Collis (1994) defines organisational

capability as “*The routines that determine the efficiency with which the firm physically transforms inputs into outputs*”.

An organisation’s capability involves high-level routines together with its implementation of input flows (Rajaguru & Matanda, 2013). Thus, Wu et al. (2014) separate the inputs into the production resources, which can be tangible (financial and physical resources), intangible (technology, reputation and culture), or human (e.g., unique skills, abilities and knowledge, interpersonal communication and motivation). Amit and Schoemaker, (1993) argued that the organisational capability represents distinctive and superior ways of allocating, deploying and coordinating resources. Thus, the firm’s capability also provides a standard process of making sense of the work environment and providing a means of configuring its resources at various levels. Therefore, the organisational capabilities facilitate decision-making problems in conditions of uncertainty, allowing managers to deal with ambiguous and ill-structured tasks (Wu et al., 2014).

Since inter-firm integration is one of the fundamental components of a firm’s capability, SCM stresses the seamless integration of value-creating activities across organisational boundaries (i.e., inter- and intra-departmental). Therefore, the particular business strategy adopted by a firm depends on, whether it is industrial, what types of product it sells and what its level of integration is. The key objective is thus to develop and implement intra- and inter-organisational boundary-crossing relationships in the supply chain that enable its members to integrate their activities and leverage individual capabilities (Wu et al., 2014).

The successes and failures of SCM implementation and practices by a business firm reflect its capability and the factors that underpin its sustainability. Moreover, the

potential failure of SCM applications may be due to the absence of some insights into the relationship between SCM practices and other elements of the operational capabilities of the firm (Hsu et al., 2008).

3.5.1 Supply Chain Operations Capability

Hsu et al. (2008) indicated that a firm's operational capability might be defined by its ability to design and develop new products and apply total quality management (TQM) and just-in-time techniques. These writers provide evidence of the direct impact of operational capacity and SCM practices on both firm's performances and in a broader supply chain context. The operational capability will help firms to reduce the cost of their operations and develop their production facilities while convincing their customers of their organisational value and power to run their business efficiently with enhanced performance. Accordingly, the firm can combat its superior rivals using innovative products, robust process development and cost-effective operations (Ortega & Villaverde, 2008; Song et al., 2008; Nath et al., 2010).

Nath et al. (2010) define SCC as "*the process, technology, reliability and quality of the overall operations of the firm that can bring competitive edge*". SCC enables a firm to do its everyday work but still enhance its professional suitability by ensuring its daily operational efficiency. The authors find that operational capability has a significant impact on a firm's business performance, which recalls the importance of its infrastructure development, for example, by upgrading a fleet, extending the distribution network and improving the use of technology in logistics firms. Thus, superior capability in its operations function can enhance a logistics firm's ability to improve its connection with potential customers and suppliers, as well as providing

more flexibility in the operational activities entailed in improving the organisational value throughout the supply chain.

This study seeks to furnish a rational analysis of the power of operations in the UAE's defence factories and also to understand better the importance of helping defence industry companies to achieve their targets in a competitive market. It also seeks to improve Tawazun's business strategy by increasing the operational capacity of its subsidiaries. It studies intra-organizational integration by examining the relationship between operational capacity and the sharing of information among the members of the supply chain, even though the Indicators to measure operational capacity are missing in the literature.

A further aim of this study is to determine the leading indicators of this element and their implementation in Tawazun's subsidiaries. Sharing information Improved resource utilization , increased productivity, organizational efficiency, improved services, building and strengthening social bonds, early problem detection, quick response , reduced cycle time from order to delivery, better tracing and tracking, earlier time to market, expanded network, and optimized capacity utilization" (Lotfi et al., 2013).

3.5.2 Supply Chain Procurement Capability

Bhakoo & Chan (2011) report that "*Unfortunately, while the Procurement function is believed to be essential to firm performance, the current understanding of the mechanisms which drive a company's Procurement capability are not widely known Procurement is recognised as a key supply chain function*". Wynstra (2010) similarly reviews the works on SC Procurement to reveal that little has been written about it.

Ordanini and Rubera (2008) comment the mechanisms that drive a firm's procurement capability are barely known even though procurement plays many essential roles and functions. Little attention has been paid to the way in which procurement can develop the capabilities needed to influence firm performance positively (Hult et al., 2004).

The purpose of the procurement process in industrial organisations is to support manufacturing operations by providing them with the right material at the right time for the production plan at low enough cost to meet the firm's requirements and thus improve performance. Dobrzykowski et al. (2012) argue that "*A core function of Procurement is thus to quickly secure such critical resources at low costs that meet the firm's needs. As such, it makes sense that higher levels of Procurement performance (capability) will support the overall performance of the firm*".

The purpose of the principal procurement functions lies in the value they yield, which is aimed at supporting the performance of a business firm. Many studies (e.g., Porter, 1985; Vargo & Lusch, 2004; Vargo & Akaka, 2009; Callaway & Dobrzykowski, 2009; Percy et al., 2012) have investigated the issue of value creation as the core element of a firm's capability, enhancing collaboration and the sharing of information with both the suppliers and the customers.

Placing a long-term purchase contract may involve facing some unpredictable market risks which may interrupt the business of the company (Paulraj et al., 2006; Miller & Leiblein, 1996; Pearson et al., 1996). Therefore, enhancing procurement capability requires all the available information about the firm's projects and plans to be shared through the coordination of planning decisions and the flow of goods with the main customers (Dobrzykowski et al., 2012).

The team members of the Procurement department should be aware of the firm's intention to build up the strategic purchasing plan and should enable the firm to:

- i) Facilitate intimate work relationships with a limited number of main suppliers.
- ii) Promote open communication among supply-chain partners.
- iii) Develop long-term strategic ties for the sake of mutual gain.

Thus, *“Plays a key liaison role between external suppliers and internal organisational customers in creating and delivering value to external customers”* (Chen & Paulraj, 2004). Strategic purchasing accomplishes this feat when it is aligned with supply-chain activities, functions and systems to achieve operational efficiency and flexibility (Chen et al., 2004; Normann & Ramirez, 1992). When purchasing and supply management executives participate in articulating and communicating a unique strategic vision, they earn the benefits of synergy through strategic collaboration and improve the firm's performance (Kanter, 1994; Lado et al., 1997; Cao & Zhang, 2011).

Strategic purchasing supports the information sharing, which is considered a critical factor in the effective integration of the supply chain. In this way, effective communication contributes to the development and maintenance of the inter-organisational methods that have been documented to enhance a firm's capability for effectively managing strategic alliances (Zollo et al., 2002). Furthermore, the use of open, informal channels of communication is key to developing and leveraging tacit knowledge, a critical source of strategic advantage (Chen et al., 2004; Nonaka & Takeuchi, 1995).

The importance of advanced ICT in performing successful productivity has conceived amongst business and manufacturing communities. Thus, ICT has drastically changed

many corporate paradigms and the way that businesses run and develop (Normann, 2001; Byrd & Davidson, 2003). Ordanini and Rubera (2008) suggested that the integration of collaborative activities from procurement to delivery to the final customer is rapidly becoming an essential element of strategic SCM.

Moreover, getting the exact parts at the right time with favourable prices is considered a key factor in acceptable performance as regards cost, quality, delivery and innovation; these factors are also critical activities in procurement. Thus, the core function of procurement is to secure promptly such critical resources at low cost to fulfil the firm's needs. The higher levels of procurement performance and capability would be supporting the overall performance of the firm (Porter, 1985).

Dobrzykowski et al. (2012) find that companies decide to coordinate their planning and flow of goods with their major customers and suppliers, based on agreements on delivery frequency, shared inventory level knowledge, shared production planning decisions and forecasting and replenishment. These factors are likely to develop a procurement capability which permits faster delivery times at lower cost, benefits which also result from the use of electronic tools which allow key customers to manage content and knowledge, track orders, gain access to catalogues and request information.

In turn, having a procurement capability offering faster procurement and manufacturing lead times and lower procurement and unit costs than one's main competitors is worth pursuing, because this capability is shown to lead to better firm performance. Chen et al., (2004) empirically find a "*significant positive relationship between strategic purchasing and the supply management capabilities*" which fosters a unique combination of these practices and engenders complex interactions among

supply management capabilities that play a strong role in generating and sustaining strategic advantage for the firm.

3.5.3 Supply Chain Inventory Capability

The SC Inventory capability may be defined as “*The process of figuring out the best quantity and timing of stock for aligning it with sales and production capacity that will directly impact a firm’s cash flow and profit margins*” (Business Dictionary, 2017).

This definition points out that the business firms must understand their customers’ characteristics as well as they understand their knowledge level, skills and attitudes relevant to the firm’s assets and earning activities, through enhancing the capability of the SC Inventory. Such inventory capability should be seen through several different lenses to indicate the ways to profitability by learning the secrets of all its corporate assets, not only financial but also human capabilities. In new ventures, it points toward greater profit but is of equal importance in all (Warren, 1965).

Many authors identified the benefits of downstream information-sharing and showed that manufacturers could reduce their inventory and cost by information-sharing (Lee & Whang, 2000). The intradepartmental sharing of the necessary information at the right time between the sales and marketing departments and the warehouse could minimise departmental conflicts and reduce manufacturing and inventory costs. Similarly, Tawazun’s subsidiaries could create their production plans and inventory policies to help manage the material requirements and keep other departments, such as Procurement, Finance and Logistics, aware of this plan through ERP system.

The business firm sees its inventory as a hidden strength with a powerful influence on the status of raw material storage. As Warren (1965) mentioned “*Yearly assessment*

of Inventory unearths the underlying competencies which: (1) Lead to successful exploitation of present products and markets; (2) May be required to serve these markets profitably; (3) Can be used to expand successfully into new areas. An example of what can happen when such an inventory is not carefully conducted may be helpful in gaining a fuller understanding of not only the need but the techniques for carrying it out”.

Aware of this, business firms should measure Inventory costs with particular precision over the cost of materials, storage and unwanted items. This process will ensure that firms are storing the materials required by its production lines only for reducing quantities as much as possible through monitoring the stock on a weekly or monthly basis according to the nature of the business and production capability. Such procedure will be providing higher returns on assets and raise the company's financial level.

The practice of inventory (i.e., a list of stocks of goods, parts and material held for future use or sale) in many industrial countries tends to reduce the amount of stored material, obviating any spoilage or physical damage. For instance, manufacturing organisations in the United States enhance their competitiveness by avoiding unnecessarily large warehouse items, thus reducing storage costs. Moreover, some Japanese companies have introduced the just-in-time inventory system, a system to highlight the planning and scheduling for receiving needed materials so that they arrive just in time and coincide with the firms' need to use them. Both approaches save considerable cost (Pan & Liao, 1989).

The demands of the defence industries must be considered in the warehouse of finished products. Therefore, close monitoring and control of the warehouse are necessary to keep the stored products at the stage of being ready to enter the market in the right

condition and reducing the possible risks of prolonged storage. Van Ryzin (2001) discussed the impact and potential risks of a longstanding inventory, such as environmental conditions (e.g., humidity, heat, dust and poor ventilation) and careless handling. These risks increase the chance of product damage by creating slower feedback loops between the supply chain partners. Therefore, the Inventory department should become more responsible for minimising the storage and handling costs as part of their warehouse practice.

Because the inventory functions are central to SCM practices, the inventory capability greatly affects the competitiveness of firms through its effect on costs and the demands of the delivery deadline. Nevertheless, in defining the exact roles of the inventory's capacity to enhance Tawazun's SCM, it is important to determine which indicators should measure this capacity and also measure the level of interdepartmental information-sharing to raise standards as high as possible. Indicators of inventory capability are missing from the literature. As noted above, one of the aims of this study determines the main such indicators and their implementation in Tawazun's subsidiaries.

3.6 Summary

The existing body of SCM literature reveals that SCM applications play vital roles in the manufacturing and service sectors. The modern trend in SCM applications is the integration of the various SCM activities in either an intra- or inter-departmental pattern. Integration paves the way for effective communication between customers and suppliers and shows how SCM practices should be aligned with the company's business strategy. Moreover, the benefits of unimpeded information-sharing with

downstream and upstream links in the chain are significant for information-sharing amongst the staff of Tawazun.

The literature survey also discovered that little had been investigated regarding the potential role of information sharing and intraorganisational integration in supporting the capability of the SCM department, and in turn enhancing the capability of an industrial firm in the defence sector. Thus, the present research looks into the role of interrelations between SCM, the integration process and information-sharing practices in supporting a firm's capability. The research findings will, as it is hoped, reduce the knowledge gap in this field.

Many industry-based organisations have achieved significant improvements eventually in their business and marketing performance through adopting the approach of integrating SCM in the manufacturing sector. However, both firms' capabilities and information-sharing in the supply chain in the defence industry domain are barely discussed in the SCM literature. Moreover, the empirical data on the UAE defence industry-related to the theme of this study are scanty; therefore, this study seeks to help fill the gap. The new developments and future trends highlighted in this literature review should find their way to the industrial sector of the UAE, especially in the defence industry.

Chapter 4: Research Methodology

4.1 Introduction

This chapter, with general reference to the dissertation topic, outlines the research methodology and methods employed in the research investigation. It is hoped to show that the choice of research methodology for this dissertation is based largely on the proposed research objectives and questions.

The chapter starts by identifying the research questions, discussing the research framework and elaborating the research paradigm, strategy and design. The next subsections discuss the research methods and data collection approaches (e.g., interview, survey, and participant-observation). Then the chapter addresses the reliability and validity of the research methods, examines possible biases in data gathering and analysis and sets out the ethical considerations for the research. The chapter closes with a summary.

4.2 Research Questions

The proposed research questions in this study take into account the defence nature of Tawazun's working environment, and the consequent sensitivity of information access and sharing between the supply chain departments. Answering the research questions below would contribute to filling a gap in knowledge about the applications of the modern SCM concepts in the defence industries and the impact of information sharing on supply chain capabilities. Our study has four main research questions:

- 1) How is the modern SCM concept successfully implemented in a defence industries firm?

- 2) What are the important roles of intra-organisational information sharing for enhancing SC capability in a defence industries firm?
- 3) How do intra-organisational communication channels impact on SC capability in a defence industries firm?
- 4) What are the main indicators for assessing SC capabilities in a defence industries firm?

4.3 Research Framework

A large body of scholarly and research literature on the topic of this study focuses on the interorganisational relationships of the SCM both upstream (supplier /manufacturer) and downstream (customer/client), without seriously considering the importance of the intra-organisational relationship of the SCM members. However, much attention has been paid to the space between the supplier and a typical client of the firm and also with the key SCM departments (e.g., Operations, Procurement, and Inventory).

The proposed research framework here adopted is based on the new concept of SCM introduced by Cooper et al. (1997) "*The SCM can be an integration of business processes including the end-customers through the key suppliers of the required material, products, service, and usable information to collectively add customer values*". The new SCM concept goes beyond its predecessor, which defines SCM only as purchasing, warehouse and logistics management; the latter is familiar in many industrial and business organisations in the UAE, including Tawazun's subsidiaries.

The modern SCM concept draws attention to the importance of integrated, seamless flows of materials, money, and information. The existing body of SCM literature

includes few empirical studies on the effect of integrating intra-organisational SCM activities, but the present study considers the information flow as a major contributor to the continuity of intra-organisational communication between the members of the three SCM departments in Tawazun's subsidiaries. Moreover, the study is also interested in evaluating the ability and willingness of the SCM departments to cooperate, share information, build teamwork, and create mutual trust and transparency in the workplace (i.e., both their departments and Tawazun, as a whole). Departmental integration and information sharing across boundaries could enhance Tawazun by improving staff productivity and increasing market competitiveness.

As illustrated in Figure 7, the conceptual research framework was developed to address the research questions and to test, in the context of the modern SCM concept, the impact of intra-organisational information-sharing practices and communication channels on Tawazun's SC capabilities.

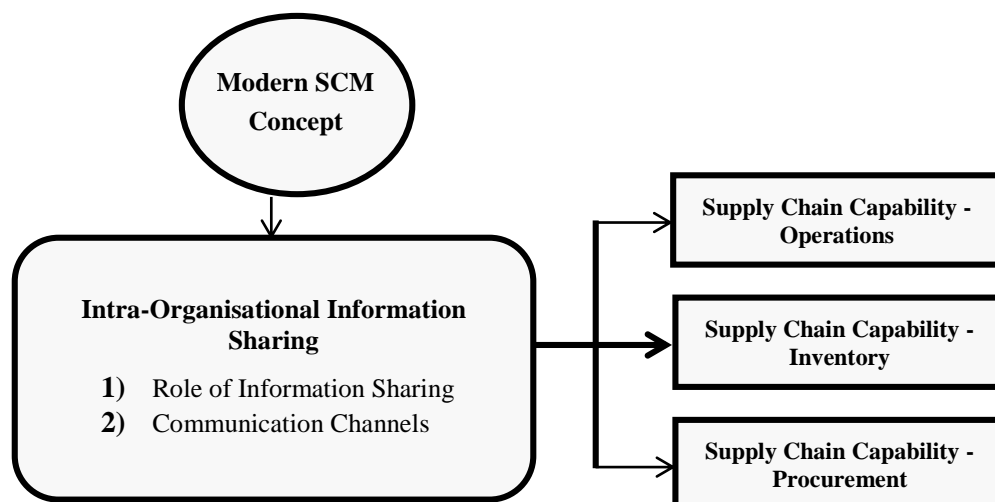


Figure 7: Conceptual Research framework

(Source: Developed for this research)

The quantity, accuracy and frequency of information shared between the primary SCM departments (Operations, Procurement and Inventory) in Tawazun are expected to have a positive impact on the capabilities of the three SC departments. Moreover, this study investigates the possible roles of communication channels (e.g., face-to-face, e-call devices, and the ERP system) in enhancing the capability indicators of each SCM department in Tawazun's subsidiaries.

4.4 Research Paradigm and Methodology

4.4.1 Concept Paradigm

The research philosophy relates directly to the development of specific knowledge, and also supports the research strategy for selecting a suitable design for the research methodology, which helps to find answers to the research questions (James & Vinnicombe, 2002). The three main assumptions of the research philosophy concern ontology, epistemology and methodology. They show how people perceive the research process. In conducting a research study, researchers may make claims about the knowledge gained of the nature of the world and human beings in a social context (*ontology*); how this can be known (*epistemology*), including the ways to acquire knowledge and the processes and methods for investigating and gathering data (*methodology*). This issue may involve a dialogue between the investigator and the theme of the research inquiries and questions (Neumann, 2003). Table 5 summarises the research assumptions and their association with the research paradigms.

Table 5: Research Assumptions and Paradigms

Assumption	Paradigm		
	Positivism	Constructivism	Pragmatism
<i>Ontology</i>	There is a “ <i>real</i> ” reality to be apprehended	Reality is locally constructed	Reality is shaped by economic, political, cultural and gender values.
<i>Epistemology</i>	Dualist/Objectivist	Subjectively created findings	Subjectivist value in mediated findings
<i>Methodology</i>	Quantitative	Qualitative	By pragmatic maxims

In the domain of scientific research in the social science, there are three contrasting schools of philosophical theory or paradigms: *social constructionism*, *positivism*, and *pragmatism*. *Social constructionism* identifies how individuals construct and seek understanding of the world in which they live and work. For this paradigm, the most appropriate methodology is qualitative research. *Positivism* is the approach of the natural sciences, which prefers the use of quantitative methods to formulate and confirm hypotheses and thereby predict general patterns of human activity (Hair et al., 2006). *Pragmatism* is a deconstructive **paradigm** that advocates the use of mixed methods in research, and “sidesteps the contentious issues of truth and reality” (Feilzer, 2010). Creswell (2013) defines the basic concepts of each philosophical theory, as shown in Table 6.

Table 6: Philosophical theories

Positivism	Constructionism	Pragmatism
<ul style="list-style-type: none"> ▪ Determinism ▪ Reductionism ▪ Empirical observation ▪ Measurement ▪ Theory verification 	<ul style="list-style-type: none"> ▪ Theory generation ▪ Understanding ▪ Participant meanings ▪ Social construction ▪ Historically-oriented 	<ul style="list-style-type: none"> ▪ Problem-centred ▪ Pluralistic ▪ World-oriented practices ▪ Action consequences

4.4.2 The Adopted Paradigm and Method

This study considers information is sharing a social phenomenon taking place in a defence industrial workplace. Therefore, the two main research paradigms that were adopted are *positivism* and *constructivism*. *Constructivism* is used to validate the present research framework and to investigate qualitatively the role of information sharing and communication channels in enhancing supply chain capability, whereas *positivism* is used to gain a more comprehensive understanding of the survey's participants on the way in which information sharing practices will affect their departments' capabilities.

The findings of this empirical study on modern SCM (Cooper's concept) may be applied to many other industrial/manufacturing settings. However, traditional SCM (including only *procurement*, *logistics*, and *warehouse activities*) would be suitable for organisations which are primarily service-oriented, such as hospitals, hotels, and shopping centres. Usually, researchers need to understand the aim of methodological distinctions used in research in order to choose and implement appropriate methods of collecting their data.

In this research, we used the triangulation approach, which involves the use of multiple methods of data collection about the same phenomena (Leech & Onwuegbuzie, 2007; Polit & Beck, 2012; Carter et al., 2014). This type of approach, frequently used in both qualitative and quantitative studies, may include interviews, surveys, observations, and field notes. Triangulation is one of the popular techniques that brings together people from different levels; and reconciles different perspectives based on their positions (Guion et al., 2014).

Moreover, Thurmond (2001; p. 254) asserts that triangulation may help the researcher to increase confidence in the research data, create innovative ways of understanding a phenomenon, reveal unique findings, challenge or integrate theories, and provide a clearer understanding of problems. These benefits largely result from the diversity and quantity of data that can be used for analysis, thereby increasing the validity and utility of the findings; for example, interviews, questionnaires and participant observations that add depth to the results in a way that would not have been possible with a single method,

As outlined by Blackstone (2012), the deductive approach is concerned with testing an existing theory. The deductive research strategy moves from a general level to specific one. During the data analysis process, researchers try to match the hypotheses with the collected data. Successful matching indicates the validation of the theory under consideration.

In this research, I adopted the deductive approach in testing the new SCM concept, as proposed by Cooper et al. (1997). This was the basis for the interviews in the present study with senior managers and the survey of junior staff. The interrelationships between the research paradigms, research design, and methods within a research framework is illustrated in Figure 8.

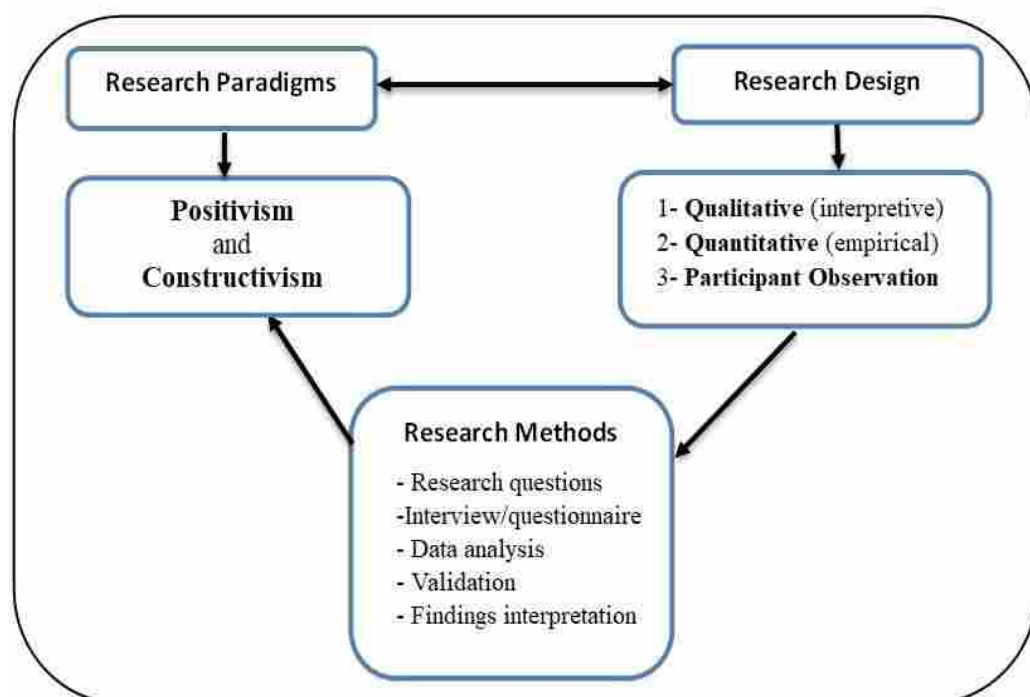


Figure 8: Interrelationship between research paradigms, design and approaches

(Source: Developed by the author)

4.5. Research Design

Two methods were applied, the qualitative (for interviews) and the quantitative (for a survey) to investigate the role of information sharing and the impact of intra-organisational information sharing on Tawazun's capabilities. Both methods involve

collecting, analysing, and interpreting data in a single study that investigates the same underlying phenomenon (Leech & Onwuegbuzie, 2007; Ghauri & Gronhaug, 2010).

In fact, Guba et al. (1994) indicate that qualitative data can provide rich insights into the attitudes and reactions of participants in social phenomena. Both kinds of data can provide a better understanding of the investigated research problem (i.e., in the interpretive paradigm). Since this dissertation concentrates on studying a social phenomenon (information sharing), its sphere is that of social inquiry. Because it was carried out in the context of the defence industries in the Arab region, it is different from other SCM studies which have been conducted in the commercial sector, in the West.

To produce research findings that can fill the knowledge gap concerning the role of supply chain information sharing, I incorporated both research methods but not concurrently. The investigations with the two approaches concentrated on the possible influence of information sharing on the intra-organisational SCM system, and ultimately on Tawazun's capability in the context of the UAE defence industry. Two SCM population samples were involved in the research investigation, namely senior managers and junior employees. A series of semi-structured interviews was conducted with the top and key seniors (e.g., CEOs, COO, and Directors) to gauge their perceptions and understanding of roles and its importance of intra-organisational information sharing and its impact on the capability of the SCM departments.

The other main objective from the interviews were to validate the proposed research framework drawing on the modern SCM concept. The interview was followed by a questionnaire survey of junior staff (technicians, buyers, support staff, and the like) to discover their understanding and awareness of their firm's information sharing

practices and the communication channels used for them, together with the impact of IS on their department's capabilities. The data collected from the surveys were used to support the statements of the key management staff and to provide descriptive statistics, adding value to the research.

4.6 Methods of Data Collection

In the investigation, I used three different approaches (interview, survey, and participant observation) to collect the required data. The datasets gathered by these approaches support each other. For instance, the survey data were used to complete and test the information found in the interviews.

4.6.1 Data Collection Approach

The qualitative and quantitative research methods were formulated to reach the research objectives, by defining the interrelations between the research questions, I employed the interview and survey methods to collect the required data from the Tawazun staff. I conducted a series of face-to-face interviews with the senior managers to gain some insights and other material from them on the research problem under investigation. Since information in a defence setting is usually veiled by full security precautions and sharing it is sensitive, I tried to create for the interviewees a conducive and friendly atmosphere in which to answer the research questions, showing my great interest in what they said.

This developed the already good relationship that I had with most of them, as colleagues in the General Headquarters of the Armed Forces (GHQ) and Tawazun. It made it much easier for me to get the required transparency and clarifications to describe the current situation in their firms. At the same time, I had to ensure that the

answers that they gave were unbiased. Their anonymity and the confidentiality of their statements, therefore, were the key conditions as far as the interviewees were concerned.

The survey was carried out with Tawazun's junior staff with the aim of using their responses to clarify and test the data collected from the interviews. The survey questions were structured to match the presumed knowledge level and job responsibilities of these staff. In this research, I planned the procedures and steps that I thought were likely to elicit a high rate of returned questionnaires and usable interview statements, as follows:

- a) *Sampling method*: A sampling method is either random or targeted, depending on the nature of the investigation sought. In this research, I used the target method to approach all the seniors and most of the juniors as samples of the population in Tawazun's three SC departments (Operations, Procurement, and Inventory).
- b) *Interview and Survey Questions*: The interviews and surveys used clear, understandable, and focused questions that matched the backgrounds of the different groups.
- c) *Covering letter*: An accompanying covering letter (see Appendix 01) was used to give an overview of the purpose of the research, and the value of the information the respondents might give, with an assurance that their information would be handled with extreme security. The primary goal of this letter was to encourage sample members to participate confidently in sharing their accumulated experience and knowledge.

4.6.2 Semi-Structured Interviews

Interviews allow researchers to investigate and prompt things that they cannot observe or collect through a survey. During interviews, researchers can probe an interviewee's thoughts, values, prejudices, perceptions, views, feelings, and perspectives. Thus, researchers can elicit their version of a situation which they may have lived or thought through (Krishnaswamy & Satyaprasad, 2010).

I got from the interviews a better understanding of the nature of supply chain management in Tawazun's subsidiaries and the impact of intra-organisational information sharing on supply chain capabilities. The interviews had two phases:

- A pilot interview was given by a research and development manager in NIMR (a Tawazun subsidiary) to assess his understanding of supply chain management and issues related to information sharing and SC capability.
- The main interviews (used to meet the research aims and objectives) involved 20 senior managers from 4 Tawazun subsidiaries (See Appendix 01).

My supervisors recommended conducting a pilot study as a start-up for preparing the research. Piloting helps in assessing the need for a full-scale research study, sets the procedure of research, and contributes to figuring out the required sample size for the research. The interviews were semi-structured, encompassing pre-planned inquiries as a guideline, with a checklist of issues to be covered during the interview. The checklist was prepared on the basis of a review of the literature on information sharing and exchange in supply chain research.

The pilot interview served as a crucial step before the interviews for the main research. It highlighted the need to ask different and simpler interview questions, revealing that

many terms and concepts used in the pilot interview were not clear and understood by the interviewee, including the very terms of “*supply chain*” and “*SC management*”.

I had to explain most of the questions initially before they were understandable to the interviewee. This approach helped to sort out the answers that yielded helpful data from the interviewees. Otherwise, biased results might have emerged, since some questions might have been judged to lead to certain answers.

The outcome of the pilot interview also guided me to adjust the interview questions to learn more about the core business areas of SCM, part of the research purpose. Hence, questions were constructed in a way that would help to reveal the following:

- Participants’ backgrounds (education, experience, career progression and challenges they face in the context of their work).
- Participants’ perceptions of the role of information sharing in the context of their job and the information sharing channels they used.
- What specific information they commonly shared with other units.
- What constituted the key capabilities in their functions/departments and what the key performance measurements were.
- What specific information they required from other units to positively improve SC capabilities and what information other units required from them.

The participants were informed earlier about the guidelines that directed the interviews. The interviews were held in the participants’ offices and lasted for an hour, on average. At the beginning of each interview, the interviewee was briefed that this was an exploratory study on information sharing /integration across the supply chain.

They were assured that the data they shared would merely be used for the research and their identity would be kept confidential.

4.6.3 Demographic Profile of the Interviewees

4.6.3.1 Qualification and Gender

Academic qualifications approximately reflect the holder's level of knowledge, which helps her/him to gain work experience, develop special abilities and skills, and to enroll in further studies. Checking academic qualifications showed the qualifications awarded to the CEOs and COOs. These qualifications ranged from basic education (high school) to doctorate level. As shown in Figure 9, one CEO held a doctorate, and eight senior managers, none of them in the Inventory department, held Masters' degrees. Moreover, eight top managers held bachelors' degrees, but no one from the SC department. Diplomas were held by two senior managers, one from the SC and one from the Operations department. A warehouse manager from the Inventory department held a high school certificate. Gender-wise, the males were dominant, filling 17 of these top and senior management positions, whereas only three females had gained senior management positions, two in the Procurement department, and one in the Operations department, as shown in Figure 10.

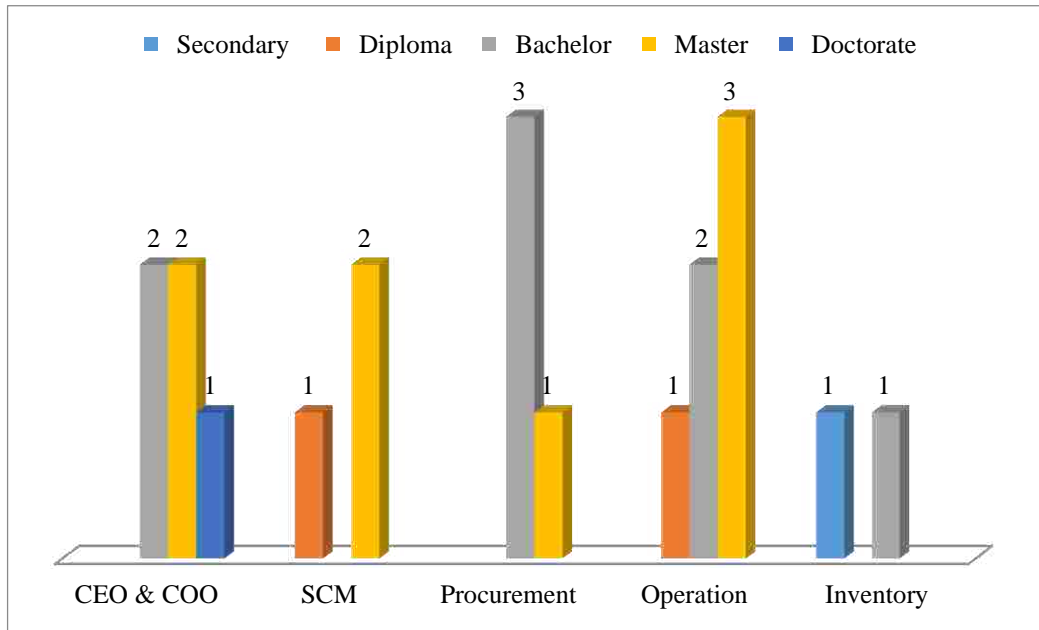


Figure 9: Interviewees' education level

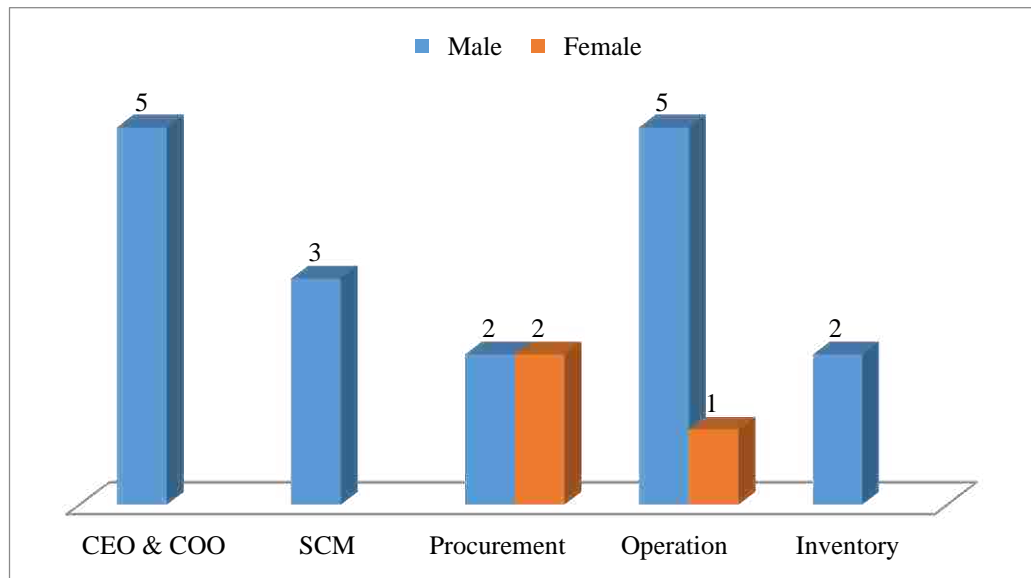


Figure 10: Gender of the interviewees

4.6.3.2 Work Experience

The professional experience gained from holding a series of job positions plays a vital role in demonstrating the capacity of the employees throughout the administrative hierarchy to fit job descriptions and assume responsibilities. Moreover, the experience thus built up also plays a key role in the promotion process, and the capacity to assume a higher position. Many CEOs and COOs, including the senior staff, came to the defence-based firm of Tawazun from the army –nine were seconded from there. A further five seniors came from non-defence work (e.g., engineering, business, and IT professionals.), and five blended professional experience from both sectors. This work background plays a crucial role in viewing manufacturing processes (Tawazun's business) through a defence lens. The description of the work background of the seniors is summarised in Table 7 and Figure 11 illustrates the length of interviewees' professional experience.

Table 7: Interviewees' job title and work background

Job Title	Defence	Defence & Commercial	Commercial
CEO	2	1	1
COO	1	-	-
Operation Director	1	-	-
Operation Manager	2	1	-
Production Manager	-	-	1
Operation Supervisor	-	1	-
Supply Chain Director	1	1	-
Supply Chain Manager	2	-	-
Procurement Manager	-	1	1
Senior Buyer	-	-	1
Warehouse Manager	-	1	-
Warehouse Supervisor	-	-	1

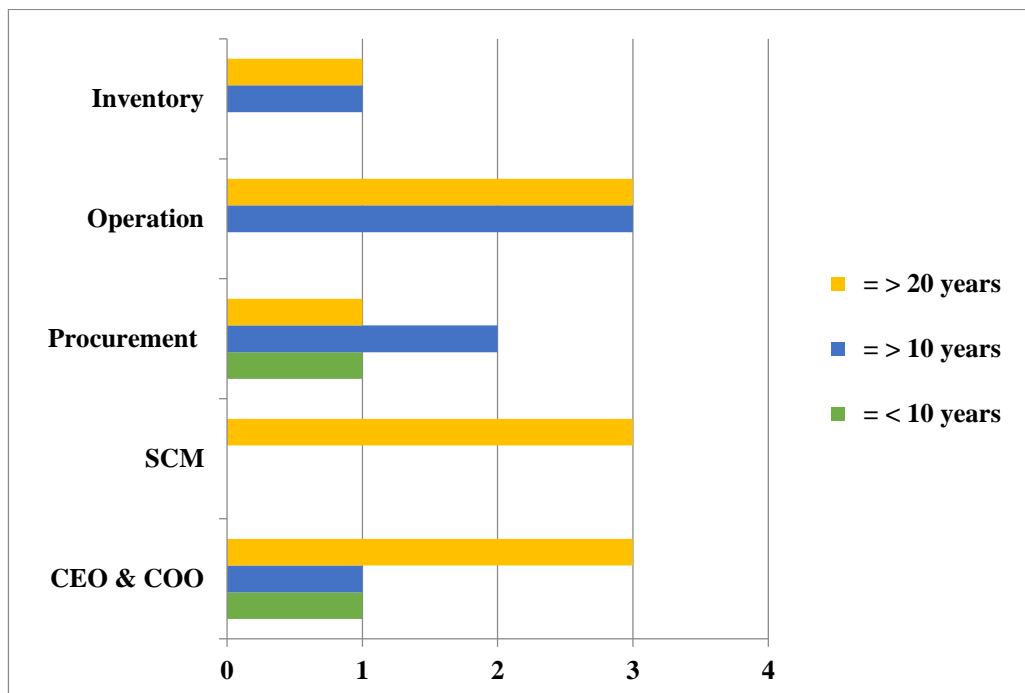


Figure 11: Length of interviewees' professional experience

4.6.4 Survey Structure

The surveys were designed to test the proposed research framework and the modern SCM concept which was validated from the interviews. This survey of junior staff, provided quantitative data to enrich our study by providing valuable descriptive statistics with which to address research questions 3, 4 and 5.

Three different versions of the surveys, were distributed to junior staff in each of the Procurement, Warehouse and Operations departments (see Appendices 2, 3 and 4). These survey instruments were designed to gather the data required about the impact of sharing information on Tawazun's capabilities, along with its proper channels and pattern intra- and inter-departmentally in the supply chain system.

The quantitative analysis of survey data may help to reveal the practices of information sharing between upper management staff and junior employees. It also sheds light on the administrative barriers to information flow and the willingness to share information between all supply chain departments. The collected data were extracted from the surveys, tabulated, and analysed quantitatively, using the SPSS package.

The generating findings were used in mapping the direction of the information flow and patterns of sharing information in intra- and inter-departmental supply chain activities. The surveys were designed with a similar overall structure and content type. Each survey had four sections, as follows:

- ❖ **Section 1:** General information section, which mainly captures respondents' demographic information (gender, education level, defence vs. commercial background, experience in the company, etc.)

- ❖ **Section 2:** An information sharing section that captures the frequency of sharing information with other departments/units.
- ❖ **Section 3:** Includes statements about information sharing channels (ERP, texting, emails, face to face and meetings ... etc.). Respondents were asked indicate their level of agreement with a set of statements regarding the information sharing channel.
- ❖ **Section 4:** Includes statements about capabilities identified during the interviews. Despite the similar structure of all the surveys, the questions in section 2 and 4 were specifically tailored to the specific department where the respondent worked. Filled and completed surveys were analysed using descriptive measures. The surveys conducted on 1 May to 15 August 2015.

4.6.5 Demographics of the Participants

The surveys were distributed to 115 junior staff from 3 supply chain departments in Tawazun; 86 surveys were completed, resulting in a return rate of 74.78%. The personal profile of the 86 participants included information about gender, age, academic qualification, and professional experience. Particular emphasis was put on academic qualification and accumulated work experience as crucial elements that could affect the junior staff's awareness of the role and importance of information sharing in developing their concern for Tawazun's capabilities.

4.6.5.1 Academic Qualification

An analysis of the educational level of the 48 Operations staff showed that 7 (14.58%) participants held Masters' degrees, 19 (39.58%) held first degrees, 16 (33.33%) were

Diploma holders, and 6 (12.50%) participants had completed high school. The academic profile of the 19 Procurement staff consisted of one (5.26%) who held a Master's degree, 11 (57.89%) with first degrees, 4 (21.05%) who were Diploma holders, and 3 (15.79%) who had completed high school. The academic profile of the 19 Inventory (Warehouse) staff consisted of 2 (10.53%) participants with Masters degree, 4 (21.05%) who had a Bachelor degree, 3 (15.79%) who were Diploma holders, and 10 (52.63%) who were high school graduates. Figure 12 illustrates the academic qualifications of the participants.

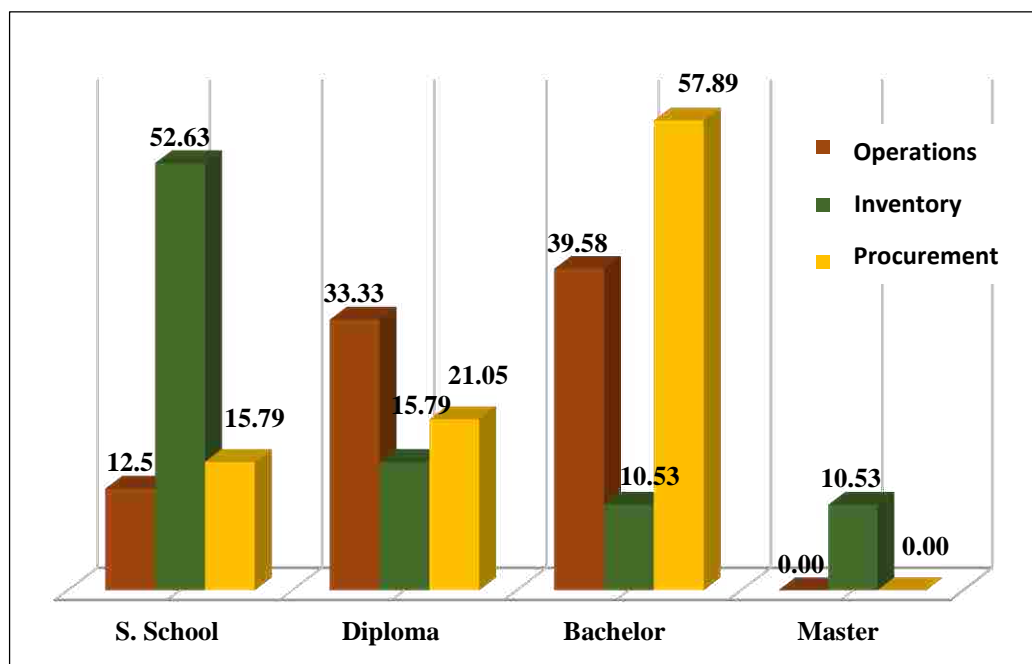


Figure 12: Academic profile of the participants of each SCM department

4.6.5.2 Gender and Age Profile

The male participants outnumbered the female in Tawazun's SCM activities, by 79 males (91.86%) to 7 females (8.14%). The gender distribution in each department is detailed in Figure 13.

- i) 47 males (97.91%) and one female (2.09%) in Operations;
- ii) 14 males (73.68%) and 5 females (26.32%) in Procurement;
- iii) 18 males (94.74%) and one female (5.26%) in Inventory.

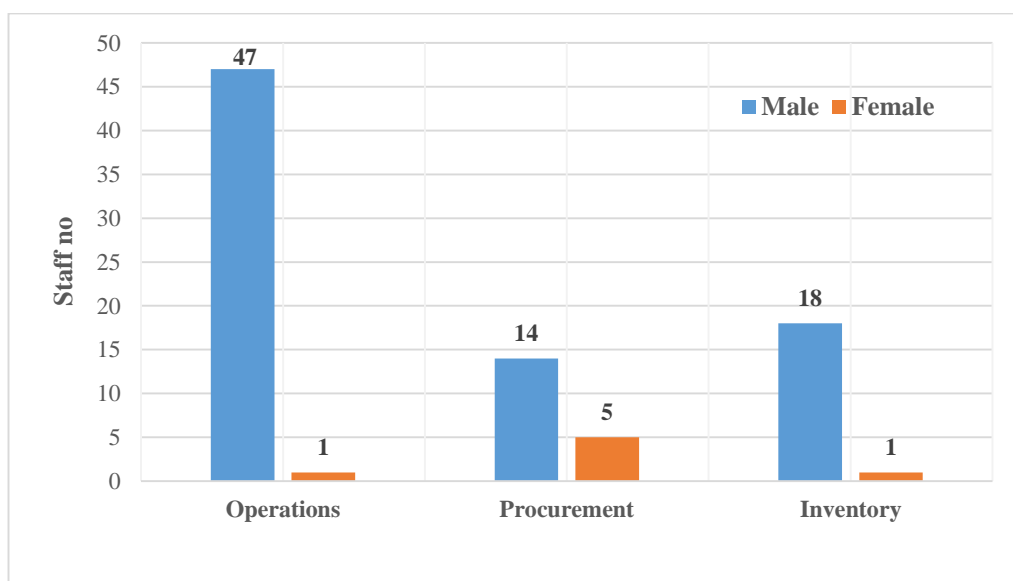


Figure 13: Gender of participants across the three departments

The age profile of the respondents across the three SCM departments ranged from 20 to 50 years. Thirty-seven participants were in their thirties (43.02%), 23 were in their twenties (26.75%), 19 participants were in their forties (22.10%), and 7 were in their

fifties (8.13%), as detailed across the three different departments, as shown in Figure 14.

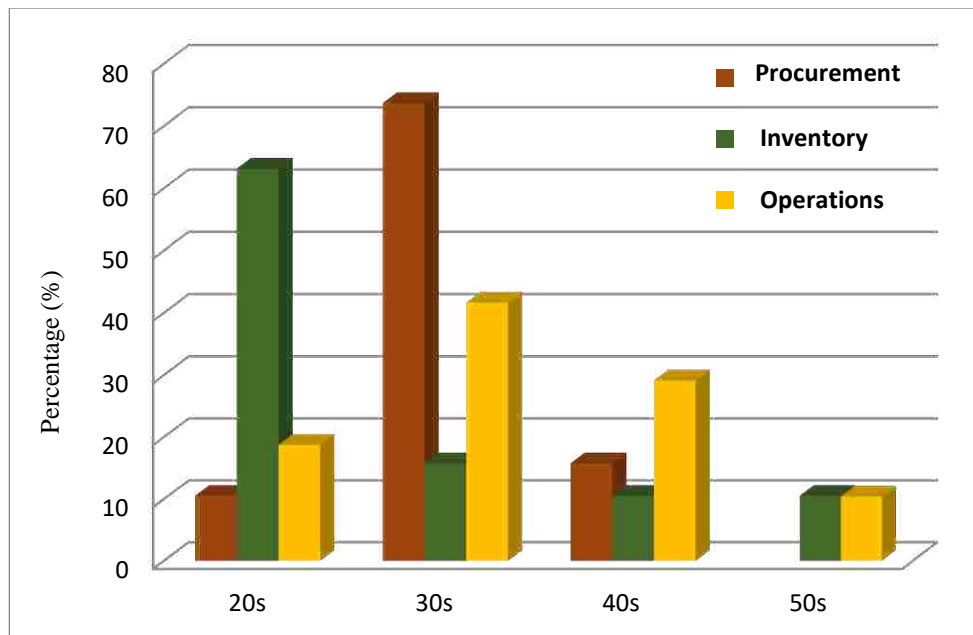


Figure 14: Age profile of the participants

4.6.5.3 Professional Experience

The participants had backgrounds and experiences in several different fields. In Operations, they had been project supervisors, manufacturing engineers, machine operators, and programmers. The Procurement staff included former buyers, purchase officers, and assistant buyers. The staff of the Inventory (Warehouse) included data entry clerks, warehouse supervisors, and senior storekeepers.

The current work of the respondents revealed a broad range of professional experience with respect to years of work and specialist. In the Procurement Department, 89.47% of the participants had 1-5 years and 5.26% had between 6 and 10 years of experience.

In contrast, all the respondents from the Warehouse department had less than 5 years' work experience. Some of the respondents from Operations had professional experience extending for more than six years (10.42%) and one quarter of the participants had ten or more years of experience because of the nature of Operations activities, which need special skills and capabilities. Figure 15 shows the length of their professional experience.

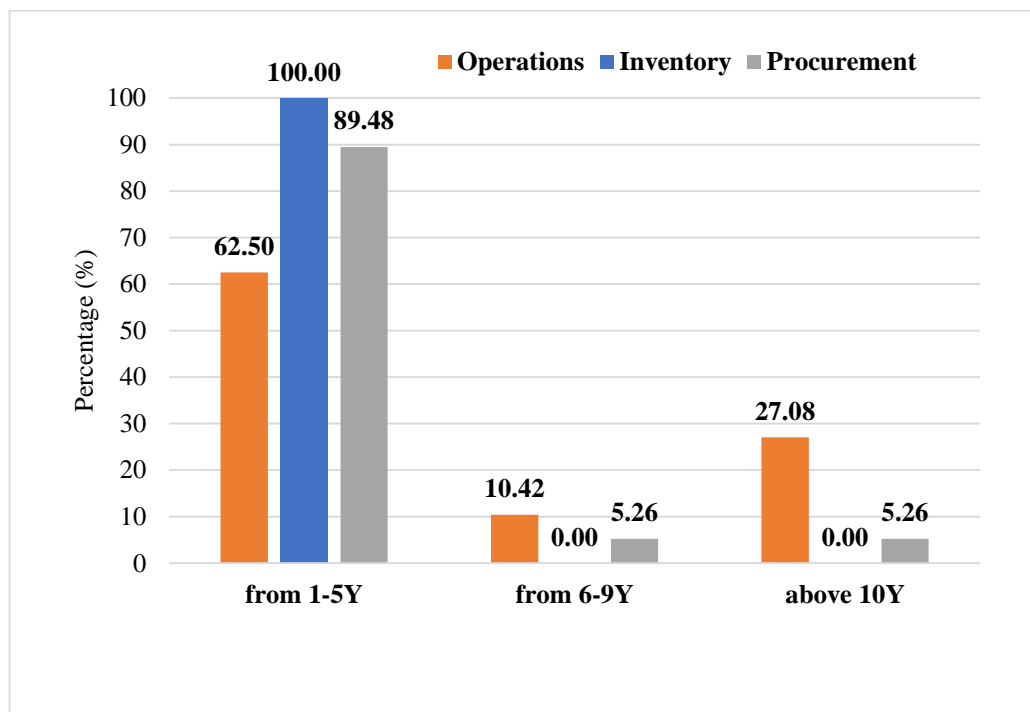


Figure 15: Years of professional experience

The respondents gained their work experience and training from either defence or civil work. Seventy-six percent of the Procurement staff came from the business sector, while 17.65% came from defence departments. In contrast, 60.61% and 44.44% the of Operations and Inventory staff, respectively, gained their experience from defence work. Some respondents in the three departments had mixed experience that included

both defence and civil work. Figure 16 indicates the professional background of the respondents.

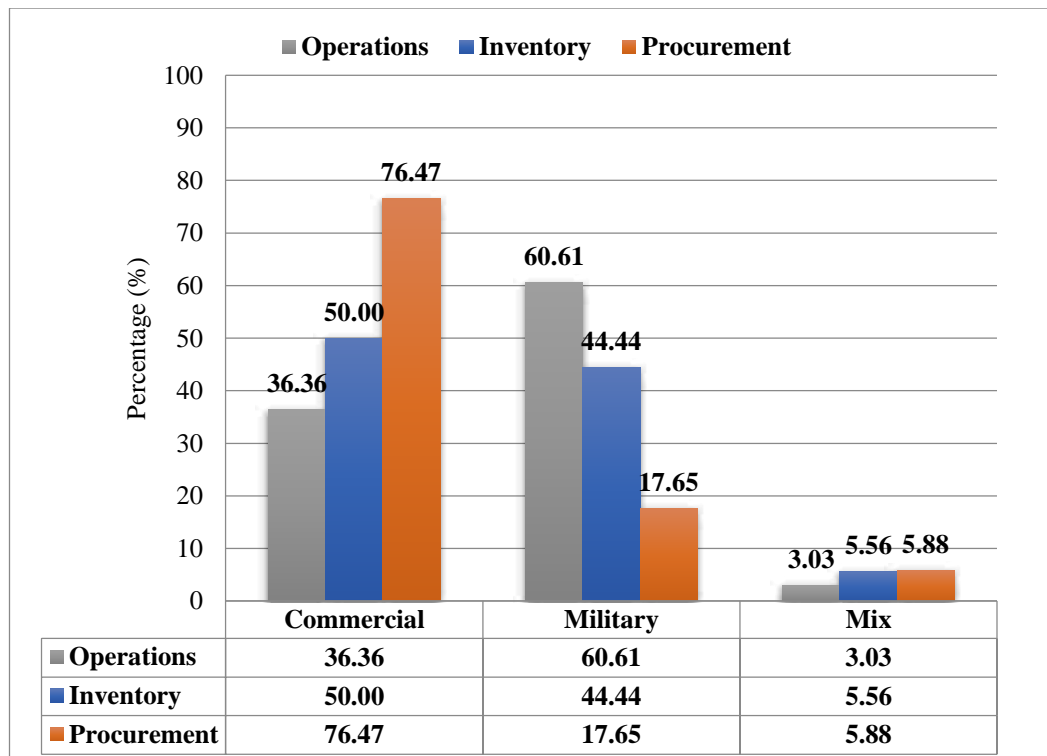


Figure 16: Professional background of the respondents

4.6.6 Participant Observation

In social research investigations, it is important to observe spontaneous human interaction and the reactions in interpersonal communication; this reveals the pattern of people's involvement in the context of a social phenomenon. Crosby et al. (2015) notes to that "*Observation is a technique of data collection based on the investigator's intention to observe in a specific research field*". Participant observation lets the *observer* join a population group that is being investigated, as a member.

The value of close observation is its power to equip an observer with the pattern of interpersonal communication and response to a common shared issues. This gives more insight into the problems of the field under investigation and obviates guesswork about the nature of the research issues. Moreover, observation may give the investigator a chance to understand better certain issues that the participants have been unwilling to discuss in their interview or mention in the survey.

Laurier (2016) adds “By undertaking participant observation, the researcher aims to gain the authority of “*insider*” knowledge. Therefore, the participant-observation approach is based on two core components, namely *observation* and *participation*”, where a researcher can

- *Observe* a spatial phenomenon from its very beginning, from a logical standpoint, and using the proper tools and a scheduled plan for collecting, comparing, and counting the presence, movement and features of individuals, groups and populations in a defined geographical space.
- *Participate*, i.e. share personal involvement or association with a target group or social event and activity. Observation is based largely on the approach that the observer has adopted to conduct the observation, such as the extent of involvement, neutrality, and physical distance.

Even though the power of participant observation lies in its familiarity with and grounded perspective on the places, practices and population group considered by the research study, combining the two components appears to spoil the quality of the data collected by this method, Thus, the knowledge acquired from this method is as much reliant on participation as it is observation.

Participant observation requires the observer to revise the proposed questions to match the emerging criteria for judging whether the action was properly executed or not. But Mack et al. (2005) explained how researchers could use participant observation to discern the essential factors for their purpose, even if these factors were it foreseen when the study was designed. This approach is of more significant advantage in gaining truthful answers to the research questions than is gained through the interview questions, and indeed helps to devise useful questions.

The collected data from participant observation may be more relevant to the research theme and objectives of the study. Researchers can appreciate natural social interaction and communication amongst the target sample members by this means. Laurier (2016) summarises the potential advantages of the activity as follows:

- Researchers can use their familiarity with the study location to collect better *insider* knowledge.
- Note-taking and notice are essential in conducting in full the necessary phases of participant observation.
- Participant observation supports the translation of know-how and the exploration of cultural difference and similarities.

I have some experience (17 years) in the field of supply chain management, such as Commercial Contracts, Support Services, Procurement and Logistics in several government and semi government sectors, including the defence sector and the health sector I have had more than seven years of experience in the defence sector, including GHQ and Tawazun subsidiaries. I have a Master's degree in Business Administration and also am a Certified Commercial Contract Manager and Certified Project Manager.

Moreover, I have solid experience in the private sector of planning, implementing, and executing strategies, resulting in greater customer confidence and strengthened business results. I have been instrumental in reducing expenditure and increasing efficiency, and manage projects, resources and staff well.

I can work in diverse environments committed to promoting creativity and effective problem-solving. My experience as founder and CEO of six companies and one office furniture factory helped me to develop self-discipline, motivation, commercial acumen and a broad entrepreneurial perspective. I am currently CEO of a car factory in Abu Dhabi (a new family project) and also hold responsibility in other companies that I own. The cumulative experience that I have gained in all these positions in the UAE has enriched my knowledge of supply chain management, especially that of the industrial field in this country.

I brought my accumulated professional experience of SCM to strengthen my academic research in the DBA graduate programme. The blended work experience and theoretical study was thought to better probe any weaknesses in the current SCM practices of a manufacturing firm, in particular in the defence industry. It was also hoped that it would refine my research questions and yield more data on the issues of supply chain management in this sector in the UAE. I can distinguish my role as a professional in this field from my recent role as a researcher who is very aware of her work in the defence environment and issues of supply chain management in Tawazun's subsidiaries.

The findings of my participant observation were considered robust evidence throughout the term of the field research in the form of input in the investigation, and helped to compile a detailed assessment of the procedures on the shop floor rather than

the laboratory. In general, participant observation is considered the least useful form of observation; however, I adopted approach to detect the behavioural pattern of information sharing, and means communication between the members of Tawazun's SCM subsidiaries whom I already knew. The discussions during the face-to-face interviews and the phone conversations were written down, along with related comments.

Three phases of research investigation, namely, observation, semi-structured interviews and surveys were implemented in turn. My observations targeted the research problem, which then initiated an investigation of research issues (statement, questions, hypotheses, and objective). My administrative position as Senior Procurement and Logistics Manager in NIMR and Caracal since June 2012 gave me a unique opportunity and sufficient time to observe, deal with and interact with both senior managers and junior staff members in order to observe their attitudes to the supply chain phenomenon.

The behaviour of the group members was explored by observing their conversation with me and with other members of their organisation; such observation requires time, acceptance, carefully negotiated access and tact (Pålsson, 2007; Krishnaswamy & Satyaprasad, 2010). Observations became sources of first-hand data about the pattern, frequency, and practices of information sharing in Tawazun's subsidiaries. In addition to working beside the organisation's staff, as noted above, I paid many field visits to the target subsidiaries to observe the characteristics of their supply chain system and the participants' behaviour in the workplace.

My observations throughout the study would be instrumental in the analysis stage as unique insights into the social phenomenon under study. These field observations of

mine constituted part of the first-hand data about the exchange of information in each subsidiary. Nevertheless, to understand them better they had to be supplemented by another method of capturing the participants' perceptions and their meanings to aspects of information sharing.

4.7 Data Analysis

The interviews were analysed through NVIVO software, which requires each section of staff (CEO, SC Seniors and the like) to have its own sources. I created these and then created nodes to represent each of the six interview questions, and linked these to approximately three sub-nodes, depending on the number and type of answers to the question. In total, 6 sources, 7 nodes and 17 sub-nodes were created in the interview analysis. SPSS was used to analyse the reliability of the data from the surveys. Microsoft Excel was also used to produce descriptive statistics related to the three SC departments in Tawazun's subsidiaries.

4.7.1. Reliability

The general concept of reliability is a focus on the dependability and consistency of the research instruments (Weathington et al., 2010; Cunningham et al., 2010) The two main types of reliability are stability reliability, or stability over time, and representative reliability, or stability across groups (Neuman, 2014). Ali and Kumar (2011) outlines some of the main factors that influence the reliability of research instruments, including the wording of the questions, physical setting, the respondent's mood, nature of the interactions, and the regression effect of a tool.

Based on the suggestions proposed by Neuman (2014), several steps were taken that were thought to improve the reliability of the present study, as follows:

- a) Having a clearly conceptualised construct, because reliability increases when the measurement involves only one concept (i.e., SCM model concept).
- b) Using the level of measurement of the instrument by asking very detailed questions about the attributes of the SCM model (its roles and functions, inter-/intra-organisational structure, and information sharing and integration impacts) and then using these questions to measure each attribute.
- c) Asking SCM experts for a peer review to give important feedback on the research instruments.

Reliability Test

Tavakol and Dennick (2011) described how researchers attempt to create reliable and valid tests and surveys to enhance the accuracy of their assessment and evaluations; reliability must be one of the fundamental elements in the evaluation of a measurement instrument. Instruments in surveys can be tests of common knowledge, skill or attitude. Instruments can measure concepts, psychomotor skills or effective values. Reliability tests seek to measure how far a tool is dependable. It is possible to objectively measure the reliability of a tool through the most widely used test, Cronbach's alpha coefficient.

Calculating alpha has become a common analytical practice. It is expressed as a number between 0 and 1, where the internal consistency indicates how far all the items in the test measure the same concepts or constructs and is connected to the interrelatedness in the test. The alpha coefficient should be at least 0.7 to demonstrate acceptable internal consistency in the scale and may range up to 0.9, showing excellent uniformity (Ntoumanis, 2001).

In this research, Cronbach's alpha was applied to the 86 responses of the survey, using the reliability command on SPSS, to assess the reliability of the measurement scale consisting of about 20 survey items. These survey items were designed to measure 5 dimensions (variables): information sharing with another department, extent of use of three different communication channels that were sub-divided into three types of communication channel (physical, electronic, and ERP/GP), and the SCM capability.

The values of Cronbach's alpha for each of the 5 dimensions (variables), namely, information sharing, an average of physical channels (face-to-face and meetings), an average of electronic communication channels (email and phone), and ERP/GP system. The departments' capabilities were aggregated and found to be 0.86, 0.76, 0.77, 0.80 and 0.79 on the above five dimensions respectively. This results indicate adequate consistency in the corresponding survey items, as shown in Table 8.

Table 8: Results of reliability analysis for all variables

Area	Cronbach's Alpha	N of Items
Sharing Information	.861	86
Physical Communication Channels	.764	86
Electronic Communication Channels	.768	86
ERP/GP Systems	.807	86
Department Capability	.790	86

4.7.2 Validity

Validity is related to measuring the fitness of the empirical indicator and the conceptual definition of the construct. Some measurable areas of validity are face validity, content validity, concurrent and predictive criterion validity, and convergent and discriminant construct validity (Neuman, 2014). To test face and content validity, I asked for a peer review to scrutinise the instrument and maximise the logical links between the questions and the research objectives, because I wanted to ensure that the coverage of the topics researched was balanced. Through the pilot study I clarified the senior managers' understanding of the concept of SCM capability, upon which I built semi-structured interview questions. Then I tried to fill the gap in the data that could not be illuminated in the interviews by creating questions and conducting a questionnaire-based survey.

Regarding criterion validity, I compared the instrument with those in other studies to establish the concurrent and predictive validity of the survey. Validity can be threatened internally and externally. Internal threats include history, maturation, regression, selection, treatment diffusion, mortality, compensatory demoralisation, compensation rivalry, testing, and instrumentation (Creswell, 2009). In the present study, selection (i.e., obstacles to information sharing) was the only internal threat that might be relevant; consequently I tried to make sure that the targeted participants satisfied the selection criteria for the study (Ali & Kumar ,2011).

4.7.3 Research Bias

In all types of research, it is crucial to consider the issues of bias and subjectivity. Thus, awareness of bias that might be negative affects the quality of the generated

findings and the interpretation of the final results, if they are to stand as reliable and valid research. In quantitative research, the objectivity, reliability, and validity of the research instrument (e.g. a survey) minimise the bias effects. In qualitative research, the investigator must play a crucial role in avoiding any bias. In addition, *bracketing* and *reflection* are effective ways of dealing with such biases. Both Tufford and Newman (2012) and Barbour (2014) define bracketing as “A *method used in qualitative research to mitigate the potentially damaging effects of preconceptions that may cause defects in the research process and thereby to increase the rigour of the study*”.

As a starting point, I was very much aware of my role in the defence industry, and the way in which my personal interests might affect the choice of a research question. The worry here was that I might choose an issue that was insignificant, or would be interesting to me alone, where the contribution would be insignificant. This sparked a strong incentive in consulting scholarly sources to learn how to construct effective questions for research surveys and interviews.

The work environment of Tawazun’s subsidiaries had inspired me to be personally involved in all the activities related to data collection, data analysis, and data interpretation, and to all the methods used to collect data for this dissertation (interviews, survey and observation). I was also very apprehensive lest my knowledge of the defence industry that might influence the way in which I approached the collection and interpretation of the collected data. To overcome possible bias, I followed the standard protocols to ensure the reliability and validity of the research activities and outcomes.

4.8 Ethical Issues

Research ethics and integrity are the key codes that researchers and scholars should adhere to. The issues of privacy, security, safety, confidentiality, and use of the research findings are of primary concern in all research, whether theoretical or applied; they need close and careful assessment and monitoring of the research processes. Hence, an investigator should be well-acquainted with the participants' profile (social studies) and the objects (physical studies). It is also essential to consider the adverse actions that may occur while conducting the study.

Before carrying out the investigation on a social problem, the participants should be informed by the investigator about the purpose and nature of the research, and the procedures used in obtaining the data. The words of the questions they are asked should be clear and understandable. Equally, it is important to choose the target participants from those who are competent to give consent. According to Kimmel (2009) the ethical aspects of any research should be addressed in the data gathering process. I maintained high ethical standards in gathering data by the following steps:

- The target members should be previously informed that they are to be involved in the surveys or interviews.
- The participants should receive a guarantee that their contribution will be kept confidential and no personal data concerning them will be transferred to any third party.
- The participants should receive full information regarding the research purpose, objectives, and critical points of the study and the value of their data.

- The survey should not name the participants in order to give them security and confidence in providing correct and useful information and data.
- Participants can join the research study of their free will and have every right to leave the survey at any stage without any commitment.
- Access to sensitive data must be restricted except for purposes of analysis and discussion.

It is vital to follow ethical norms since they are relevant to the integrity of the research (Bryman & Bell, 2007). The sources that were used here as references were properly cited according to academic conventions, and plagiarism and violation of copyright were avoided. Because the field-based research dealt with the concepts, views, and opinions of Tawazun's members of staff, confidentiality and anonymity were emphasized to make them feel more comfortable and not afraid of providing reliable information, even if it were negative.

4.9 Summary

In this chapter I described the most suitable paradigms and methods to adopt in this research for developing the research framework and addressing the research questions. I presented the qualitative and quantitative methods of gathering data from the senior managers and junior staff working in the four Tawazun subsidiaries. This chapter also discussed the software used in the data analysis, the issue of research bias and the ethical issues related to writing a DBA dissertation.

Chapter 5: Information Sharing: Perception, Value, Reliability- Survey Analysis

5.1 Introduction

This chapter discusses the inputs of the interviews that were conducted with Tawazun's top and senior managers to address their *perception* of the importance, value and reliability of information sharing. It also focuses on the way in which senior members of staff practice by stating that information sharing is both a social phenomenon and a business process in the workplace for improving the capacity of both the supply chain departments and, in turn, all the subsidiaries of Tawazun. In addition, this chapter presents the findings from the surveys to support the descriptive analysis of the concept and practice of information sharing in the context of SCM activities in a defence industry workplace.

The process of information sharing has received much attention in scholarly management studies. Sharing and exchanging information have become, in today's business world, one of the strategic goals of a firm that seeks to compete in the marketplace. The pattern of information sharing is firm-specific, and its nature is defined on the basis of the type of business and the intra-organisational structure of a firm. This chapter discusses the quoted statements under two broad themes:

- 1) *The perception among senior managers of information sharing introduced* through the discussion of i) Achievement of goals and objectives, ii) Confidentiality issues, and iii) Willingness.
- 2) *The value and reliability of information sharing:* i) Right information at the right time, ii) Frequency, iii) Decision-making and iv) Misunderstanding.

The survey findings used in mapping the intra- and inter-departmental direction and flow of the required information involved in the supply chain activities, and also in comparing the attitudes of juniors and seniors to information sharing.

5.2 Information Sharing- Perception

The interviews reproduced various definitions of information sharing, which typically reflect the thoughts and perceptions of the senior managers regarding behaviour and initiative in the sharing process. For instance, some seniors considered information sharing to be a healthy trend for developing an active professional network in the workplace and a support for the employer, whereas others looked on it as a private issue that might raise particular problems.

5.2.1 Achievement of goals and objectives

Most of the top supply chain managers developed over time a positive view of the information sharing and data exchange that went on between the various SCM departments. A positive image showed that these activities could bring some competitive advantages to their departments in the long term, particularly by keeping them abreast of the latest news and information about their work. In this case, all SCM members should be involved in the information sharing cycle, each one being simultaneously an information receiver and sender. The availability of information could significantly enhance job performance and the execution of Tawazun's goals and objectives, as expressed below:

"To synchronise thinking that will support the executive work of sharing other people's thinking (to know about commercial, finance, production thinking and to be aware of these ways of thinking; to pass

work, milestones and goal more easily". (Male, BSc in Chemical Engineering, CEO, with 21 years' work experience).

A senior operations manager added a comment on transparency and sharing a clear annual plan:

"...very transparent information about a mandatory training course for the local employees. A proper plan for the whole year should be presented clearly, and the target will be achieved that will reflect my KPI at the end of the year. It is only the way of all departments to achieve the company goal". (Male, BSc in Environmental Manufacturing, Operations Manager, with 21 years' work experience).

Another senior manager added: *"It is the main thing that will help you to success in your plan and vision". Information should also be shared with any departments related to that information". (Male, BSc in Manufacturing, Operations Manager, with 21 years' work experience).*

A fourth senior added: *"Getting our work done efficiently and achieving the goal, requires the sharing of information and demands teamwork." (Male, BSc in Economics, with expertise in procurement and logistics, Warehouse Supervisor, with 17 years' work experience).*

Some production managers acknowledged the importance of top-down information sharing at two intra-organisational levels; it should be done at the right time and would lead them to take the necessary steps to attain the goals, as the following two statements indicate:

"It is important to share the information from the top downwards to make sure that all the employees are in harmony with one another to attain the firm's goals. Therefore, sharing important job-related

information keeps everyone on the same page, sharing the same intention as all the rest of the firm as one unit and not feeling that we are in different departments.” (Male, MBA, Production Manager, with 18 years’ work experience).

The perceptions of the interviewees indicated the importance of information sharing as a strategic tool to achieve the company’s goals and objectives. An analysis of the quoted statements by the senior managers revealed the importance of preparing a clear work plan, such as the key performance indicators (KPI) for employees, which described the tasks to be implemented during the year, was that it would:

- 1) encourage employees to ask various members for the information required to complete the project they were working on (the senior wanted to foster a cooperative spirit among the junior staff in several SCM departments).
- 2) inspire the employees to exchange information with all the rest of the staff and smoothly transfer information from top to bottom and vice versa (information flows downwards through the hierarchy (i.e., from seniors to juniors).
- 3) share the right information with all members to help them take the right action to achieve their goals.

The scholarly research of Lee and Whang (2000) and Leiphart and Lee (2001) support these findings: *“Effective information sharing among the supply chain members can enhance most supply chain initiatives. The major components of the SCM initiative include vendor connections, managed inventory, continuous replenishment programmes, collaborative forecasting, and efficient customer response. Therefore, there is a need to have actionable information available to the organisation’s members at all times about their tasks.”*

5.2.2 Confidentiality issues

It was found in investigating the shareable information among Tawazun's subsidiaries that neither CEOs nor COOs gave sufficient clear explanation of the information's content for it to be accessible and shareable in the research. Their failure to do so may be attributed to the faint demarcation between confidential and non-confidential information that Tawazun (a defence-manufacturing firm) imposed. The senior managers, unless otherwise stated, were keen to avoid any problem of confidentiality; hence, they defined and classified the information according to its content.

One CEO gave some insights into the perception of the type of content of shareable information and the impact of information types on the functionalities of Tawazun's subsidiaries. The CEO expressed his interest in information sharing, as follows:

“Nothing in Tawazun is called strictly confidential. Many members often ask only about what they should know and what they shouldn't. So, in our orientation sessions, we tell the middle and junior staff what they need as shareable and non-confidential information. To avoid any leakage, they should also be aware whether the information provided to them is confidential and restricted in circulation. This approach increases their loyalty and trust in the top managers.”
(Male, BSc in Accounting, CEO, with nine years' work experience).

After a while, the same CEO was re-interviewed to further clarify what type of information contents is shareable; he said:

“Not every piece of information is supposed to be shared with every employee. Thus, the shareable information amongst the employees must be accurate and related to their work alone”.

This quotation from the CEO reveals that the nature of the work environment of Tawazun had wrapped information up in thick sensitivity, and shows the way the top staff negotiated this issue. The statement also reveals the serious issues facing the information sharing process, including lack of confidentiality, anti-trust regulations, the high cost of ICT implementation, and the timeliness and accuracy of the information shared.

The top managers in Tawazun's subsidiaries, whose professional experience came from a defence background, are by default the primary decision-makers. The interview sessions with the senior managers showed that they are trying to be the sole source of official and authenticated information and data; there may be an ulterior motive behind this restriction, but none of them disclosed it. The ability of non-defence employees (civilians) or those who came from the business sector to share information has been affected significantly by the defence precautions, cultural atmosphere, and surrounding environment of confidentiality that the top management imposed.

Clearly, then confidentiality issue is crucial in figuring out the type of content and quantity of shareable information across Tawazun's subsidiaries and amongst its staff, as the statements below confirm:

"We do not share it with all employees; it depends on the contact of that meeting. Some projects have stopped without telling me; but because of the sensitivity of this field we are not able to share all the information as it is." (Male, BBA, Procurement and Contract Manager, with 15 years' work experience).

An operations manager confirmed the existence of effective restrictions on sharing information from decision-makers; particularly that related to strategic decisions:

"Minutes of the meeting were written and shared in some meeting, but we are not getting any of the information about the strategic plan that was discussed between CEO and Directors" (Male, MBA, Production Manager, with 18 years' work experience).

In my view, the senior decision-makers should act as motivators by realising the importance of sharing all information without restriction among the SCM members at all levels. Moreover, the decision-makers should be expected to realise the significant role that information would play in improving productivity, accountability, transparency, and coordination in Tawazun's subsidiaries, along with setting up active relationships with customers and stakeholders.

5.2.3 Willingness

5.2.3.1 Unwillingness of Senior Managers to Share Information with SC Members

The military flavour of Tawazun's top management has imposed barriers to the spread of information sharing amongst administrative and technical staff. Such a work atmosphere discourages the members of the SC from wanting to share and exchange information and ideas with each other, particularly in either vertical direction. The interviews revealed that one's educational background and level, along with accumulated work experience, seem to influence one's behaviour and willingness in information sharing. For instance, interviewees with a defence background dealt very cautiously with open information sharing.

Although some SCM seniors realise the importance of sharing information within the organisation, the interview participants nominated some core obstacles to practising a meaningful exchange of information, ideas, and opinions around the work communities in Tawazun's subsidiaries. Nevertheless, Tawazun imposes military

policies and regulations concerning information release and sharing, justifying it by the fact that Tawazun's products are particularly confidential. To highlight these points, some of the firm's senior managers explained the reasons behind the reluctance to share information:

"I cannot share the strategy with all managers and employees because there is still a gap between what holders need to achieve and the company strategy. This complicates industry because we should have a long-term strategy to meet customer demand with high technology. However, the customer does not have a clear long-term strategy, so we have to have their long-term requirement to build sustainability if we want to make clear plans for my firm and to invest in the right plans, such as SC production, and development of the staff. However, the lack of a plan (information sharing) may impact on our plan as well". (Male, MBA, CEO, with 33 years' experience).

Another senior manager specified that his management style did not encourage him to share information with other members if staff:

"My management style does not encourage information sharing. Even my line manager and I, who understand the importance of information sharing". (Female, BBA, Commodity Manager, with 10 years' experience).

Other seniors showed their unwillingness to share information but without giving reasons:

"The seniors do not share strategic information with the middle and junior ranks." (Male, BSc, Operations Manager, with 21 years' work experience).

"Unfortunately, we still don't know anything about the company strategy. Why I have no idea." (Male, BSc, Operations Manager, with 21 years' work experience).

From all the above answers, it can be seen how the defence mentality affects the senior managers in Tawazun: they all hide relevant information which they consider to be confidential. This suppression of data by SC members tends to have a negative impact on the supply chain capabilities and to discourage the spirit of teamwork in Tawazun's subsidiaries.

5.2.3.2 Willingness of the Seniors to Share Information with SC Members

Information sharing in the workplace is widely acknowledged since it can play a significant role in making every member of staff equally aware of the organisation's affairs. Such sharing would encourage staff to involve themselves in the information sharing process voluntarily. The SCM literature gives evidence that information sharing is one of the key factors for improving work performance and production quality, saving time costs, promoting coordination between the SCM departments and production lines, and increasing their sense of responsibility and the spirit of teamwork.

As noted in the previous subsection, information is a matter which has been influenced by the defence environment and background of most of the decision-makers in Tawazun's subsidiaries, where a closed circle of members handles all the detailed information. However, there are a few decision-makers in these firms who, as they show in their interviews, are willing to share information with SC members and encourage their teams to be open with each other. Moreover, these managers explained

the urgent necessity of intra-organisational information sharing as highlighted in the statements below:

“Information sharing in Tawazun is a routine activity and done on a daily and weekly basis amongst twenty senior managers. They learn from each other and build knowledge teams. It is important that each senior manager knows his/her department well, along with any “sister” departments, when they carry out projects in support of each other. For example, the commercial manager should provide the right information to the customers while explaining the product specifications. False information might cause an upset for an end-customer. Therefore, concerned members put it in a loop and are aware of any update. Regarding the yearly plans, each department must propose three different plans and share them with the others. This imperative to be sure that we are all singing from the same sheet.” (Male, MBA, CEO, with 33 years’ work experience).

At the same time, other managers link the willingness to share information with SC members’ sense of responsibility and improved understanding of the company's vision and strategic plans:

“This practice helps all the members to increase the sense of responsibility of everyone involved. Tawazun members need to work as a team, since more members knowing much information would be better than a single member.” (Male, BSc, Project Manager, with 29 years’ work experience).

Another CEO added a more important concept by linking transparency and accessibility with the sharing of information:

“Information in each department should be accessible to any employee regardless of job position so that s/he can carry out the tasks that s/he is entrusted with.” (Male, DBA, CEO, with 16 years’ work experience).

These statements reflect the positive attitude of some of the top executives to the proposition “*information for and shared by all*”. This perception by the top management of the significant role of information sharing would support mutual understanding and trust between Tawazun members and thus increase communication and cooperation between groups. Ultimately it would create specific-firm values, and give Tawazun’s workplace environment more welfare and incentives.

In my professional experience, as an ex-Senior in NIMR and Caracal (Tawazun’s subsidiaries), the worst scenario to do with a lack of accurate information would be set in a meeting when some attendees (*Middle and Junior staff*) found themselves out-of-step and not updated about the issues under discussion, which directly related to their core job responsibilities. This situation might severely disrupt the interrelated SC activities.

The evidence of a lack of willingness to release certain types of information and data spotlights the passive culture of information sharing in Tawazun, where junior members of staff form the majority. It suggests the need to provide a motivating atmosphere, in which all Tawazun’s members are committed to promoting the active use and dissemination of available information on a professional basis. The following subsections show instances of the junior staff being unaware of important and relevant information available in their department.

5.2.3.3 Impact of Missing Information -SCM Junior Ranks

Missing information about a specific task naturally has an adverse impact on carrying out the task properly. In the workplace, information does not always reach all the firm’s members equally; particularly when they are junior staff. Unknown

information, a common deficiency in interdepartmental information sharing, may cause undesirable consequences in all the SCM activities. Analysis of the juniors' survey revealed that the juniors of the three SCM departments suffered from a lack of information; most of them miss a considerable amount of released information. The missing information for the those who rank as juniors in the three Tawazun SCM departments is discussed next.

Operations

Figure 17 shows the missing information for the Operations juniors regarding some data and information requested from other SCM departments, as well as data and information received by their department at different intervals (i.e., on a daily, weekly, monthly, or quarterly basis). The answers of the Operations juniors indicated the major areas where information might be withheld. About 58.33% of juniors had no information about storage capacity from the Inventory Department, as well as data on parts specifications from the Engineering Department were unknown. 54% of the shared information about problems with raw material shipments and client-specific data from both Procurement, and Sales and Marketing Departments were unknown. About 43.75% of the information on the Procurement plans from the Procurement Department was also unknown to the Operations juniors.

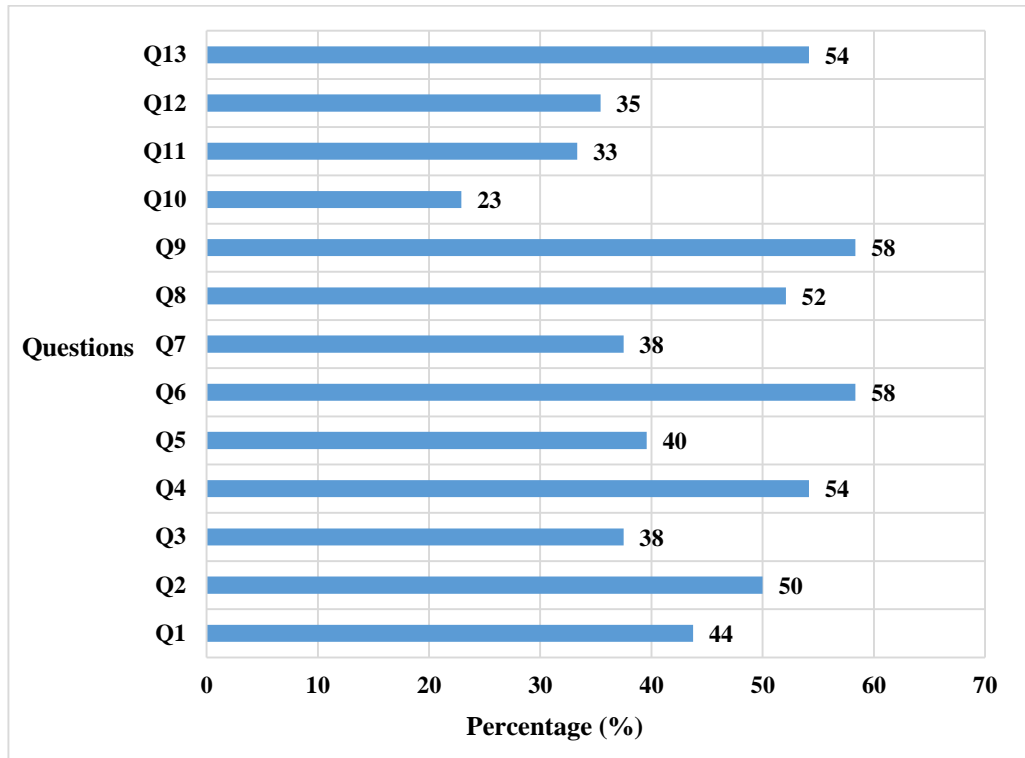


Figure 17: Percentage of questions not answered by Operations's Juniors

If the Operations juniors had known the inter-departmental information shared with their department, they would have been clearer about:

- *Storage capacity.* This can provide clarity about the quantity of raw material available, which will affect the Operations capabilities directly through offering a chance to increase the acceptable ability to handle any project from local or foreign customers.
- *Parts specifications* form the information that impacts on product specifications, which means that any missing information can affect the quality of the final product.
- *Information on raw material shipping problems* should be shared with the Operations team so that they can help to decide the causes of the delay in

production, as well as switching some products to other production lines to manufacture, This is for the sake of avoiding delay to the Operations activities. This procedure would keep the workers busy and maximise their productivity.

- *The Procurement plan* is required to give the Operations staff accurate information for assessing how the purchasing capacity could meet their plan. It would also give the juniors some clarity about the supplier's ability and to provide the needed parts. If they knew this plan, the Operations staff would know whether to produce the parts in-house or outsource production.

Procurement

Figure 18 shows the information withheld from the Procurement department's juniors regarding data requested from other SCM departments, as well as the data they regularly received at different intervals (e.g., daily, weekly, monthly, or quarterly). The answers of the Procurement juniors revealed the major areas where they needed but did not have information. About 47.37% of the information on the personnel and training courses from the HR Department was unknown. About 36.84% of the Production Master Schedule (PMS), parts specifications, tooling, and parts requirements (e.g., quantity, quality, and delivery schedule) were unknown, since this information is sent to the Operations department, but not to Procurement. also unknown were data on the spare-parts specifications from the Engineering Department and data of the budget, payment status, and cash flow from the Finance Department.

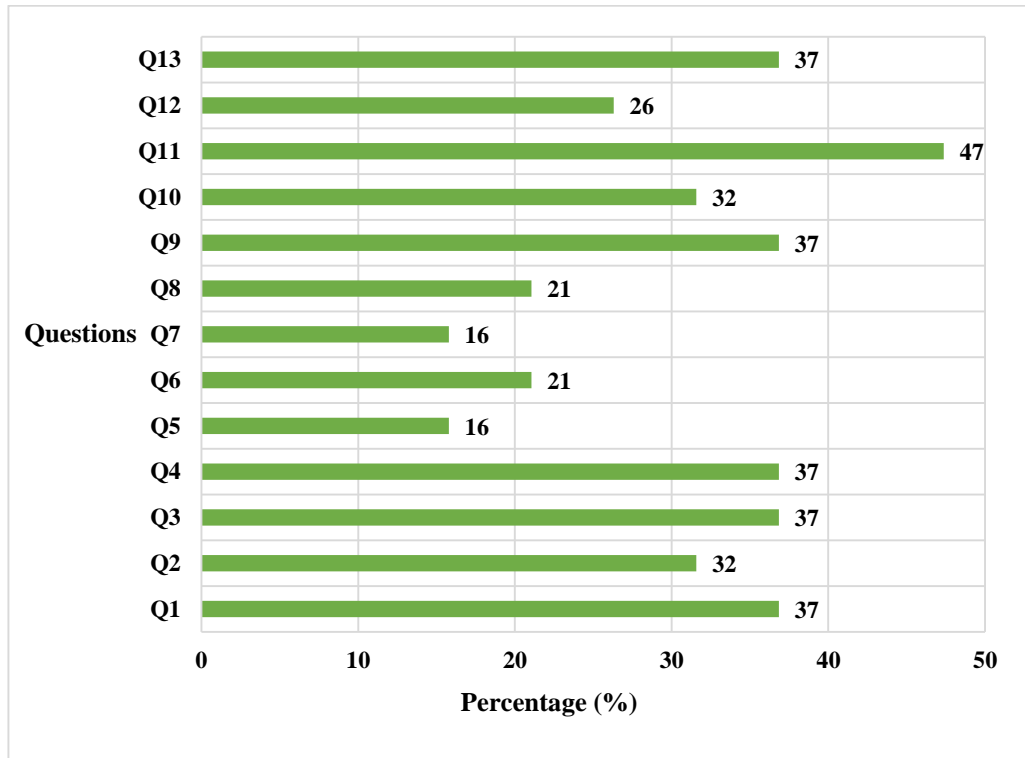


Figure 18: Percentage of questions not answered by Procurement Juniors

If the Procurement juniors had known the inter-departmental information shared with their department, they would have been clear about the following:

- *Production Master Schedule (PMS)*: this could have told the Procurement team what was required of the production line in terms of quantity and time. This would have allowed it to compile the right delivery schedule and avoid increasing the stock level and spent on managing the shipment schedule, as well as reducing the shipment cost by creating a safe delivery plan that would help the firm to attain its target with minimum cost and effort.
- *Specification of tooling and spare-parts*; this could have supported the Procurement team in providing the right parts for the production line, thus avoiding unpredictable delays and targeting ways to save money and effort.

- *The budget and cash flow status* is financial situation of the firm, so far as is known. Knowing the cash flow may, for instance, help the Procurement team to decide what the payment terms should be in each agreement with suppliers. This would also have encouraged them to find useful alternative and valuable deals such as a credit facility extended to 60-120 days and to avoid making cash payments in advance. Adopting these procedures would have supported the firm financially and provide the materials required without putting the firm under stress.

- *The training courses shared by HR Department*, which are essential for equipping the trainees with the necessary skills and abilities to fit their job descriptions and responsibilities. These training courses should be designed to be relevant to the firm's business activities, marketing strategy and employment succession plans. The survey revealed that there were some drawbacks in the organisation of professional training courses at Tawazun's subsidiaries; such courses sometimes irrelevant or inadequate with regard to adding professional value to the career development of the trainees. Hence it is vital to raise the awareness among Tawazun's employees at all levels of the content, purpose, and relevance of these courses to their current or related jobs. Moreover, each SCM department should plan the training course dates in a proper schedule that takes account the fluctuating work intensity. Planning training courses is essential for avoiding any interruption or delay in completing a department's tasks.

Without transparency and by not sharing the required information among the Procurement staff, the best deals/ways are inaccessible to the organisation, which thus

loses the chance to add value, maximise profits, work efficiently and increase achievement, and to save money, effort and time.

Inventory

Figure 19 shows the missing information for the Procurement's junior staff regarding data requested from other SCM departments, as well as data regularly received by their department at different intervals (e.g., daily, weekly, monthly, or quarterly). The answers of the Procurement juniors revealed the major areas where information was unknown. About 21.05% of information about the following activities was unknown:

- Information on shelf-life, the quantity of raw material, and problems in shipping raw material from the Procurement Department.
- Information on the delivery of finished parts shared by the Operations.
- Information on the personnel and staff training sent out by the HR Department.
- Information about client delivery schedule from the Sales and Marketing Department.

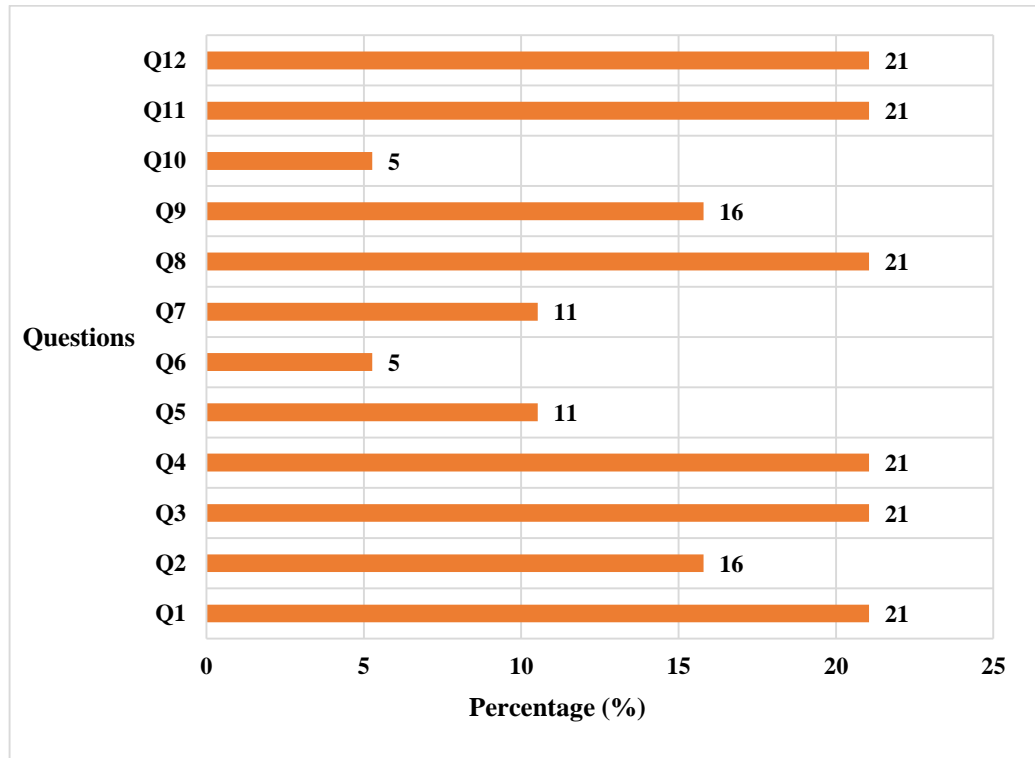


Figure 19: Percentage of questions not answered by Inventory Juniors

Missing information might cause a deficit in the juniors' achievement and capability in the Inventory department. If the juniors had known all the inter-departmental information shared with the Inventory Department, they would have been clear about the following:

- *Shelf life data* can tell the Inventory team how to manage the movement of the stored items according to their expiry dates. This monitoring of shelf-life helps the Inventory team to decide whether to send the items concerned to the production line or to extend the warranty from the main suppliers. By doing so, they could reduce loss; at the same time, they could build a good relationship with those customers who asked about the warranty for the final product.

- *Clarity over the quantity of raw material* is necessary to give the Inventory team enough time to prepare a spacious storage area for accommodating and controlling an item for a specified period in the quantity required, according to the production plan.
- *Shipment problems:* here, the Inventory team could have had a tool to cover the deficit either by buying in the local market or by making another purchase order. Thus, the Procurement team could assist the Inventory in receiving a timely shipment by using air cargo delivery. It also shares the shipment problem with the Operations team to resolve it without affecting their commitments.
- *Delivery plans* are necessary for the Inventory, since it should abide by the client delivery schedule for the finished parts. This commitment can help the Inventory team to arrange the delivery of an item requested by the customer either on time or earlier, which reflects well on the marketing reputation of Tawazun, both locally and internationally.

5.3 Value and Reliability of Information Sharing

The strategic benefits and values of intra-organisational flow and use of information resources are gained through increasing the efficiency of the decision-making process and improving the product quality to raise its market position. It was found that not all SCM departments or employees are actively involved in the information sharing cycle in Tawazun, as the below statement of an Operations Manager:

“The only way for all SCM departments to be involved in the achievement of the Tawazun’s goals is by using [all] the available information as an element of vital importance to Tawazun’s business. I believe that the value of accurate information is enormous. However,

we do not need to know everything but at least [all] the information related to our work. Some of Tawazun's staff do realise fully the significance of information sharing in completing their projects successfully. In contrast, some members regard information sharing as unnecessary or a waste of time to read or follow up the information. Such differences in concepts may raise many challenges when people face the prospect of information sharing. Thus, the debate continues over this issue, taking up yet more time" (Male, BSc, Operations Manager, with 21 years' work experience).

Analysis of the quoted statement above yielded multi-dimensional aspects of information as an essential resource for achieving sound outcomes. Moreover, the accuracy and relevance of the content are necessary for initiating an efficient information sharing cycle and creating needed values for Tawazun. It points to an appreciable difference of concept among Tawazun's staff of the importance of information sharing as an influence on the building of mutual trust among the stakeholders.

Senior managers often differentiate the type of information circulated among the members of their closed circle (e.g., agreements on raw material specifications, delivery terms of payments and schedules, and so on). Such misuse of information sharing limitations may cause a severe waste of resources and money, besides losing the trust of end-customers. In this regard, Baihaqi & Sohal (2013) state: "*The shared information provides tools for a company to create harmonised and synchronised activities along the supply chain and thereby deliver value to customers*". Information sharing also plays a vital role in helping managers to complete their task; tackled individually, it would be hard to finish. However, the shareable information amongst

Tawazun's supply chain members is generated and accumulated from the professional experience that they have built up.

Since Tawazun's subsidiaries are striving to increase their competitive strength in the global defence market, they should know that this can be achieved through information sharing among supply chain members, keeping close and efficient coordination with all of them. Moreover, the reliability of shareable information is a critical factor in attaining the firm's goals. Mentzer (2004) and Peng (2011) heighten the role of information sharing in promoting collaboration, mutual understanding, and a unified vision, sharing resources and attaining common goals. The quality of shareable information can benefit or impair business outcomes and a firm's social responsibility.

5.3.1 Right Information at the Right Time

The interviewees mostly focused on the importance of sharing useful and helpful information at the right time with the right members of the various supply chain teams. This approach supports them in carrying out their tasks efficiently and in passing on the experience and ideas they have gained to their colleagues. The following quotations show these inputs:

CEO said, *"The Business Development Department should build its commitment to work and check with other departments (the sustainability of all the firm's processes). They will create a plan for the music team who are working to give together to make a nice song, so we need the right information at the right time for the right people"* (Male, MBA, CEO, with 33 years of experience).

"Sharing the right information at the right time, and communicating with the right people would be worth it, to do a better job" (Male, MBA, Supply Chain Director, with 23 years' work experience).

"Sharing information - more details should be provided to all the departments that need to be aware of them, on time and accurate. It is the way to function: control of stock and control of the order. also, if a certain part has to be discontinuous without informing the Procurement team, it will impact on the operation, lead time and cost". (Male, High School diploma, Warehouse Manager, with 19 years' work experience).

One senior operations manager also focused on the quality and usefulness of the shareable information, which had to be shared among the right people only and not among those not interested in it. From my experience of Tawazun, this problem recurred daily; much released information is CCed to irrelevant SCM members and the messages are deleted or unanswered. Some seniors indulge in this pattern of mass messaging just to share their information with all SCM members, regardless of the recipients' need (illustrated below):

"On the other side of the exchange of information, some people share information unnecessarily widely and waste people's time on reading that reduces our activity. People do not know the essentials of some information; they think it is highly significant, but it is not". (Male, BSc, Operations Manager, with 21 years' work experience).

The statements above emphasise the need to share the right information at the right time; this can make the sharing of information an efficient and meaningful tool for i) helping Tawazun to meet its obligations on time and still save much effort and cost; and ii) increasing its business competitiveness.

The right components (time, information content, recipients) in the ribbon of the SCM system have been the focus of recent research works. Schiefer (2004) states, *"Nowadays, the debate is not about whether information should be exchanged through*

the supply chain. The debates continue over how to share the right information at the right time in the right format by the right people under the right environment to maximise the mutual benefits of the entire supply chain and the individual business players”.

5.3.2 Frequency

The responses of some senior managers showed how their professional experience defines the importance of information sharing, ensuring that they meet other staff regularly every day or weekly. And the frequency with which eligible members are updated about SCM activities. Some senior managers reflect on the importance of interdepartmental information sharing and communication, as shown below:

"Communication and sharing information type from CEO, HR Department, production Department is essential. It should happen frequently and each employee has to be aware. Because you need to know everything especially if it is any kind of new requirement, changing and improving, so you need feedback not to miss an element that will impact on our work". (Male, BSc, Engineer, COO, with 27 years' work experience).

"We share it verbally and in writing; we have frequently met – once a week (we are sharing them, even instructions from the top to keep them on top of everything)" (Female, Diploma, Production Planner, with 19 years' work experience).

Some senior managers cribbed how they are aware of the importance of sharing information frequently, consistently and regularly with all the organisational staff and of keeping them in the loop with the latest changes, as reflected in the statement below:

"The importance of sharing information in my perspective is very high. I need to know from my team immediately of any changes or developments or action or problems that happen in the department so that as a manager I can sort out or think of a better way to deal the situation". (Female, BBA, Commodity Manager, with 10 years of experience).

"Information sharing in my job means all the stakeholders of my end product maintain a consistent and regular delivery of information and input of information to my team. Open communication means regular prompt and consistent information sharing". (Female, BBA, Commodity Manager, with 10 years of experience).

From my experience in this field, the type of information shared daily and weekly by staff can help them hit their targets in the proper way and avoids all delay or needless cost. Thus, sharing information frequently can keep all members on the same page and make them work together as one team by sharing opinions, problems and solutions.

The survey responses from junior staff revealed that the frequency of sharing information varies from one department to another. The Operations department received information from both the Procurement and Inventory departments on a monthly and quarterly basis, while it gets information from other departments such as Engineering, Quality, Human Resource (HR), Maintenance and Sales Departments every day and every week. Meanwhile, the Procurement and Inventory departments were getting their information from other departments once a month or once a quarter, as shown in Figure 20.

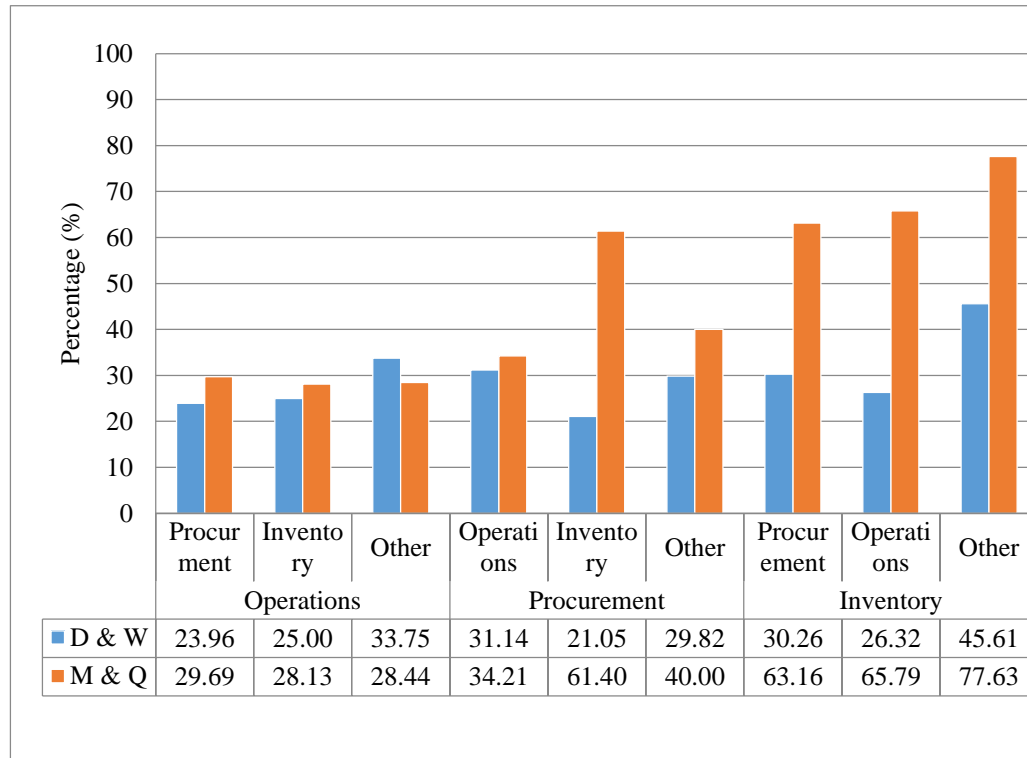


Figure 20: Information sharing among departments in SCM

5.3.3 Decision Making

Some of the senior participants were focusing on how information sharing among members and departments can help them make the right and feasible decisions for improving of the department's functions and services, as shown in the statement below:

“Information sharing allows me to make a proper decision based on the information needed and the team of people involved in the assigned work. Thus, the team members can be a key factor in making a fruitful and acceptable decision through sharing various ideas, opinions, and knowledge. This variety of experience guarantees the accuracy of the information used in the decision.” (Male, BSc, Project Manager, with 29 years' work experience).

Another production manager agreed about the impact of sharing information on decision-making: *"The information flow is significant because that helps all departments to be sure what needs to be treated as a priority. That must be determined by what is important to the company and not for the individual department. When information is good, all departments can work in sync and make the best decision for the enterprise.* (Male, MBA holder, Production Manager, with 18 years' work experience).

Another operations manager reinforced this viewpoint by explaining how sharing opinions and experience can help in taking the right decisions:

"All the people have to share their opinions and experience to get the right solution. Moreover, we have begun to set up a committee that will gather everyone from several departments to take decisions together" (Male, BSc, Operations Manager, with 21 years' work experience).

Although most managers in Tawazun knew the importance of sharing information and its effect on their decisions, they still complained about having too little information to allow departmental decision-making. Obviously, if the top management monopolised the supply of information, decisions would be made by only a limited number out of the closed circle of senior managers. Sharing in the decision-making process needs a shared sense of the importance of information-sharing by all staff.

Nevertheless, we found that junior staff are active contributors to the interdepartmental information sharing practices. The exchange of required information by an SCM department is based on its activities. The three SCM departments shared different types of information, ranging from 25% (Procurement) to 45.61% (Inventory) on a daily and weekly basis, which kept all staff in the loop and updated regarding the available information. This should be the fundamental policy of Tawazun for the effective use

of data in various manufacturing processes, and for developing its organisational culture and learning.

The possession of the right and accurate information by all the Tawazun members would hasten the decision-making processes, improving management approaches, and increasing the performance and capability of its supply chain system, as supported by the study of Baihaqi & Sohal (2013): *“Internal integration and inter-firm collaboration are collectively considered as necessary components to establish a successful supply chain. So, information sharing should be used in various decision-making [situations] to increase collaboration with SC members and to enhance the organisation’s internal integration practices”*.

5.3.4 Misunderstanding

The interpretation of information by different team members may occasion serious misunderstanding for the recipients regarding the purpose of the needed information.

The statement of a COO below reflects this:

“Information, as a valuable resource, has become a matter of workplace culture and an issue of discussion in Tawazun. There are two types of shareable information: informal (general news) and formal (contracts, plans, new policies, annual leave, and more.). To avoid misunderstandings, the top managers, as authenticated information sources, should write clear and understandable information and revise the message to make sure that the released information does not cause any conflict.” (Male, BSc, COO, with 27 years’ work experience).

Another statement, this time from a Senior Director, clarified how the inputs could add value to the firm:

"All departments should understand their contribution to getting the best value out of money - the exact requirement for the Engineering Department and a production plan. A quantity product – is it ready and qualified? Moreover, the Finance Department should pay the invoice to the supplier on time." (Male, MBA, Supply Chain Director, with 33 years' work experience).

A Senior Operations Manager explained how forgotten or hidden information about any project could impact negatively on the implementation of a project:

"It is one of the essential elements of the company; but unfortunately, if at any time they understand the wrong thing. But the value of information is enormous, and there's no need to know every single thing. Some information people hide or forget, but it is important to share. It has an important and significant impact on the project or the firm". (Male, BSc, Operations Manager, with 21 years' work experience).

The participants' statements yielded interesting points of advice that should be followed to avoid any misunderstanding among intra-organisational SCM members:

- 1) Prepare a clear and understandable work plan key performance indicators (KPI), which should explain the specific tasks assigned to each staff group and implemented during the year.
- 2) Encourage the SCM members to know the necessary information for completing the assigned project successfully, which can be obtained from various sources; this activity will maintain the spirit of teamwork.
- 3) Increase the involvement of the SCM members in intra-organisational information sharing, as well as making the flow of information easier, whether

downwards or upwards (currently, information flows downwards only, from seniors to juniors).

- 4) Share the right information with all members so that the right action can follow accordingly. Thus, the active sharing and flow of information play key roles in improving the performance of the SCM's functionality and increasing transparency.

5.4 Summary

This chapter presented the findings generated from analysing the interview statements, and the statistical analysis of the Juniors' survey. The research investigation collected data on the perceptions of both the senior and the junior staff of the three SCM departments concerning the possible value and reliability of information sharing in enhancing the capability and integration in and across the SCM departments. Most of the senior managers placed deep trust in the importance and significant value of information as a way of improving product quality and decision-making processes. Moreover, they considered the reliability of shareable information to be a kind of fuel for keeping all Tawazun's staff equipped, increasing their teamwork spirit, as well as motivating them to learn and respond to new advances in their work domain.

The investigation also revealed a conflict between the confidentiality of some information and the willingness and ability of the SCM members to practise beneficial information sharing in the workplace. Many senior managers with a military background believe that most of the information is confidential and are not willing to share information with other SC members. Most of the juniors apparently noted such conflict, which inhibited their keenness to receive and supply the required information

and data. Moreover, the analyses implied that a high percentage of the required interdepartmental information and data were missed or unknown in the process of sharing and exchanging them amongst the juniors, in particular. Such gaps might lead to severe misunderstanding and wrong interpretation of the content of information, whether received or released.

Chapter 6: Information Sharing Channels- Analysis and Discussion

6.1 Introduction

Many business and manufacturing organisations view the availability of sufficient information as a strategic asset for meeting the rapid changes and emerging challenges in local and international markets. Therefore, business and manufacturing organisations have been much concerned to use all the available forms of information on a professional basis and to provide efficient multi-communication channels for information sharing and data exchange between all the departments and units.

In Chapter 5; the statements of the senior managers and directors in their interviews revealed some contradictory attitudes to the importance, value and reliability of information sharing in improving Tawazun's capability, while at the same time putting restrictions and limitations on the sharing practices. Some of the seniors deal conservatively with an open pattern of information sharing; this behaviour may lead to developing a closed circle and limited sharing practices among their staff. This discourages them from sharing information through the different communication channels of the organization, and thus had a negative effect on SCM productivity and the capability of the production lines.

This chapter seeks to shed light on the patterns and preferable communication channels of information sharing, and the use of resource planning systems in the implementation of integration in the intra-/interdepartmental supply chains of Tawazun's subsidiaries.

6.2 Interdepartmental Information Sharing- Patterns and Channels

The collected interview statements of the twenty seniors in the research sample, together with the survey responses of the juniors, concentrated on the options of preferable communication channels and modes of interdepartmental information sharing across the SCM departments (Operations, Procurement, and Inventory). Moreover, the three SCM departments were observed to play a significant role in facilitating the promotion of information sharing throughout Tawazun's subsidiaries.

6.2.1 Communication Channels Used by Seniors

This section concentrates on identifying the communication channels for information sharing which are preferred by senior managers, using the information sharing and data exchange practices throughout Tawazun's four subsidiaries. The interviewees nominated the available physical and electronic channels, as shown in Figure 21; their quoted statements reported which-of-which channel is most important for sharing information comfortably.

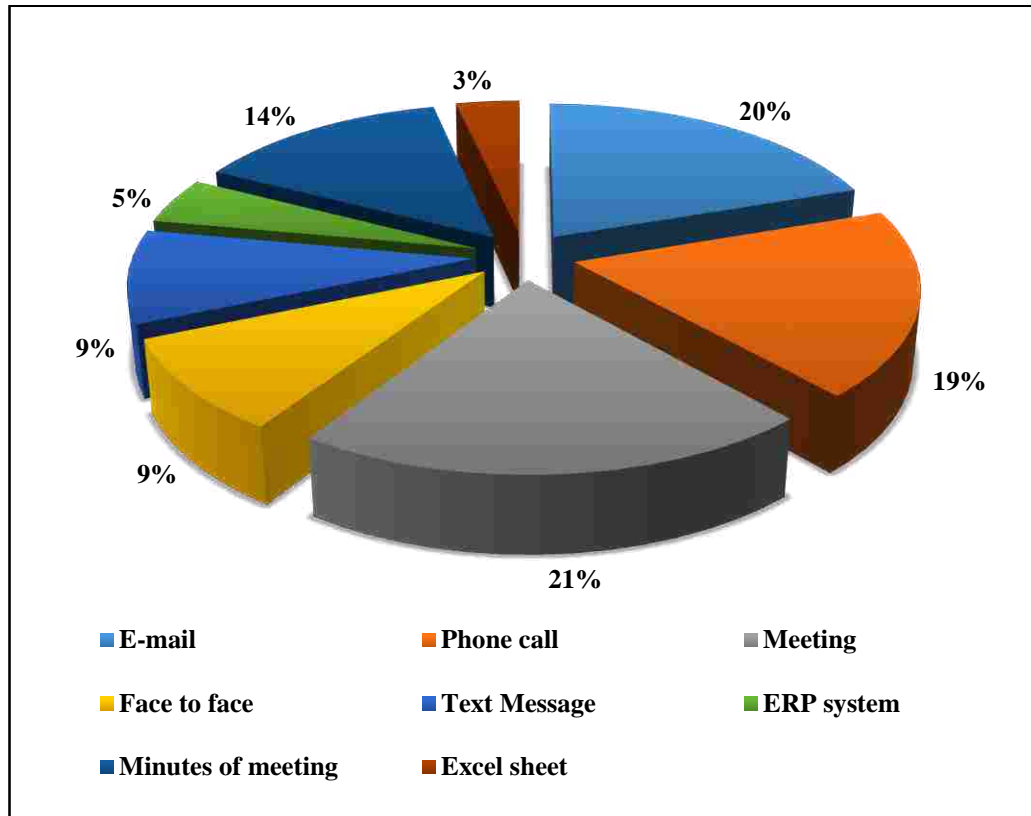


Figure 21: Communication channels used by senior managers

6.2.2 Physical Channels for Sharing Information

6.2.2.1 Meetings and Face-to-Face

All the interview sessions stressed the usefulness of meetings as a channel in information sharing among intradepartmental staff, because this channel has a social dimension; it brings colleagues together to discuss different viewpoints and ideas openly and in a friendly way.

Senior Managers

Meetings can undermine the psychological barriers between ranks and titles, making it easy for SCM staff at all management levels to access information. The interview statements quoted below expressed the significance of meeting to share information:

“Meetings ... put everybody on the same page: i) Weekly meetings between CEO, Directors and Managers; ii) Weekly meetings between director and managers; and iii) Daily meetings between manager and juniors” (Male, MBA, Production Manager, with 18 years’ work experience).

“Weekly meetings are imperative because each member involved in the meeting is aware of the actions and decisions that have been taken” (Male, CEO, DBA with 16 years’ work experience).

Accordingly, meetings represented 21% of the communication channels that are used by the senior managers, who justified the system by saying that this way of information and data sharing is secure, as well as capable of minimising misinterpretation and misunderstanding of the content of the data. Preparing the agendas of the meeting is important for getting the greatest benefit from discussion by those present. Thus, the meetings allow a common view to be taken of proposed business strategies, development plans, marketing policies, and the introduction of innovative management tools or management approaches. An awareness of the topics to be discussed is consequently necessary for making the meeting fruitful.

Mehrabian (2008) studied the human interactions and body language during meetings; the concerned study revealed that 55% of meaning in an interaction comes from facial and body language, while 38% comes from vocal inflexion, and only 7% of the meaning is derived from the words. Beal et al. (2003) acknowledge information

sharing during meetings as leading to an encouraging and motivating workplace environment, which improves group performance and team spirit. Moreover, face-to-face and meetings on a personal and unofficial footing are to be seen between individuals who share related activities or exchange ideas within their own department or a partner departments. 9% of the respondents preferred to use this communication channel for information and data sharing. An Operations Manager found face-to-face discussion a supportive way to resolve any issue, as shown in the statement below:

“We hold face-to-face discussions often to solve mild problems; we established a committee to gather all our colleagues from different units to hold discussions in a friendly atmosphere” (Male, BSc, Operations Manager, with 21 years’ work experience).

A colleague, also a manager found this channel was a best way to discuss critical issues: *“I usually use face-to-face communication in discussing many critical issues with my colleagues who are interested in a topic of concern”*. (Female, Diploma, Production Planner, with 19 years’ work experience).

Moreover, other managers added that face-to-face discussions could clarify the tasks to be performed, as stated below:

“Discussion through face-to-face talk is important to be sure that both parties have agreed on the next steps” (Male, MBA, Production Manager, with 18 years’ work experience).

It is important to note that these responses reflected the work proficiency of the respondents in dealing with various issues and approaching problems with equal interest. The friendly approach to face-to-face communication proved to be a complementary channel for discussing and exchanging opinions plainly, which allows

the necessary action to be taken promptly without waiting for official meetings with stakeholders.

Moreover, many respondents consider face-to-face communication in information sharing as the most secure channel and trust it to prevent any leakage of information. Kirkman et al. (2004) describe the influence of face-to-face interaction “*Using electronic devices, such as telephone, mobile, email and the like can take a long time to get responses regarding the required information. Therefore, a face-to-face meeting is an important process that likely changes the fundamental features of task accomplishment*”.

The popularity of face-to-face as a channel has become convenient for personal communication amongst Tawazun’s staff when they have information to share. This channel seemed to strengthen Tawazun’s capability in such strategic activities as marketing policies, sales strategy, product improvement, customer satisfaction, increasing productivity, and ultimately enhancing the visibility of Tawazun’s brands in local and international markets.

Junior Staff

The junior staff from several Tawazun companies responded to the inquiry about using face-to-face and meetings to share information with staff from other departments. The analysis indicated that 73.13% of them disagreed or strongly disagreed, while only 7.01% agreed or strongly agreed that they would use it, as shown in Figure 22.

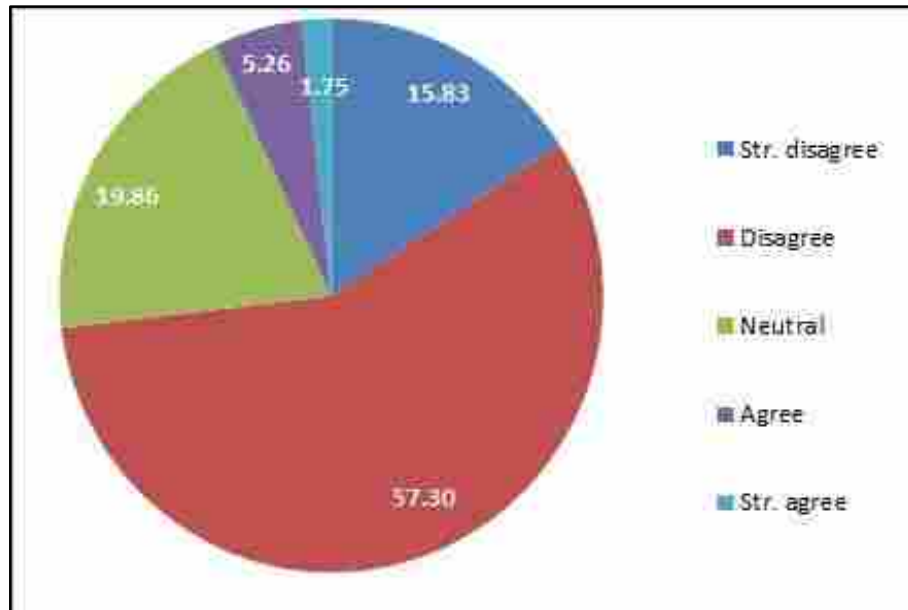


Figure 22: Information sharing via face-to-face meetings as seen by junior staff

The responses of the survey participants from each SCM department revealed, however, that face-to-face and meetings are not preferred for the exchange of information among members. The survey analysis indicated that 73.68% of the Inventory, 68.42% of the Procurement, and 77.27% of the Operations juniors disagreed or strongly disagreed that they would use this communication channel. In contrast, 10.52% of the Inventory and 10.53% of the Procurement juniors agreed or strongly agreed that they would use it, although none of the Operations juniors did, as shown in Table 9 and Figure 23.

Table 9: The percentage of SI prepared to use Face to face & Meetings as channels –
Junior Staff

Face to Face & Meetings			
Answer	Inventory	Procurement	Operations
St. disagree	21.05	10.53	15.91
Disagree	52.63	57.89	61.36
Neutral	15.80	21.05	22.73
Agree	5.26	10.53	0.00
St. agree	5.26	0.00	0.00

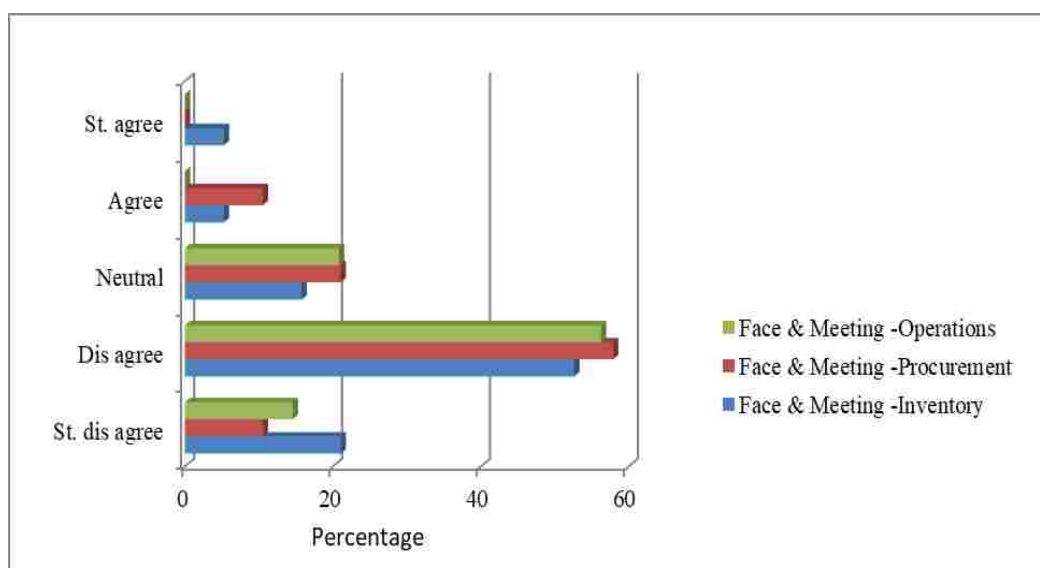


Figure 23: Information sharing via face-to-face meetings- Juniors' view

The generated results indicate that 30% of the seniors were keen on using meetings and face-to-face as a channel for communicating and sharing work information with their community. In contrast, the juniors were not happy to adopt this channel and pattern for sharing information or the discussion of work-related issues. Moreover,

there was an apparent lack of willingness in the community of juniors, despite their awareness that meetings removed the obstacles that limited intra-organization information sharing. Therefore, it is critical to consider making the workplace a spacious room in which to hold friendly discussions on department-associated matters. Such an information-rich work environment would support the juniors in completing their work satisfactorily.

6.2.2.2 Meeting Minutes

The meeting minutes represent another channel of information sharing for senior managers. The minutes of the document is first discussed and agreed on by those who attended the meeting. The following statement confirms the importance of meeting minutes:

“Each meeting should document minutes of the discussion to address the issues decided on, how they are to be pursued and by whom; in addition, someone should be in charge to follow up the execution of these tasks.” (Male, High School, Warehouse Manager, with 19 years’ work experience).

“We are always using minutes of meetings, which are distributed amongst all Department Managers. We asked them about the actions to be taken; our enquiries are usually about what the action should be, when it will be done and whether other methods will be involved in any action. However, for some reason I do not know, I have not received any feedback regarding my enquiries. Unfortunately, we still lack any information about the company strategy – why, I have no idea!” (Male, BSc, Operations Manager, with 21 years’ work experience).

Another senior manager described the way in which the meeting minutes are shared by the whole group of seniors apart from the CEO; this may illustrate the type of closed circle and limited sharing that goes on, as expressed in the statement below:

“Meeting minutes are written down and shared with us, but this is not enough to improve our understanding of the issues related to our firm’s strategic plan which has been discussed. So we are not getting any of the information discussed between the CEO and the directors”. (Male, MBA, Production Manager, with 18 years’ work experience).

Minutes of meetings represent 14% of the communication channels used by senior managers. Documenting discussions and decisions from meetings is an important aspect for all those involved in undertaking related tasks and in keeping them on the same page and at the same level of unforcedness. Such minutes also raise the accountability and transparency of task performance (i.e., necessary information, actions and clear task descriptions). Their answers suggested that such minutes are often not the primary source of information and it is optional to use their mission instructions. The low percentage of those who preferred to use minutes as an information channel implies that a considerable number of SCM staff do not care about the actions addressed by meetings in their minutes.

6.2.3 Electronic Channels for Sharing Information

6.2.3.1 Emails and Text Messages

Senior Managers

Nine percent of the Seniors preferred to use text-messages in information sharing to respond to urgent issues, or if they were unable to hold a meeting promptly. Web-based email has revolutionised the way people communicate with each other as they

can at any time transcending physical presence. Therefore, emails and text messages have become the cheapest and quickest messaging tool for transmitting long message and attached documents anywhere without loss of time. To the inquiry regarding the use of e-devices (emails and text messages) by senior staff in Tawazun's firms, the respondents made it clear that 29% of them preferred these communication channels and used them to exchange information with staff, regardless of the type or importance of the message or the degree of its confidentiality. Conrad (2014) reassures users as follows: "*Using ICT, such as email, text messaging, and social media, has made communication easier*".

The popularity of using email in information and data sharing is attributed to its effective virtual communication, allowing the virtual communicators to write and reply at their convenience. The following statements illustrate this popularity:

"Email is daily used in the exchange of information. Email is also used in asking for further information about particular specifications." (Male, Diploma, Supply Chain Manager, with 19 years' work experience).

"Email is normally used as a channel for the documentation of messages, task circulation, and other administrative instructions, like solving particular problems" (Male, BSc, Operation Manager, with 21 years' work experience).

Nevertheless, using email without monitoring and controlling can create a severe problem of information security. The related literature has comprehensively discussed the issue of information security and cyber crimes. These problems may be summarised as follows:

- Mistakenly sending detailed data to irrelevant people or email addresses.

- Sending e-messages to individuals who are not interested in replying or sending feedback.
- Lack of awareness of the purpose of the messages and the need to take action.
- Too many unnecessary emails may cause a recipient to react by forwarding messages to their colleagues and relying on them for action.
- Unclear or vague email contents may cause the circulated information to be misunderstood and the completion of the task to be delayed. Conversely, clear and understandable content can strengthen the sharing of information.
- The side-effect of dependency on email communication may weaken physical communication and personal interaction.

Junior Staff

The total responses from all junior staff regarding the use of emails and text messages in information sharing with each other indicated that 78.15% of them disagreed or strongly disagreed that they would use emails and text messages. Only 9.29% agreed or strongly agreed about using these channels, as shown in Figure 24.

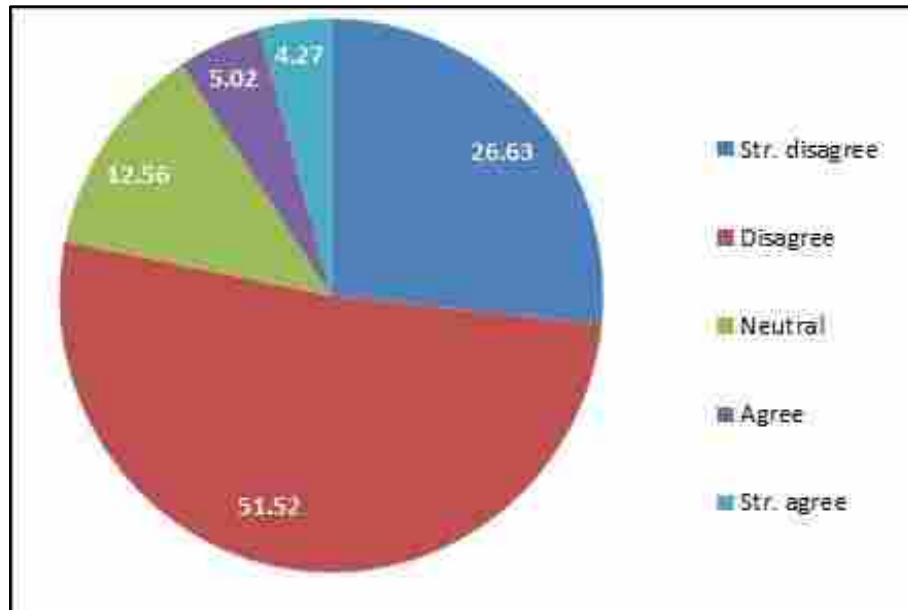


Figure 24: Information sharing via emails & text messages as seen by juniors

The feedback of the respondents from each department – Operations, Procurement and Inventory – in Tawazun’s subsidiaries, regarding the use of email and text messaging revealed that 5.26% of Procurement staff strongly agreed, whereas 6.82% of Operations agreed or strongly agreed that they would use these channels. In contrast, 15.79% of Inventory staff agreed or strongly agreed on it. Table 10, and Figure 25 showing the level of agreement among the junior staff in using email and mobile messaging in information sharing activities.

Table 10: Information sharing using emails & text messages in three SCM areas

Emails & Text messages			
Answer	Inventory	Procurement	Operation
St. disagree	26.32	26.32	27.27
Dis agree	52.63	47.37	54.55
Neutral	5.26	21.05	11.36
Agree	10.53	0.00	4.55
St. agree	5.26	5.26	2.27

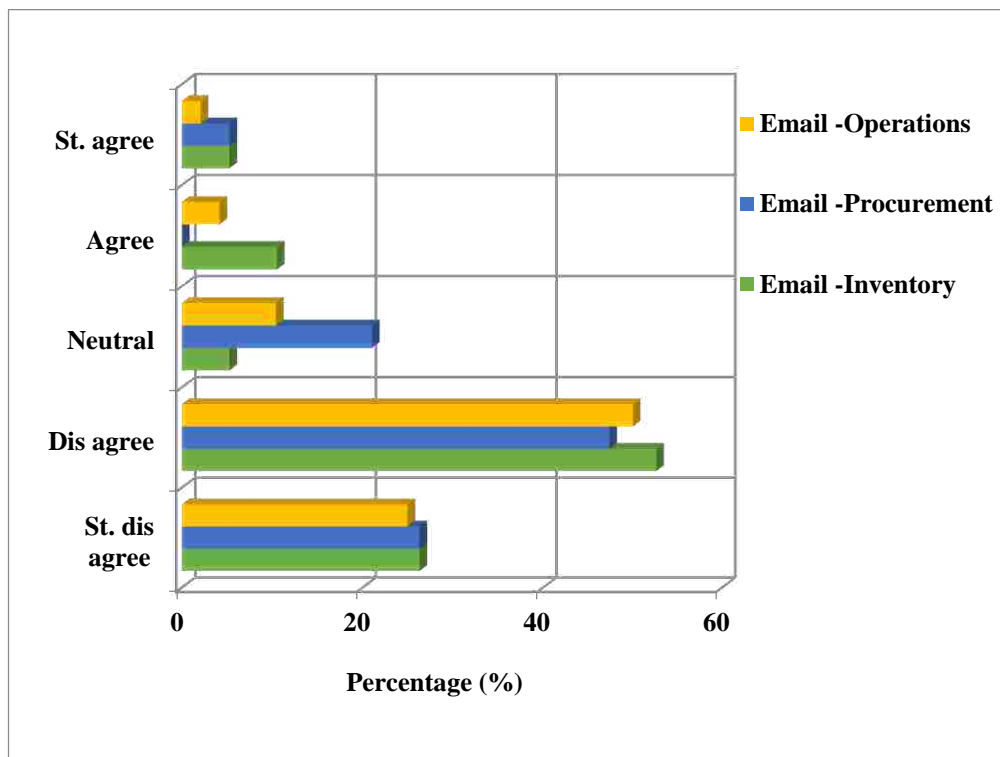


Figure 25: Information sharing via emails and text messages in three SCM areas

The responses received from the interview and survey participants indicate that 29% of the seniors preferred using emails and short text messages (SMS) in information sharing and asking their peers for data to expedite the process and carry out their target

task. Most of the juniors were not willing to use this channel in their communication and information sharing with other SCM staff. However, from my experience in this field, it seems that the Inventory team's work causes them to use email on a regular basis for sharing with the Logistics and Procurement staff their information about delivery schedules of goods and also updating these two departments with lists of shipments arrivals.

6.2.3.2 Phone Calls

Senior Managers

Nineteen percent of the seniors frequently used online phones, or mobile cells for sharing information and discussing urgent issues with colleagues or stakeholders. A manager gives more details:

"We use telephone conversation to contact remote colleagues; for example, in Al-Ain facilities" (Male, MBA, Production Manager, with 18 years' work experience).

Another manager added, *"We use the phone only for official calls with certain people, but not for discussing critical points"* (Male, BSc, Operations Manager, with 21 years' work experience).

The SCM staff use fixed line phoning for the communication of official information and the discussion of urgent issues, although this channel may not always be secure against remote monitoring or taping. Phone contact is helpful for:

- Communicating with work-mates in remote departments.
- Making meaningful conversation, i.e. asking a question and receiving an immediate answer.

- Getting clarification and confirmation from various stakeholders on urgent issues, which saves time and is cost-effective.

Junior Staff

The total responses from all the junior staff in the sample regarding the use of phone calls (on mobile and fixed lines) to share information revealed that 47.29% disagreed or strongly disagreed that they would use them, and only 14.40% agreed or strongly agreed that they would use phoning as an everyday communication channel for sharing information with other staff in their departments (see Figure 26).

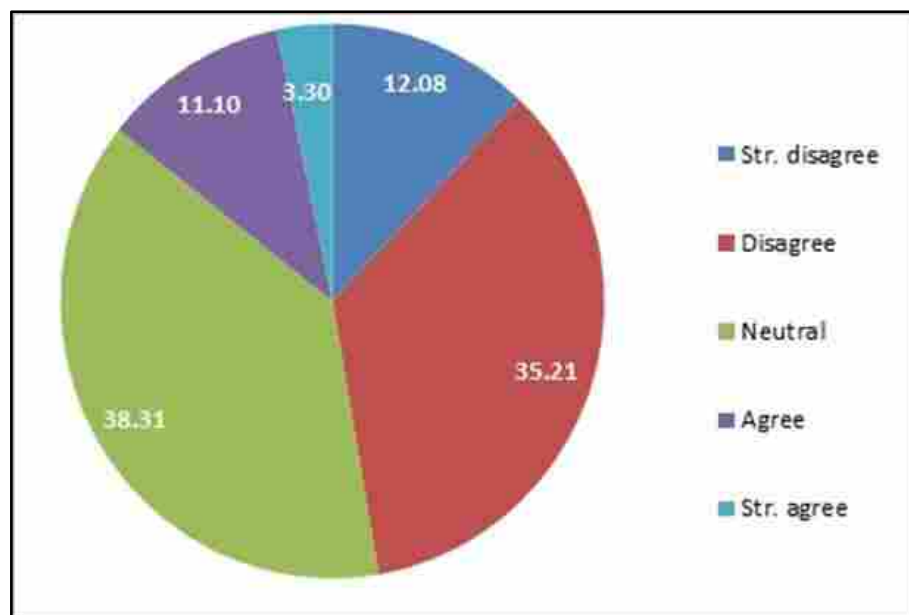


Figure 26: Information sharing through phone calls among junior staff

However, if the feedback of the respondents from each department is taken separately, the junior staff in the Operations, Procurement and Inventory departments of Tawazun's subsidiaries, revealed that about 11% of them in the Procurement and

Operations departments agreed or strongly agreed that they would use phone calls for sharing information with other departments. Among the Inventory staff, 21% agreed that they would use phoning to share information with other departments as a standard communication channel. Table 11 and Figure 27 showing the degree of agreement of the junior staff in using mobile and landline phones for sharing information.

Table 11: Information sharing via phone calls in different SCM departments

Phone Calls			
Answer	Inventory	Procurement	Operation
Strongly disagree	21.05	10.53	4.65
Disagree	31.58	36.84	37.21
Neutral	26.32	42.11	46.51
Agree	21.05	5.26	6.98
Strongly agree	0.00	5.26	4.65

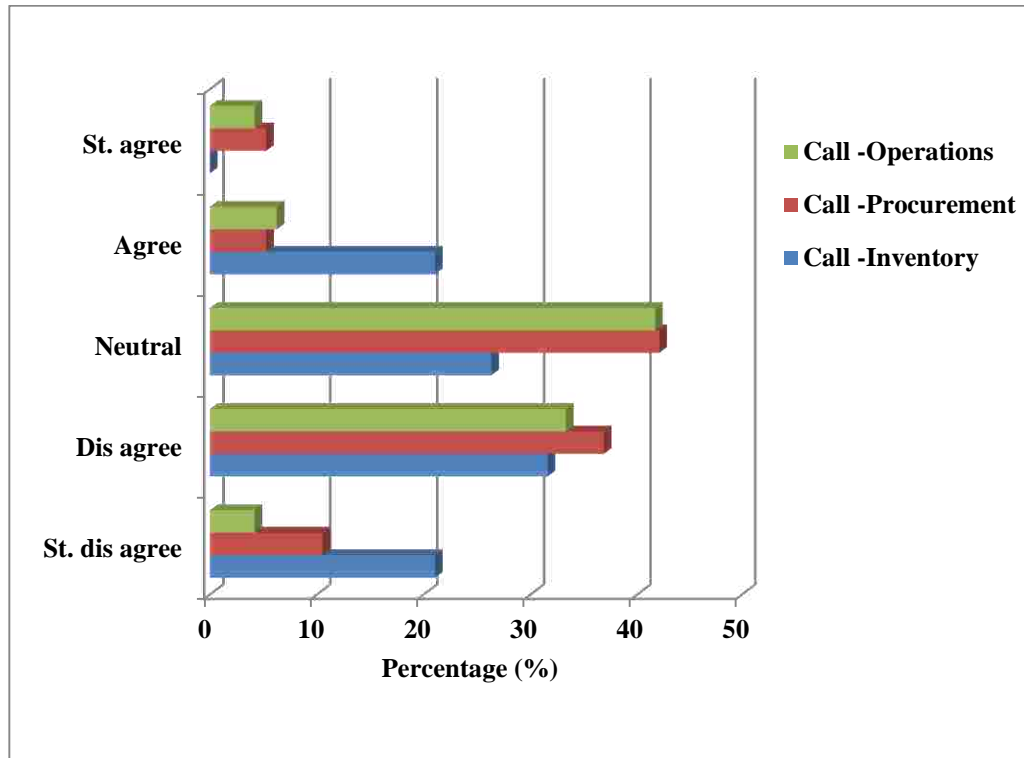


Figure 27: Information sharing through phone calls in different departments

6.2.3.3 Resources Planning Systems

Senior Managers

This section discusses various planning systems for organisational resources, e.g., governmental procurement (GP), manufacturing resource planning (MRP), and enterprise resources planning (ERP) – used currently in Tawazun’s subsidiaries as communication channels among SCM senior staff. These systems integrate and manage the functions and processes of the SCM departments of Operations, Procurement and Inventory. The interviews revealed that only 5% of the senior managers were using ERP/MRP/GP as communication channels. Three subsidiaries use the ERP system while only one subsidiary uses the MRP system.

a) GP and MRP System

Microsoft (2015) describes the core functionalities of the GP system as follows: “The GP system can be easily implemented to deliver quick information and appropriate management solutions to SMEs. It can also put different people and systems within an internal network to integrate the processes and activities of various departments (e.g., Finance, HRM, Manufacturing, Operations) to achieve small firms’ business strategy.”

Two senior managers commented that the GP system still needs to be developed:

“GP is a fundamental ERP system at this stage. The inventory function control is an automotive company, we should buy things on an MRP system, but right now inventory control is limited to very few items like hardware and fasteners. The concept of GP is at a very early stage; it needs a lot of improvements and modifications” (Female, BBA, Manager, with ten years’ work experience).

“Currently, GP provided the MRP system and some components started by using MRP but they still need to improve and to avoid the manual system.” (Male, BSc, Senior Buyer, with 18 years’ work experience).

As for capability as the primary concern of Tawazun’s subsidiaries, resources and data management and planning have received much attention from the upper ranks of management. Despite the genuine need to use a range of resource planning systems in channelling information and transferring data (as a strategic commodity) so as to improve performance and increase the firm’s capability, it has been observed that only 20% of the interviewees claimed to be familiar with the correctly installed ERP and the like, such as Oracle, SAP, and XS from Microsoft Corp.

MRP is derived from ERP (a subset) and can answer four fundamental questions: *What do I make? What do I buy? When do I buy?*, and *When do I make?* Therefore, the MRP system is suitable for handling these questions merely in the context of small or mid-sized enterprises (SMEs). For instance, MRP is compatible with the business activities of even small shops as long as a single-user system or a small network is available. However, as an ex-manager of one of Tawazun's SCM departments, I have experienced some limitations in the system, such as difficulties in connecting one of the SCM departments with another, generating accurate reports about the input and output material in the warehouse, and limited ability to upload technical drawing, etc. All these deficiencies have discouraged Tawazun from employing MRP in the management of its large SCM operations and transactions.

The interviews with senior managers intimated that the MRP system is nonetheless being used in Tawazun to manage the processes of the Procurement and Inventory departments, and to share information with other departments, such as Engineering, Configuration, and HR. A senior manager explained the situation thus:

“The MRP system did not meet our needs and expectations. ‘It would be useful if the user is experienced’ [we were told], which means that the MRP can be fully functional and operational only if it is set up correctly. Unfortunately, the system is limited in doing what is wanted and generating the needed results. We do not have a professional system that will support business by providing the right material at the right time in the right quantity and for good projects”. (Male, High diploma, Warehouse Manager, with 19 years' work experience).

This statement from a senior member of staff indicates that some Tawazun subsidiaries are lagging behind those which use the latest version and are still using the previous MRP version despite its limited functions. MRP is an efficient system with wide

integrative applications; hence, the firm uses it to support its business strategy by integrating specific processes in the departments of Procurement, Finance and Human Resources. Such functional limitations of the MRP system compel the staff to use the manual approach instead in their tasks.

The standard guidelines may generate inaccuracy, gaps in the data, and lack of transparency. These deficiencies could collectively delay the completion of the work and a waste of effort that might eventually weaken the desire to share information. At the same time, using more than one resource planning systems may reduce the quality of data, and produce inadequate information retrieval. Therefore, platform unification instead should be an easy way to manage data and keep it in a retrievable and usable form. The MRP system can handle the receiving, identification, process phases and production steps of the raw materials; thereupon, the Manufacturing Execution System (MES) takes on the responsibility.

b) ERP System

Three subsidiaries have been using the ERP for three years. Senior managers in these subsidiaries described the core use of the system:

“ERP is being used for sharing all types of information; except the drawings and illustrations for security purposes. It is also an efficient system, but the problem is with those who do not know how to use it correctly; because the system has recently been implemented, but we need to be offered enough training sessions. Thus, there is still a weakness in our use of it”. (Male, MBA, Production Planning Manager, with 26 years’ work experience).

A Quality Manager endorsed this point: *“It will prove useful once we implement all the modules. Right now, we have achieved only 50 of*

them” (Male, BSc, Quality Manager, with 29 years’ work experience).

Moreover, a senior director of Operations explained the importance of the ERP system in carrying out the tasks, and how little aware junior staff were of the support they could get from this system.

“The biggest missing things that I do mention is most of our employees do not realise why we need information sharing, what benefit will be gained from the ERP system. By using it, we will be no longer waste time on data entries, or on working out what we have achieve [You get] a full picture of what you are doing with ERP; it will ease the work because it is suitable for base routing”. (Male, BSc, Operations Manager, with 21 years’ work experience).

The answers of the seniors revealed less than full use of the ERP in managing various information resources, and also in facilitating intra-/interdepartmental information sharing and data exchange. At the same time, all the seniors agreed on the importance of the ERP in retaining information availability and accessibility, which could be used as a professional basis for improving staff performance and the achievements of the SCM departments. The work of Ajit et al. (2014) indicates the significant role of the ERP as an organisational information resource: *“Implementation of ERP systems intra-organization could add a positive value that enhances their business in the future”.*

Junior Staff

The responses from the junior staff revealed that 30.37% of the participants agreed or strongly agreed with the statement that the ERP/GP system is used in information sharing, while 34.62% of them disagreed with this statement, as shown in Figure 28.

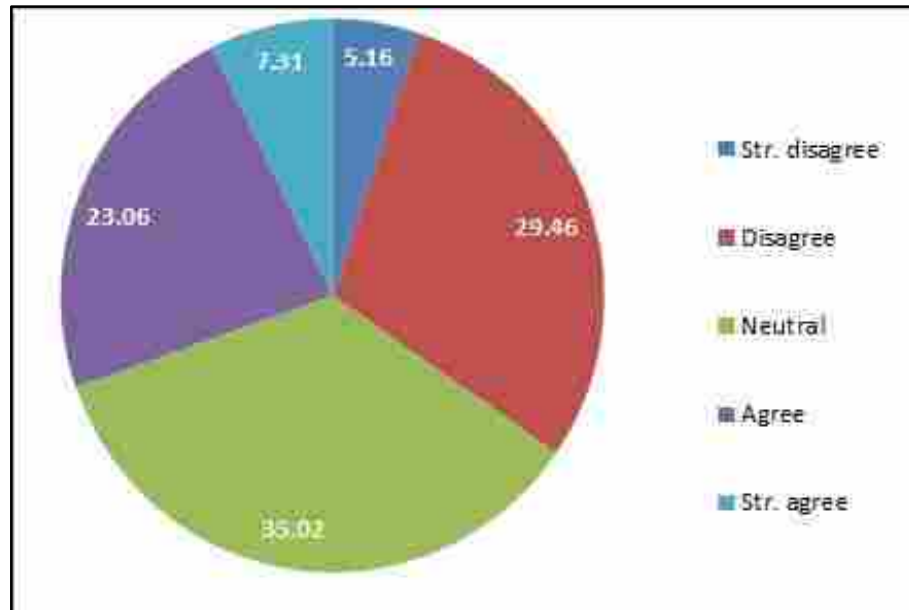


Figure 28: Using ERP/GP in information sharing in the three SCM departments

The juniors' responses shed light on the purposes of using the ERP, MRP or GP system for information management and retrieval; they indicated that 33.34% of the Inventory staff agreed or strongly agreed that the system was used for sharing information. Similarly, 36.84% and 20.93% of the respondents from Procurement and Operations, respectively, agreed or strongly agreed on the use of this system as an essential communication channel. Yet 44.18% of all junior staff disagreed or strongly disagreed on this point; as shown in Table 12 and Figure 29 .

Table 12: Using ERP/GP in Information sharing in three SCM departments

ERP & GP system			
Answer	Inventory	Procurement	Operation
Strongly disagree	5.56	5.26	4.65
Disagree	27.78	21.05	39.53
Neutral	33.33	36.84	34.88
Agree	16.67	31.58	20.93
Strongly agree	16.67	5.26	0.00

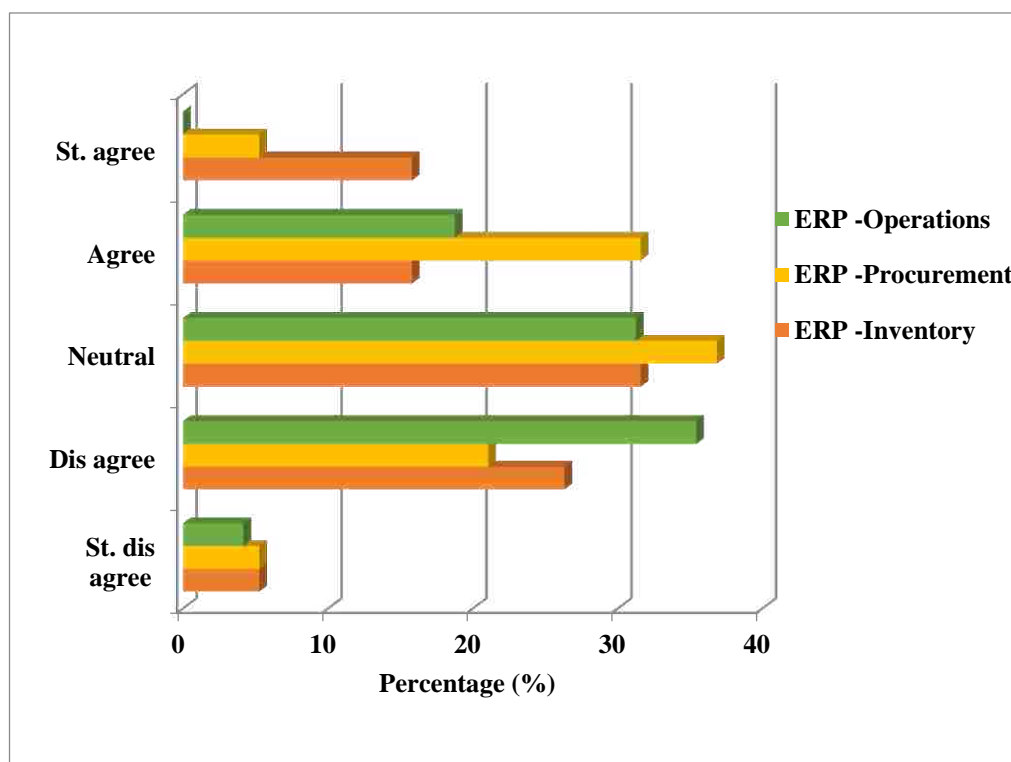


Figure 29: Information sharing via ERP/GP System in three SCM departments

The seniors appreciated the potential functionalities of the ERP system in integrating inter-departmental processes, using available information and relevant data for making the right decisions, and furnishing and auditing technical reports. Such smart functions of the ERP would increase the firm's transparency, accountability, and control over

various business activities. Despite this keen appreciation by the seniors, they have not fully employed the system. However, the SCM departments that have benefited from its use to different degrees are Procurement, Inventory, Operations, Finance, Human Resources, Engineering, and Maintenance. Likewise, the integration function of the ERP could increase the performance and total capability of Tawazun's subsidiaries.

In opposition, some respondents among the senior staff are interested in keeping the traditional paper-based methods of communication, such as Excel sheets, for information sharing, even though ERP/GP systems are physically installed in their firm. This issue implies that there is a serious gap between personal knowledge of the use of ICT and the urgent need of the firm to improve its productivity and profitability, and also its market visibility. However, the survey revealed that the subsidiaries, which were using the ERP capabilities well, were quite satisfied with the ERP functions for managing their inter-departmental processes. Although the ERP provides a variety of modules with different functionalities, there are still two major problems facing its implementation and use:

- 1) Activation of ERP modules based on a specified firm's requirements (i.e., customisation).
- 2) Training the employees to use the ERP functionalities (i.e., skills deficiencies).

These enterprise systems usually create an open communication environment within the firm whereby the workplace is improved for all employees and they can access any information needed (with updated data), which could, in turn, accelerate the cycle of production and eventually increase productivity. Although Tawazun's subsidiaries use a different integration planning system, they still can make only limited use of these

systems for sharing information of a different type and for official documents (see Table 13)

Table 13: The limitations of the system used

System Used	Limitation in the System
GP/MRP System	<ul style="list-style-type: none"> ▪ It does not meet our requirements. ▪ It cannot do all the things that need to be done. It does not implement all the modules required for the business functions. ▪ It cannot support the business by providing the right material at the right time in right quantity and for the right project. ▪ Still needs to improve before it can replace the manual system. ▪ It is not set up yet; we have to apply the information required to share it with others.
ERP System	<ul style="list-style-type: none"> ▪ It is used to share all kinds of information; except for drawings that must be kept secure. ▪ It has been implemented recently. ▪ It is not easy for all users to use. ▪ Our people need training before they can use it.

There is a large body of studies on planning systems for organisational resources and their domains of application Shatat & Udin (2012); Hsu & Chen (2004); Klaus et al. (2000). Findings suggest that several ERP modules are combined in a common data model/database to carry out functional integration. Thus, ERP has been able to offer a range of functionalities for supporting a broad spectrum of business functions, such as manufacturing, inventory management, personnel management, storage management, financial management systems, marketing, and order processing.

In today's business world and innovative production infrastructure, industry-based firms should restructure their processes, management methods, market policies and strategy to meet the new challenges. Among the necessary things to restructure is the ICT, including management information systems and resources planning software. Thus, from a practical viewpoint, the ERP system supports the management of available resources (e.g., materials, production capacity, and more) within a single site or the multiple sites of a firm.

Akkermans et al. (2003) are in favour of it: *“From a technical perspective, ERP can be seen as an excellent extension of MRP systems which appeared in the 1970s and of MRP II in the 1980s. The ERP can potentially enhance transparency across the supply chain system by erasing information misrepresentations and increasing the information flow across various channels. However, many improvement programmes devoted to supplying chain and ERP implementation appears to be run independently by different staff”.*

6.3 Summary

This chapter discussed the findings gained from analysis of the interview responses and surveys regarding the preferred communication channels for information sharing. Most of the senior managers considered face-to-face an important channel for information sharing, exchanging ideas and in-depth discussion. In addition, the seniors used e-devices extensively (e.g., mobiles, fixed line, internet) in sharing information and communicating. In contrast, the juniors were not keen on face-to-face information sharing; moreover, most of them did not use e-devices in communication with peers, either.

The integration of information resources is a key factor for enhancing supply chain activities. Thus, the implementation of an effective resource management mechanism is required before an organisational commitment can be developed that would create an attractive and safe atmosphere of trust in teamwork between Tawazun's seniors and juniors. The answers of the seniors revealed that the enterprise resources systems (e.g., ERP, GP) are not often used for managing the available information or archiving documents; this may be attributed to a lack of experience and interest. However, the Inventory team was exceptional in using this system manually.

On the other hand, most of the juniors paid positive attention to intra-/interdepartmental information sharing as an important practice involved various communication channels and systems and could enhance the capability of an SCM department by improving the way in which their assigned tasks were performed. Nevertheless, they still made limited use of the range of communication channels to exchange the information with their colleagues.

Analysis of the use of ERP/GP system revealed that the Operations juniors preferred to use it for exchanging information; particularly through using mobile phones or fixed line. However, they did not show any willingness to get the information by personal communication (face-to-face or group meetings). The Procurement juniors were interested in using the ERP/GP system as well as face-to-face conversations. This communication pattern may help the Procurement juniors in obtaining the information needed to carry out their duties satisfactorily. The Inventory juniors preferred to use several channels in information sharing for work purposes, such as the ERP/GP system, phone calls, and email/text messages.

Chapter 7: Information Sharing and SCC– Discussion and Analysis

7.1 Introduction

This chapter presents the findings generated from both the interviews and an analysis of the survey. These findings concern the concept and significant role of information sharing in enhancing the capability of three SCM departments (Operations, Procurement, and Inventory) to contribute to Tawazun's manufacturing activities.

The motivation for investigating the concept of *capability* amongst Tawazun's members at all ranks was that the term was vague and used from different perspectives, as the quoted statements and survey responses showed. Nevertheless, I recalled the commonly used criteria used by the senior managers to measure the capability of the three SCM departments in the firm's activities. Participants from each SCM department nominated the main indicators in measuring the capability of their own department. The chapter concentrates on the entire capability of Tawazun's SCM departments, and the suitable functional criteria for measuring the desired capabilities of defence industry firms in the UAE business environment.

7.2 Supply Chain Capability (SCC)

This section investigates the perspectives of both senior managers and junior staff regarding the potential impact of information sharing on the supply chain capability of the relevant SCM departments (Operations, Procurement and Inventory). It also discusses the main indicators used by the SC departments for measuring their capabilities. The issue of the information sharing-induced capability is appreciated by most CEOs and seniors. Tawazun's top management deals with information sharing as a practice that enhances the vocational experience on which a professional career

rests. The skilled SCM managers understood the desired capability, as expressed below:

“Information sharing means giving willingly to support others, to support yourself and to empower yourself with accurate information to increase the capability of our department” (Male, BSc, CEO, with 21 years’ work experience).

7.2.1 Operations Capability

7.2.1.1 Information Sharing and Capability

Most of the interviewees from Operations expressed a positive attitude to the impact of information sharing on operations capability, as shown below:

“We have to produce a certain amount of weapons according to commitment with Airforce. That commitment has to be delivered. We have to deliver it based on a contract signed and based on our progress that is already be done, deliver and has update status now from the CEO. All managers have to know every single thing, and I should be able to give them to the management team. The latest status is we are able to achieve the goal, and explain the reason for any delay in practice, with the right capability. Based on that we can meet the HQ schedule”. (Male, BSc in electrical engineering, Production Manager, with 40 years’ work experience).

“We believed that sharing accurate and sufficient information should enhance our department capability” (Male, BSc, Project Manager, Operations Management, with 29 years’ work experience).

The above statements imply that senior Operations managers are keenly interested in encouraging and supporting reciprocal information sharing between seniors and juniors to improve the capability and profitability of the production lines and the

quality of final products, and to minimise the time taken to supply materials and store finished goods. Lotfi et al. (2013) endorse this: "*Sharing information improved resource utilization, increased productivity, organizational efficiency, improved services, building and strengthening social bonds, early problem detection, quick response, reduced cycle time from order to delivery, better tracing and tracking, earlier time to market, expanded network, and optimized capacity utilization.*"

A sample of 48 juniors from the Operations department were surveyed to discover their concept of the possible role of information sharing in enhancing the capability of their department. Their responses varied regarding the actual role of information sharing practices in achieving this aim. Fifty-three percent of the participants believed that information sharing could enhance capability to a high or very high level. About 2% of them rated the impact of information sharing on operations capability as low or very low, while about 9% did not know how information sharing practice would impact on achieving their department's capability, as shown in Figure 30.

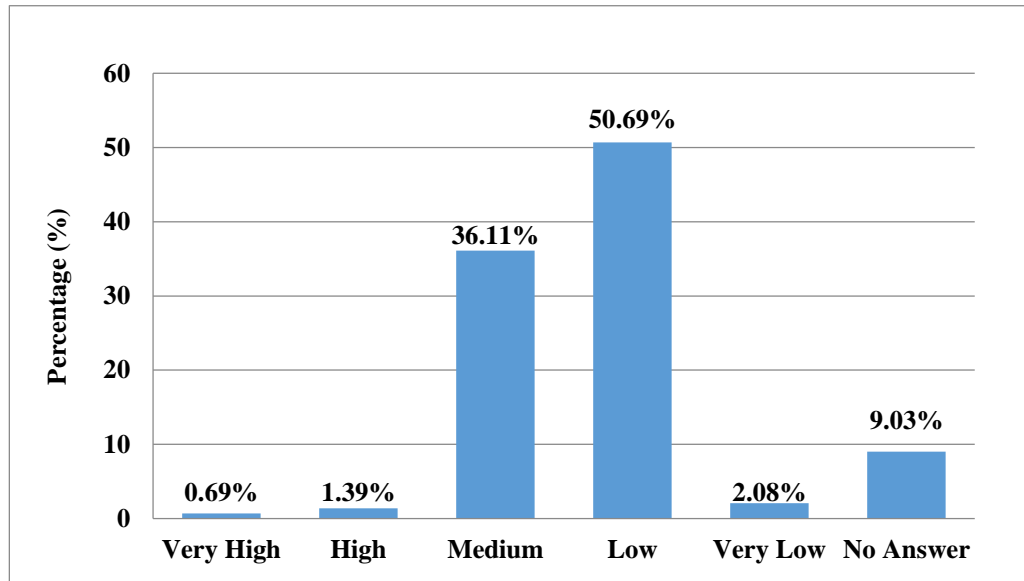


Figure 30: Views on the Achievement of Operations' Capability by information sharing

The survey analysis revealed that a large number of Operations' junior staff realised the importance of intra-/interdepartmental information sharing practices for improving their work performance and task achievement, which in turn would increase their department's capabilities.

7.2.1.2 Capability indicators

Most senior managers from the Operations Department gave a useful clue to measuring their department's capability by mentioning various indicators, as shown below:

“For the three main measurements of operations capability, Productivity measures the daily production rate. Workforce use measures labour achievement per hour, output & the completion of delivery”. (Male, MBA in production engineering, Production Manager, with 18 years' work experience).

“The measurement used to assess the production capability are

Machine capability, which measures the output of the machines; Productivity: which measures the workforce output to complete a product; and Production time, which measures the lead time for the product”. (Female, Diploma, Production Planner, with 19 years’ work experience).

However, some senior managers did not know how to measure their department’s capability, as shown below:

“Unfortunately, we do not have a system to evaluate or measure performance. I do not have that much experience in this field, but we try to measure the KPI for the staff and the department as well. Like unique output, measuring the rejection rate will be an acceptable limit. We are doing research and development to reduce the waste. To improve the quality of the product, we are buying a new machine that produces very high-quality products. We also have a ballistics lab that measures the quality of test samples”. (Male, BSc environmental and manufacturing, Operations Manager, with 21 years’ work experience).

My professional SCM experience suggests that the lack of capability is one of the main problems that Tawazun is suffering from. There is a shortage of skilled personnel to carry out the assigned tasks and support the delivery schedule to customers. This situation may impact negatively on capability.

After analysing all the interviewees’ responses, three main indicators were selected:

i) Labour and machine productivity, ii) Capacity utilization, and iii) Production cost.

- i) ***Labour and Machine productivity:*** This is a measure of the efficiency of a worker or a machine in converting inputs to useful outputs. Productivity is computed by dividing the average labour/machine output per period by

the total costs of the resources (materials) consumed per period; it is a critical determinant of labour/machine cost efficiency (Business Dictionary, 2017). Machinery is a ubiquitous word in the industry, especially when a higher rate of production output is wanted. Since the investment in machinery is high, industries try to maximise their use in the shortest time possible (Subramaniam et al., 2008).

- ii) **Capacity utilization:** This is the extent or the level to which the productive capability of a business firm is put to use in producing specific goods and services, which is usually expressed as the ratio of the actual output to the potential output or capacity (Business Dictionary, 2017). This indicator is considered a major operational metric for manufacturing firms. Prior D. and Filimon (2002) indicate that many attributes could define the possible output in business or engineering, depending on the extent to which the potential output represented the maximum amount of products completed in the short run with the existing stock of capital.
- iii) **Production Costs:** This has been differently defined by different socio-political systems. However, the economic definition is the sum of all the costs related to production in the observed production period divided by the total amount of products produced in that production time (Business Dictionary, 2017).

On the other hand, The three indicators were used in our survey to assess the views of junior staff in Operations on the value of these indicators in helping their department to achieve capability as a result of information sharing practices (see Figure 31).

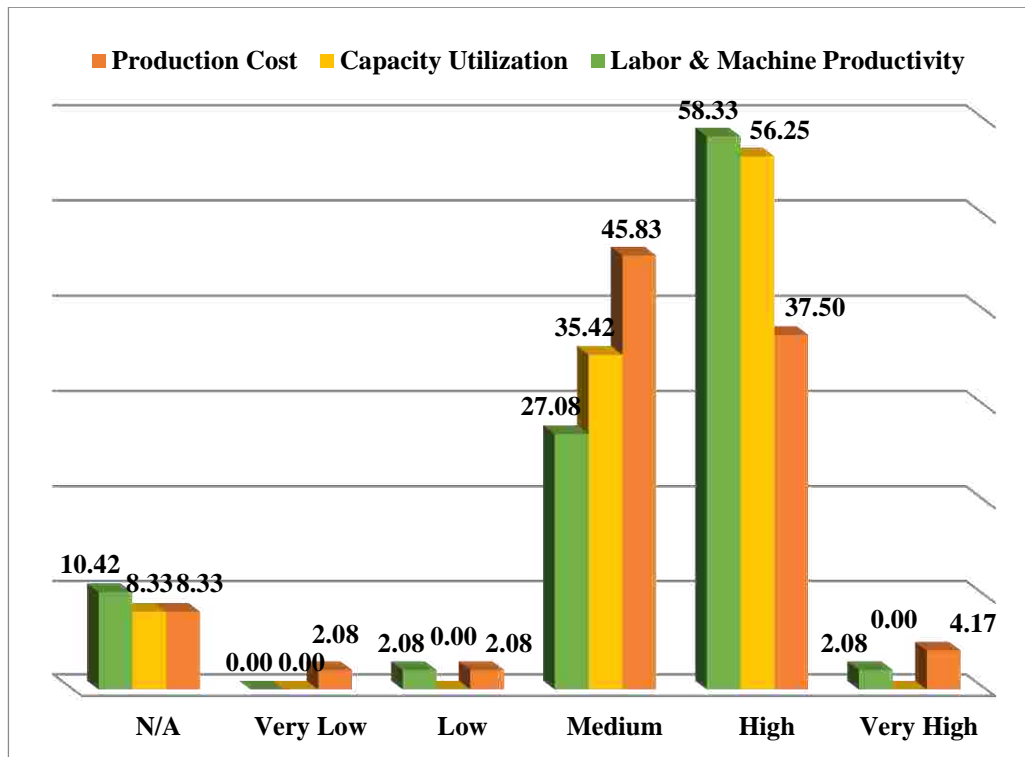


Figure 31: Operations Capability Indicators – Juniors' responses

Statistical analysis of the survey data revealed that 60.41% of the Operations' juniors selected labour and machine productivity as attaining a high or very high level of achievement as a result of information sharing practices, 56.25% chose the capacity use to fulfil this purpose, and only 4% of the juniors considered production cost to be an important indicator.

The absent/incomplete information from another department can impact on operations designed to assess that department's capability: for example, labour and machine productivity cannot be assessed or improved without getting clear information from the maintenance department on the machines' capacity and being trained in using these machines to their maximum operating capacity. Understanding labour and

machine productivity can clarify to the top management how well they are using their workforce and machinery to produce their product, which from operations perspective could help them to assess the production cost more accurately. At the same time, the capacity utilisation cannot be assessed/enhanced without obtaining information about the workforce ability from the Human Resources Department, and the availability of workers and raw material, and machine productivity from the Warehouse Department. Managers get more choice to maximize their firm's productivity according to need. However, capacity utilization will fully support management to understand accurately their capacity to meet customers' requests and let them know the delivery schedules.

Moreover, the product cost cannot be assessed without getting adequate information about the costs of labour from the HR department, and the cost of electricity and machinery, along with any other cost that is incurred from other departments. And Production costs can give the firm the accurate cost of each product which enables them to quote a competitive price to the customer. From all these indicators, the firm can build up customers' loyalty and gain their trust; it can also to be a strong competitor in the market if the firm is supported when it seeks to reduce its production costs compared with other producers. Neglecting these important indicators may affect sales negatively and may weaken market competitiveness.

7.2.2 Procurement Capability

7.2.2.1 Information sharing and capability

Most of the interviewees from Procurement appreciated the impact of information sharing on their department's capability. As shown in the statement below, a senior manager understood this well:

“From my perspective, to attain the firm’s goals for its clients it is necessary to provide the suppliers with accurate information. Inaccurate information leads to misunderstanding. If our requests for material do not match our specifications; this causes a delay in the delivery of the purchased material to us; we may lose money and waste time, and ultimately the capability itself”. (Male, BSc, Procurement, and Contract Manager, with 15 years’ work experience).

This statement quoted from Procurement’s senior manager reflected the significant role of accurate information for sharing among his staff and stakeholders. They had to avoid any mistake or misinterpretation of the information content to save work time and money while increasing the capability of their department. The research findings of Zhou and Benton (2007) support this analysis *“Both effective information sharing and efficient supply chain practices are necessary to attain a target improvement in supply chain capability. Therefore, inter-functional coordination in a business firm is required because the alignment among the various functions is needed to achieve a firm’s business strategy. Therefore, inter-firm cooperation and information sharing between supply chain departments and stakeholders gains value.”*

A sample of 19 juniors from Procurement were asked their views on the potential role of information sharing practices in delivering enhanced capability in their department. The survey responses revealed that the juniors’ opinions varied greatly on this point. About 50% of the participants rated the impact level of information sharing on delivering enhanced capability as high or very high, while 12.28% conceived that the impact of information sharing practices on capability was low or very low, as shown in Figure 32.

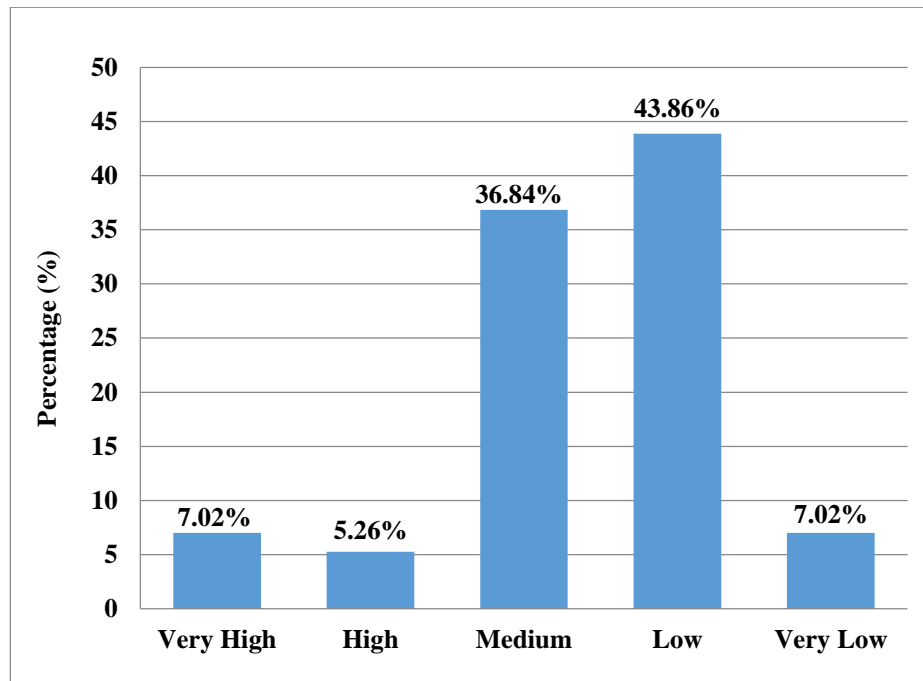


Figure 32: Impact of information sharing on Procurement capability- Assessment

The survey made it clear that most of the juniors in the Procurement department were aware of the important role played by intra-/interdepartmental information sharing practices in enhancing their department's capabilities.

7.2.2.2 Capability Indicators

I probed the concept and understanding of the most senior managers who worked directly with the Procurement department concerning the indicators that could measure the department's capability. These managers had a professional idea about measuring it and based their expertise on their professional experience:

“The three measurements of Procurement capability we use are a) Total cost of BOM; b) On time delivery (Number of deliveries on time/Number of the delivery plan); c) Quality; (Number of goods fit for

purpose/ Number of goods delivered)". (Male, MSc in engineering management, Supply Chain Director, with 33 years' work experience).

Another senior manager added "We assess our capability by measuring the administration time: how long a buyer takes to transform a purchase request to a purchase order; by cost saving: how much money we have saved on a contract; and quality: the quality of the goods that we buy". (Female, BBA, Commodity Manager, with ten years' work experience)

The above statements outlined some important indicators by which to measure Procurement's capability. After analysing all the responses, the three main indicators were found to be i) Supplier on-time delivery, ii) Supplier defect rates (quality of the part purchased), and iii) Procurement cost.

- i) ***Supplier on-time delivery:*** This is the ability of Procurement to fulfil shipping orders to the end user within the period promised. This indicator measures how efficiently the Procurement department gets what the governing body demands.
- ii) ***The quality of material defect rate:*** This can be estimated by dividing the spoiled items by the total number of purchased items (or the number of shipments with defects by the full number of loads). This indicator measures the quality of the purchases made by the Procurement department.
- iii) ***Procurement Cost:*** This includes purchasing costs and other terms and conditions, such as quality, warranty, payment, and maintenance services. The cost may sometimes include the costs of logistics (i.e., custom duties and handling costs) and storage, as well as the types of purchase agreement (e.g., long-term or short-term) that influence the cost price, together with the tactics used to reduce the operations

cost by outsourcing instead of offering a wholly in-house product, and importing new technology to reduce other costs to the firm (Hall, 2016).

Based on the above main indicators of procurement capability, I examined the survey responses from the juniors to analyse how far these indicators could be applied to gauge the capability-related activities of the procurement department as a result of information sharing practices, as shown in Figure 33.

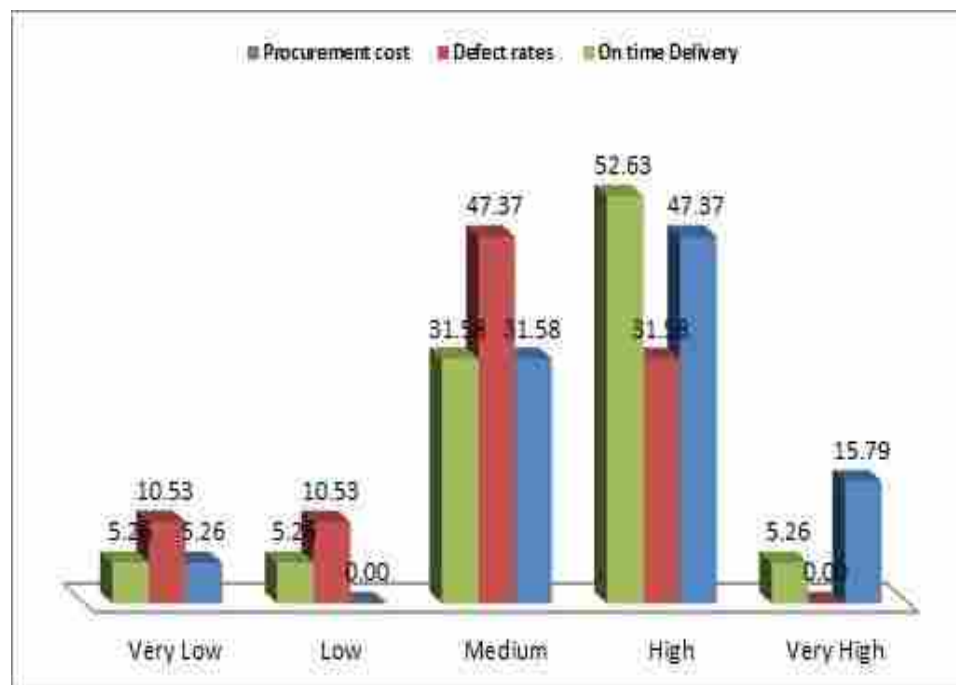


Figure 33: Procurement Capability Indicators – Juniors' responses

Statistical analysis of the survey data revealed that about 58% of the Procurement' juniors selected on-time delivery as the sign of a high or very high level of achievement resulting from information sharing practices. About 63% chose procurement cost as promoting a high or very high level of achievement. However, only 31.58% of the juniors considered supplier defect rates to be an important indicator.

As in Operations, information sharing would have a strong impact on the Procurement indicators. If the Procurement department knows enough about the supplier's on-time delivery, this could clarify when the Procurement department can apply the Supplier Key Performance Indicators (KPI). The KPI would help Procurement to appoint better suppliers based on the assessment indicators. By this action, Procurement can meet the requirements of the production lines; this will improve the operations to meet the firm's commitment. But the Procurement department cannot complete this assessment unless it gets the information about the delivery date/receiving date of the raw material from the Warehouse department.

The knowledge of the defect rate, moreover, can also keep the procurement team ready to replace the defected parts promptly and create a Plan (B) to prevent any delay from the production line without impairing the quality of the parts. Insufficient information or documentation about defective parts might prevent the Operations Department from meeting the requirements of the customers promptly. The availability of relevant information on shortcomings in the components may support the Procurement team in taking action to recover missing or damaged parts and getting what it needs from the original suppliers. The involvement of suppliers in providing the right parts would ameliorate such situations, as well as helping Operations to avoid delay or frustration from receiving defective parts. So, this indicator cannot be assessed/improved unless feedback is received from the Quality Department about the quality of material received from the quality report (QC), and the goods received notes (GRNs) from the Warehouse Department.

The procurement cost is considered significant due to its effect on the final product cost. Therefore, the Procurement department when looking for the best deal should be

concerned with each cost that might increase total value, such as signing a long-term contract with multi-suppliers, adapting on time delivery to avoid any other cost, which impacts on the raw material cost such as logistics (airlift cost) and storage costs. Minimizing procurement costs could also help the company not merely to reduce the raw material cost, but to give the firm clarity about the real cost of each part. This would help them to decide either to produce it in-house or to out-source it and in turn give them the chance to decide about the sourcing of parts required for the production line, and let them meet more efficiently their commitment to the customer.

To assess/improve this indicator, the members of the Procurement Department need sufficient information from many SCM departments; for example, i) the Projects Department, should explain the projects, ii) the Operations Department should clarify the production plan, iii) the Sales Department should tell them know about the specification required by the customer and the delivery schedule, iv) the Finance Department should clarify the cash flow status, and v) the legal department should clarify the terms and conditions that will be discussed when the supply/service contract is negotiated. All this necessary information will assist the Procurement team to find a suitable supplier and negotiate the contracts satisfactorily. Not paying enough attention to this indicator may indirectly exert an undesired effect on the Operations processes if core components are missing or received without knowing their quality or appropriateness.

7.2.3 Inventory Capability

7.2.3.1 Information sharing and capability

Most of the senior managers in Inventory spoke of the positive impact of information sharing on capability, including the two below:

“To get our work done efficiently, attaining the company’s goals, the capacity and willingness to share information sharing should meet the requests of team members for specific and accurate information. This would develop our professional knowledge and experience” (Male, BSc, Warehouse Supervisor, with 17 years’ work experience).

“The staff need information on time to be aware of the current news. It should be accurate and two-way to control stock and oversee the task of ordering. If information about certain parts fails to reach Procurement, this can impact negatively on Operations, wasting time and increasing cost. Besides, the ordering of the needed parts may be delayed due to lack of the necessary information. Therefore, the information should flow in a two-way direction. Without this, the result would not be accurate. The GP system is necessary to make the required information shareable amongst all the staff; unfortunately, this system is yet not set up. However, the information sent to management is not shared with the junior levels” (Male, high school qualification, Warehouse Manager, with 19 years’ work experience).

Analysis of the statements indicated that Inventory’s senior managers focused on the accuracy of the shared information as an important success factor in delivering their capability to a high level. Moreover, the seniors insisted on the reciprocal flow of information between seniors, juniors, also across the SCM departments. Such patterns

in information practices could save them work time and cost, and increase their department's capability.

A sample of 19 juniors from Inventory was surveyed to investigate their attitudes to the impact of information sharing practices on enhancing the capability of their department. About 38% of the participants indicated that the effect of information sharing on the Inventory's capability was at high or very high, whereas 17.55% rated the achieved capability as low or very low, as shown in Figure 34.

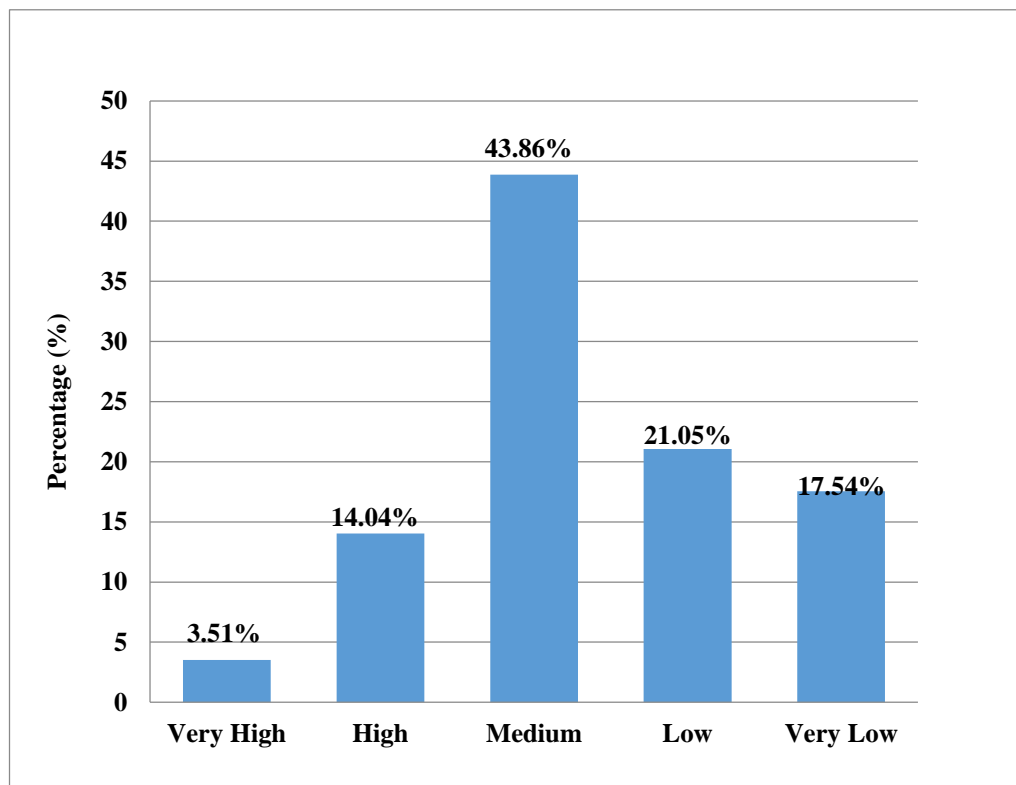


Figure 34: Assessment of Information sharing on Inventory's capability

The survey analysis showed that a high percentage of these junior staff appreciated the importance of intra-/interdepartmental information sharing practices. Nevertheless, professional know-how might have encouraged them to get the most benefits from the

shareable information and increase their department's capabilities by improving the performance of their tasks.

7.2.3.2 Capability indicators

Most of Inventory's senior managers are professionally knowledgeable and keenly interested in measuring the capability of their department by using standard criteria. When asked about the main indicators of capability, they provided answers according to their knowledge and experience:

Capacity: we have to know the days of stock (DOS); with that we can calculate our stock level based on the production plan; what items should be stock the authorized stock level (ASL) and the Min/Max reorder points, based on the daily and weekly use & lead time (we can measure it). Turnover: yearly, we have to decide how many times turnover is worked out, depending on the type of material. A, B and Care the labels for Value, Volume & lead time. Through put: all the material that comes in, all the material that goes out in a certain period. Efficiency of personnel and process on the place (people are not willing to take responsibility; that will affect your productivity. Accuracy: receiving incorrect parts or correct parts affects such departments as warehouse, finance, procurement and operations. Picking the wrong part will also impact on operations and warehouse and this will impact on the resources and cost". (Male, high school qualification, Warehouse Manager, with 19 years' work experience).

"Turnover: calculated quarterly. Delivery on time: measure the delivery time to the customer (meet the committee). Materials: stock level". (Male, MBA, Supply Chain Director, with 23 years' work experience).

"The Inventory measurements are a) Auditing the stock level to make sure accurate quantities are measured quarterly between physical

assets and the system, knowing the reasons behind the results and opening up new orders to cover any shortages; and b) How many movements of stock out of the store have there been, to measure the labour output” (Male, Diploma, Supply Chain Manager, with 19 years’ work experience).

The scholarly work of Hishamuddin et al. (2014) supports these statements *“In a supply chain system, the inventory cycle exists for placing and purchasing in bulk orders. On the other side, the fixed costs of orders, delivery, and special discount offers for bulk would be encouraging different supply chain stages to exploit these trade promotions to place orders to great lots”.*

The stock levels reflect the delivery service, demand uncertainty, and supply chain flexibility needed to meet customers’ expectations. Managing long-life products and storing them safely at the warehouse are easy tasks. Therefore, the Warehouse unit should handle the storage space and tools by either leasing or owning these properties. The average cost of the inventory should be known to help figure out the needed physical storage space. After analysing the 10 responses from the Inventory seniors, three main indicators were found to measure inventory capability; i) Safety stock, ii) Inventory cost, and iii) Inventory turnover.

- i) ***Inventory Turnover*** is the number of times a firm's average investment in Inventory is regained during an accounting period. Normally, a high number indicates greater sales efficiency and a lower risk of loss through unsaleable stock (Business Dictionary, (2017); Schreibfeder, (2015)). In other words, it

determines the number of “*opportunities to earn a profit*” a firm experience each year from its investment in stock inventory. Inventory turnover is calculated by:

$$\frac{\text{Cost of goods sold from stock sales}}{\text{Average inventory value}}$$

- ii) ***Safety Inventory (Safety stock)*** is the level of extra stock that is maintained to mitigate risk of stock outs (shortfalls in raw material or packaging) due to uncertainties in supply and demand.
- iii) ***Inventory Cost*** is the cost of holding products in stock, usually expressed as a percentage of the inventory value. Inventory cost includes capital, warehousing, devaluation, insurance, taxation, uselessness, and decreased costs (Business Dictionary, 2017). The exact determination of the cost rate to apply is an actual cost accounting matter, but the related core components are the costs of capital, storage, and obsolescent items; however, all these costs are measured together as a single inventory cost rate (Van Ryzin, 2001).

Based on the three main indicators selected for measuring inventory capability, I examined the survey responses from the juniors to analyse how far these indicators can be applied to gauge the capability-related activities of the Inventory department, as shown in Figure 35.

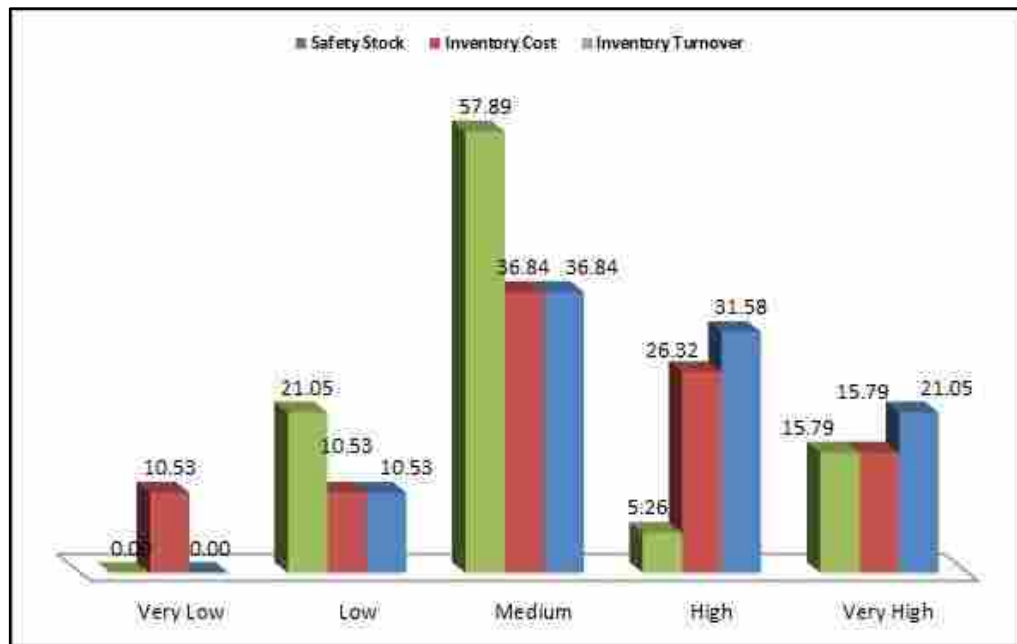


Figure 35: Inventory Capability Indicators – Juniors’ opinion

Statistical analysis of the survey data revealed that about 52.58% of the Inventory juniors believed safety stock to have a high or very high level of achievement as a result of information sharing practices, while about 42% chose inventory cost as attaining a high or a very high level of achievement. However, only 21% of the juniors considered inventory turnover to be an important indicator. The results showed that a high proportion of the Inventory junior staff working in the four Tawazun subsidiaries do not sufficiently appreciate the importance of these indicators in measuring their department’s capabilities. However, the application of these indicators can furnish the Inventory team with reliable tools for assessing and/or re-estimating the capability of the Inventory department.

The inventory cost can tell the firm what the storage cost will be. This can impact on their liquidity, and in turn their profitability, so the Warehouse department has to get clear information from Procurement about the store rent and labour cost (handling

cost), as well as the shelf life for the raw materials. With these figures they can calculate this cost correctly and can also reduce it by transferring it to the leading supplier.

The inventory turnover can show the stock movement (raw material/ goods), that reflects the company's sales power. To assess this indicator, the Warehouse department needs information from Operations on the list of goods ready to go, and also needs the sales plan from the Sales department. In addition, it needs the production plan which can be sent quarterly, based on each project, or weekly, as the mass production schedule (MPS).

The safety inventory (Safety Stock), however, cannot be assessed/improved until Inventory receives information from Operations on its production plan and has a list of goods that are ready-to-go besides the sales plan. It also needs the expected delivery schedule from Procurement and the expected arrival schedule from Logistics department. Moreover, the top management has to consider the importance of the inventory, which is normally used to gauge the firm's success, but cannot do so until its indicators can be assessed.

7.3 Information Sharing: Intra-SC Departments

7.3.1 Information from SC Departments shared with other Departments

7.3.1.1 Senior Level

A series of interviews with the senior personnel, mainly the CEOs and COO, was devoted to highlighting the most important information from each SC department to share with other departments in order to carry out their tasks. I illustrate the primary

activities of equal importance in each department. Table 14, 15 and 16 show the information to be shared by each SC department with the other departments. All inputs were collected from the interviewees' responses.

Table 14: Information shared from Operations to other departments

Operations Dept.	Procurement Dept.	<ul style="list-style-type: none"> ▪ Production plan ▪ Specific material required for production line ▪ Material consumable ▪ Yearly material resource plan ▪ Generate scraping
	Inventory Dept.	<ul style="list-style-type: none"> ▪ MPS (Master production schedule) and quantity ▪ Production plan ▪ Generate scraping ▪ Material requirement plan
	Finance Dept.	<ul style="list-style-type: none"> ▪ Finance Dept.: Generate scraping. ▪ Budget on time, based on production plan.
	Engineering Dept.	<ul style="list-style-type: none"> ▪ Equipment capability that will impact on the department's design.
	HR Dept.	<ul style="list-style-type: none"> ▪ Manpower and annual leave on time.
	Sales & marketing Dept.	<ul style="list-style-type: none"> • Factory capacity. • Pre-deliver in sections for production. • Product times.
	CEO Office	<ul style="list-style-type: none"> ▪ Weekly report with production status and risk.

Table 15: Information shared by Procurement with other SC departments

Procurement Dept.	Operations Dept.	<ul style="list-style-type: none"> ▪ Shelf life. ▪ Data sheet (BOM) ▪ Procurement plan ▪ Lead time/arrival time for material ▪ Any delay on delivery date of raw material ▪ Shipping problems ▪ Quality of parts ordered ▪ Availability of material ▪ New technology and data available in the market.
	Inventory Dept.	<ul style="list-style-type: none"> ▪ Delivery date of raw material. ▪ Procurement plan.
	Engineering Dept.	<ul style="list-style-type: none"> ▪ New technology in the market.
	HR Dept.	<ul style="list-style-type: none"> ▪ Manpower plan.
	Finance Dept.	<ul style="list-style-type: none"> ▪ Full visibility of inventory. ▪ Outstanding payments. ▪ Goods price. ▪ Payment terms ▪ Delivery schedule. ▪ Support documents to release payment with GRN. ▪ Payments status especially for advance.

Table 16: Information shared from Inventory to other departments

Inventory Dept. (Warehouse)	Procurement Dept.	<ul style="list-style-type: none"> ▪ Shelf life. ▪ Rejected parts and quantity. ▪ How much material can be received daily? ▪ Space availability in the warehouse. ▪ Quantity of material received and accepted.
	Operations Dept.	<ul style="list-style-type: none"> ▪ Stock levels. ▪ Rejected parts and the quantity of them. ▪ How much picking can be done daily? ▪ Space availability. ▪ Full visibility at inventory. ▪ Availability of material.
	Finance Dept.	<ul style="list-style-type: none"> ▪ Full visibility of inventory. ▪ Any adjustment in the stock. ▪ Turnover. ▪ Scraping. ▪ Documents for processing the payment.

The above tables show that, in addition to the three main SC departments, the active players in interdepartmental information sharing are Finance, Engineering, Quality, and Human Resources. These practices guarantee continued business efficiency.

7.3.1.2 Junior Level

a) Sharing Information with Operations Department

Figure 36 and Table 17 show the frequency and patterns of information shared by the juniors of the Procurement, Inventory and other related departments with their peers in the Operations Department. Regarding the frequency of interdepartmental information sharing with Operations, 35.42% of the responses showed that Procurement shared new technology; Inventory shared their control policy, while the

Sales and Marketing Department shared client feedback on a daily or weekly basis. Moreover, 41.67% of the responses indicated that the Maintenance Department shared its plan, and 54.16% indicated that Human Resources (HR) shared details of the workforce and staff training on a daily or weekly basis. With regard to sharing information on a monthly or quarterly basis, 45.84% of the responses indicated that Procurement shared the quantity of raw material; 54.16% stated that the Inventory Department shared the raw material availability, and 60.42% reported that the Quality Department shared material inspection and quality.

Table 17: Frequency of Information sharing with Operations - Junior Staff

Question no.	Object of question	No answer	Daily	Weekly	Monthly	Quarterly
Q1	Procurement plan from Procurement Dept.	43.75	2.08	20.83	25.00	8.34
Q2	New technology from Procurement Dept.	50.00	8.33	27.08	8.33	6.26
Q3	The quantity of raw material from Procurement Dept.	37.50	6.25	10.42	29.17	16.66
Q4	Raw material shipping problems from Procurement Dept.	54.17	8.33	12.50	16.67	8.33
Q5	Raw material availability from Inventory Dept.	39.58	2.08	4.17	39.58	14.59
Q6	Storage capacity from Inventory Dept.	58.33	8.33	20.83	2.09	10.42
Q7	Stock level from Inventory Dept.	37.50	4.16	25.00	22.92	10.42
Q8	Inventory control policy from Inventory	52.08	25.0	10.42	8.33	4.17
Q9	Parts specifications from Engineering	58.33	12.50	8.33	10.42	10.42
Q10	Inspection and quality of materials from Quality Dept.	22.92	8.33	8.33	18.75	41.67
Q11	Manpower and staff training from HR Dept.	33.33	20.83	33.33	12.51	0.00
Q12	Maintenance plan from Maintenance Dept.	35.42	4.17	37.50	16.67	6.24
Q13	Client feedback from Sales and Marketing Dept.	54.17	25.00	10.42	8.33	2.08

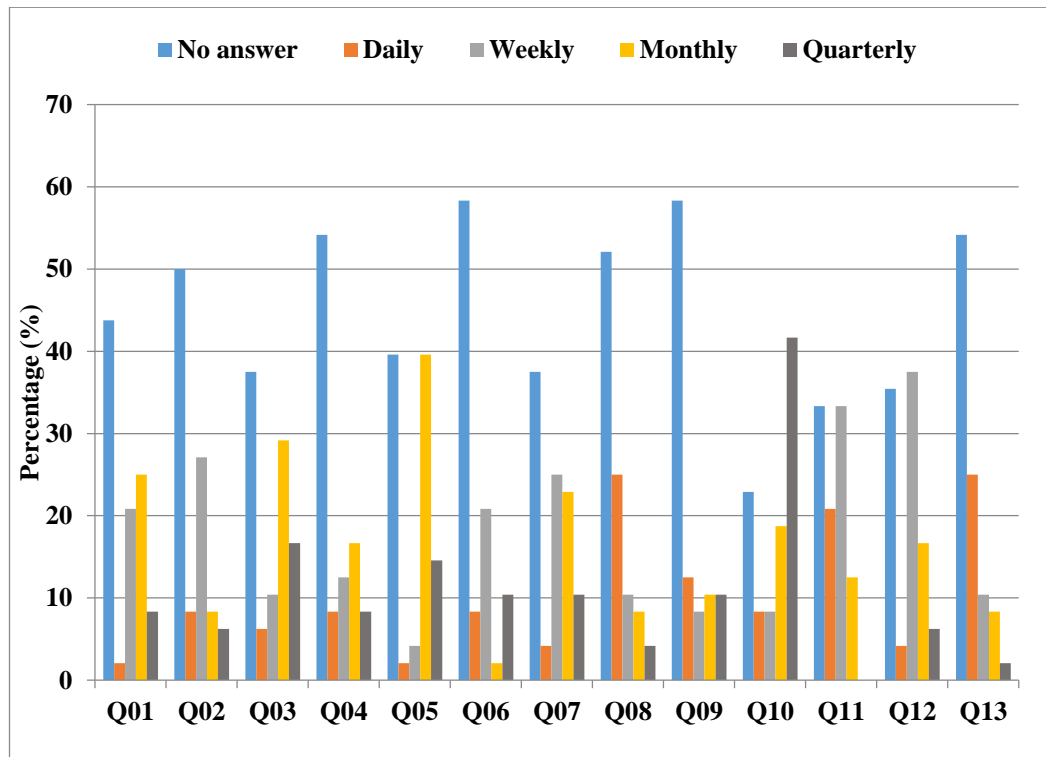


Figure 36: Information sharing with Operations according to Junior Staff

b) Sharing Information with the Procurement Department

Figure 37 and Table 18 show the frequency and pattern of information shared by the junior staff of the Operations, Inventory and other departments with their peers in the Procurement department. Regarding the frequency of interdepartmental information sharing with Procurement, 42.11% of the responses showed that Operations shared the production plans, and 47.37% of the replies indicated that the Sales Department shared the payment status of clients on a daily and weekly basis.

In contrast, 68.43% of the responses showed that Inventory Department shared information about the safety stock levels, while 73.68% of the replies indicated that this department received information about goods notes on a monthly and quarterly

basis. Moreover, 57.9% of the responses indicated that the Quality Department shared inspection reports and details of materials quality, and 52.63% indicated that the Engineering Department shared parts specifications, whereas 47.37% of the responses indicated that the Finance Department shared information about payments, budget and cash flows on a monthly and quarterly basis.

Table 18: Frequency of information sharing with Procurement - Junior Staff

Question no.	Content Question	No answer	Daily	Weekly	Monthly	Quarterly
Q1	Master Production Schedule (MPS) from Operations Dept.	36.84	5.26	21.05	26.32	10.53
Q2	Production plan from Operations Dept.	31.58	10.53	31.58	21.05	5.26
Q3	Part requirements (quantity, quality, delivery date) from Operations Dept.	36.84	0.00	26.32	21.05	15.79
Q4	Tooling and spare parts needed from Operations Dept.	36.84	10.53	15.79	31.58	5.26
Q5	Raw materials availability from Inventory Dept.	15.79	0.00	21.05	36.84	26.32
Q6	Storage capacity from Inventory Dept.	21.05	5.26	21.05	36.85	15.79
Q7	Stock levels and safety stock from Inventory	15.79	10.53	5.26	26.32	42.1
Q8	'Goods received' notes (GRN) from Inventory	21.05	0.00	5.26	0.00	73.69
Q9	Parts specifications from Engineering Dept.	36.84	0.00	10.53	31.58	21.05
Q10	Inspection and quality of materials from Quality Dept.	31.58	5.26	5.26	26.32	31.58
Q11	Workforce and staff training from HR Dept.	47.37	10.53	15.79	21.05	5.26
Q12	Payments, budget and cash flows from Finance Dept.	26.32	0.00	26.31	31.58	15.79
Q13	Payments status and cash flow from Sales Dept.	36.84	26.32	21.05	10.53	5.26

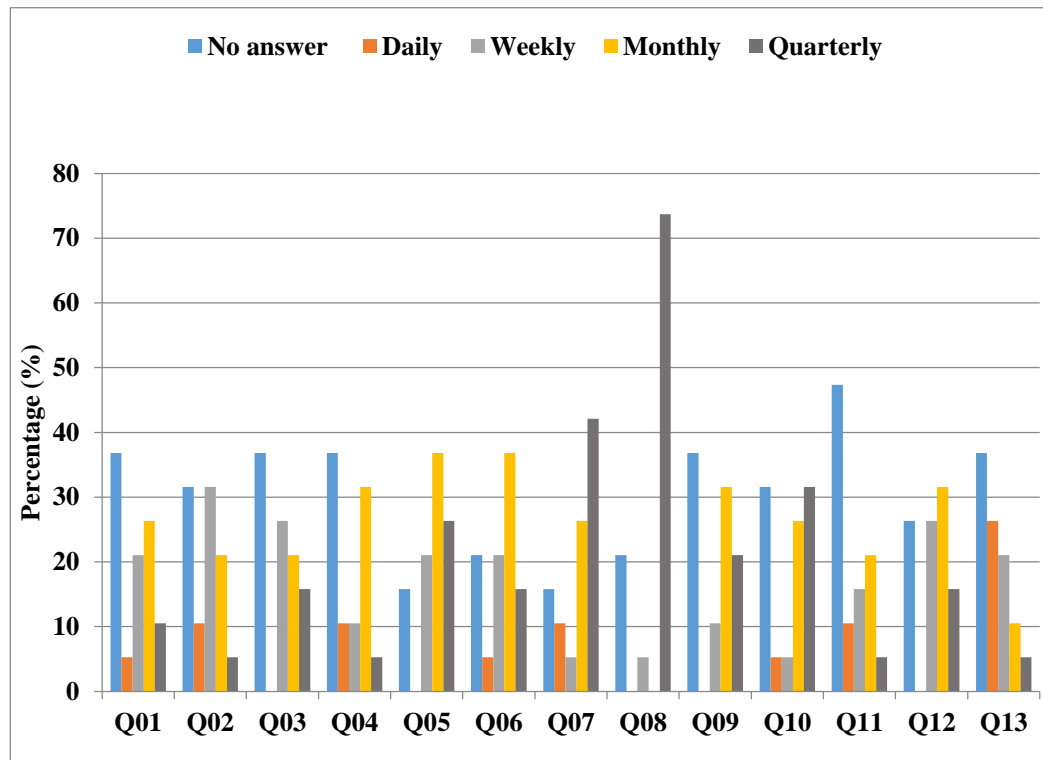


Figure 37: Information sharing with Procurement according to Junior Staff

c) Sharing Information with Inventory Department

Figure 38 and Table 19 show the frequency and patterns of information shared by the juniors in the Operations, Procurement and other related departments with their peers in the Inventory Department. Regarding the frequency of interdepartmental information sharing with Inventory, 42.11% of the responses indicated that Procurement shared the shipping problems with raw material, and 63.16% indicated that the HR and Sales Departments shared information about training courses and the delivery schedules of clients, respectively, on a daily and weekly basis.

Further, 78.95% of the responses indicated that the Quality Department shared data about inspection reports and material quality monthly or quarterly. Moreover, 73.69% of the replies indicated that both the Operations and the Engineering departments

shared information about the parts specifications and quantity and quality of finished parts monthly or quarterly. Likewise, 68.42% of the responses indicated that the Operations Department shared information about the finished parts, and 63.16% indicated that both Procurement and Operations shared information about their plans on a monthly and quarterly basis.

Table 19: Frequency of information sharing with Inventory - Junior Staff

Q no.	Content Question	No answer	Daily	Weekly	Monthly	Quarterly
Q1	Shelf life from Procurement Dept.	21.05	5.27	21.05	21.05	31.58
Q2	Procurement plan from Procurement Dept.	15.79	5.26	15.79	21.05	42.11
Q3	Quantity of raw material from Procurement Dept.	21.05	0.00	21.05	0.00	57.9
Q4	Raw material shipping problems from Procurement Dept.	21.05	0.00	42.11	0.00	36.84
Q5	Master production schedule (MPS) from Operations Dept.	10.53	10.53	21.05	21.05	36.84
Q6	Production plan from Operations Dept.	5.26	5.26	26.32	15.79	47.37
Q7	Quantity and quality of finished parts from Operations Dept.	10.53	0.00	15.78	10.53	63.16
Q8	Delivered finished parts from Operations Dept.	21.05	0.00	10.53	5.26	63.16
Q9	Part specifications from Engineering Dept.	15.79	10.52	0.00	15.79	57.90
Q10	Inspection and quality of materials from Quality Dept.	5.26	0.00	15.79	10.53	68.42
Q11	Manpower and staff training from HR Dept.	21.05	21.05	42.11	15.79	0.00
Q12	Client delivery schedule from Sales Dept.	21.05	31.58	31.58	15.79	0.00

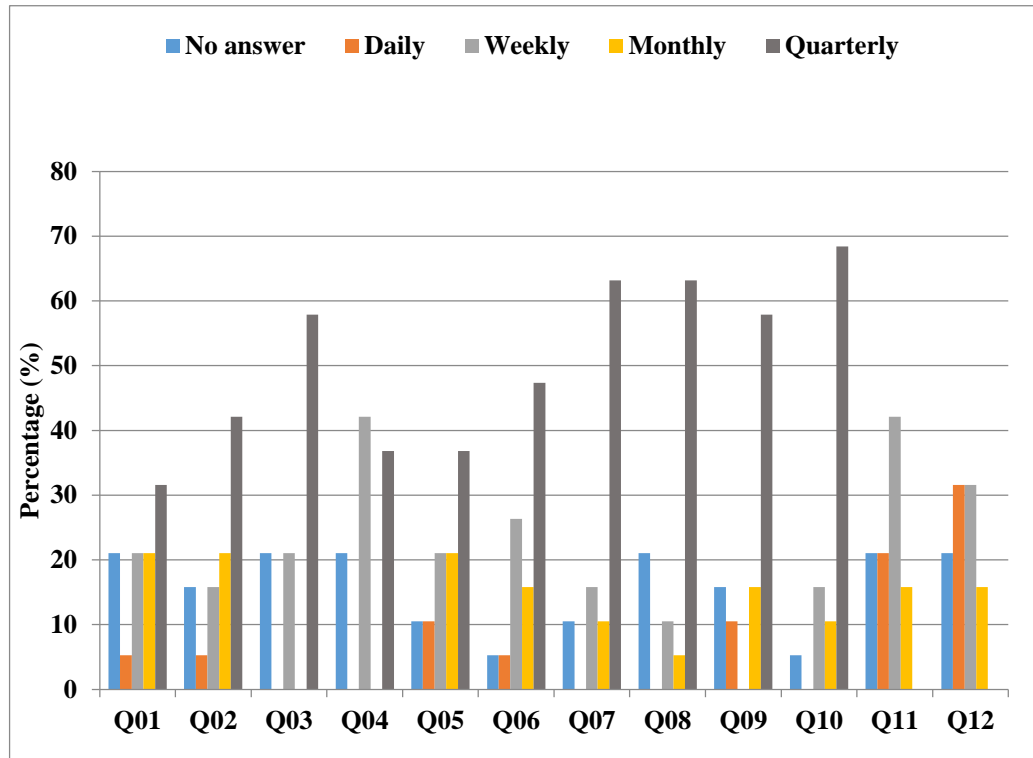


Figure 38: Information sharing with Inventory - Junior Staff

It is worth noting that these tables and figures reflect the role of information flow continuity in supporting on-job professional career development by clearly telling workers about such specific requirements as providing data on the budget, specification, inventory, stock level, and lead-time related to their tasks. The flow of such accurate information is needed to sustain the circulation of information amongst the different units of the SCM system (e.g., Sales, Finance, Procurement, and Inventory).

The actual needs of each department or its team activities determine the amount and pattern of the shareable information flow across Tawazun's supply chains. At the same time, the continuous feeding of such required information draws a staff response

within the team for achieving their tasks on time and in a cost-effective way. Figure 39 shows the interdepartmental flow of information in Tawazun.

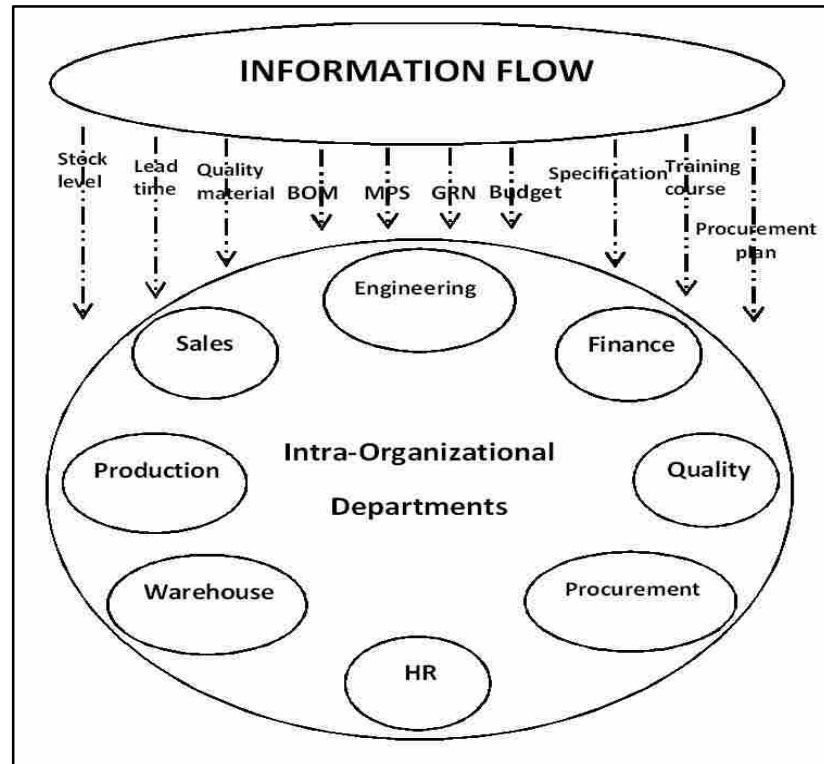


Figure 39: Flow pattern of shareable information in the SCM system

(Source: Developed by the author)

Storer (2005) discusses the importance of a continuous information flow ultimately to the specific work, “*The intra-organisational information sharing and its steady flow across the industry-based organisation can assist in developing an organisational culture*”.

7.3.2 Information required from SC Departments

The analysis of statements by senior managers indicated that each SCM department is in want of accurate information from other departments in order to complete its tasks.

It confirms their disregard of the importance of sharing information with the right people/intra-organizational departments. The tables below identify the missing data still needed from other departments, including Engineering, Quality, Human Resources, the COO office, Sales and Marketing, Maintenance, and Finance which would have an effect on the SCM departments' capabilities. Tables 20, 21 and 22 show what information is by each SC department. All inputs were collected from the interviewees' responses.

Table 20: Information Required from Operations to other departments

Operations Dept.	Procurement Dept.	<ul style="list-style-type: none"> ▪ Shipping problem ▪ Rejected parts and quantity ▪ Delivery schedule ▪ Material plan. ▪ New technologies
	Inventory Dept.	<ul style="list-style-type: none"> ▪ How much picking can be done daily. ▪ Short-/long-term stock turnover. ▪ Storage capacity. ▪ Availability of raw material.
	Engineering Dept.	<ul style="list-style-type: none"> ▪ Assembly drawings; ▪ Process sheet, control plan; ▪ DFMEA (Design failed mode evaluation analysis); ▪ PFMEA (Production factoring mode engineer analysis).
	HR Dept.	<ul style="list-style-type: none"> ▪ Manpower.
	Configuration Dept.	<ul style="list-style-type: none"> ▪ Documentation e.g. reports on assembly inspection; instruct and quality manuals.
	Quality Dept.	<ul style="list-style-type: none"> ▪ Latest revised drawings & specifications.
	COO Office	<ul style="list-style-type: none"> ▪ Production requirement.
	Maintenance Dept.	<ul style="list-style-type: none"> ▪ Maintenance plan for the factory.
	Sales & Marketing Dept.	<ul style="list-style-type: none"> ▪ Client feedback.

Table 21: Information Required from Procurement to other departments

Procurement Dept.	Engineering Dept.	<ul style="list-style-type: none"> ▪ Production plan ▪ Operations Dept.: output. ▪ Production Dept.: Their requirements with specified dates. ▪ Tooling and spare parts needed.
	Quality Dept.	<ul style="list-style-type: none"> ▪ Drawings and technical specification and BOM
	Operations Dept.	<ul style="list-style-type: none"> ▪ Shelf life. ▪ Short- and long-term stock turnover. ▪ Storage capacity ▪ GRN
	Inventory Dept.	<ul style="list-style-type: none"> ▪ Inspection material (quality report) and Evaluation report.
	HR Dept.	<ul style="list-style-type: none"> ▪ Additional manpower needed.
	Finance Dept.	<ul style="list-style-type: none"> ▪ Payments terms, budget, LC status and cash flow.
	Maintenance Dept.	<ul style="list-style-type: none"> ▪ Complete technical specifications for the machines.
	Commercial & Sales Dept.	<ul style="list-style-type: none"> ▪ Customer requirements preferred, ▪ Future trends. ▪ Delivery schedules from clients.

Table 22: Information Required from Inventory to other departments

Inventory Dept. (Warehouse)	Procurement Dept.	<ul style="list-style-type: none"> ▪ Shelf life ▪ Rejected parts and quantity ▪ Delivery schedule ▪ Shipping problems ▪ Material plan. ▪ Quantity of material received and accepted.
	Operations Dept.	<ul style="list-style-type: none"> ▪ Mass production schedule (MPS) ▪ Production plan. ▪ Rejected parts and quantity. ▪ Report for delivered parts. ▪ Generate Scraping.
	Engineering Dept.	<ul style="list-style-type: none"> ▪ Serial number & variants
	Quality Dept.	<ul style="list-style-type: none"> ▪ Inspection material on time document
	HR Dept.	<ul style="list-style-type: none"> ▪ Training staff ▪ Delivery date to customers.

7.3.3 Information Sharing among SC Departments- Capability Implications

7.3.3.1 Procurement and Inventory

Despite the active interdepartmental information sharing and data exchange between Procurement and Inventory, some needed information is still either lost or missed when information is shared. Doing without it may have consequences for the tasks of both departments, which need sufficient and accurate information and data, as shown in Tables 23 and 24. The information from Inventory that should be shared with Procurement is shown in Table 23.

Table 23: Information sharing from Inventory to Procurement

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> ▪ Shelf life. ▪ Rejected parts and quantity. ▪ How much material can be received daily ▪ Space availability in the warehouse. ▪ Quantity material received and accepted. 	<ul style="list-style-type: none"> ▪ Shelf life. ▪ Short- and long-term stock turnover. ▪ Storage capacity ▪ GRN 	<ul style="list-style-type: none"> ▪ Short- and Long-term stock turnover. ▪ Storage capacity

- *Short- and Long-term Stock Turnover:* Insufficient information reaching Inventory regarding short- and long-term stock turnover may lead to incorrect information being sent to Procurement. This in turn will allow orders for unwanted materials or parts and will increase the cost of storage, waste budget (cash) , and spoil the quality of the items.
- *Storage Capacity:* The exchange of accurate data and information between the two departments would help Procurement to estimate the storage capacity required to accommodate new purchases or supplied items, and to arrange with the suppliers to deliver the requested orders on time in the specific quantities.

Information that should be shared by Procurement with Inventory is shown in Table 24.

Table 24: Information sharing from Procurement to Inventory

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> ▪ Delivery date of the raw material. ▪ Procurement plan. 	<ul style="list-style-type: none"> ▪ Shelf life material ▪ Delivery schedule ▪ Shipping problem ▪ Material plan. ▪ Quantity of material received and accepted 	<ul style="list-style-type: none"> ▪ Shelf life material ▪ Shipment problems ▪ Quantity of material received and accepted

- *Shelf-life Material*: It is essential to furnish Inventory with the exact expiry date of all purchased material and parts for monitoring and controlling the storage period, and to adopt the right methods to manage the raw materials/goods dispatch by LIFO or FIFO methods to feed the production lines with the required items. If Inventory chooses to extend the expiry date of some items, it should inform Procurement to arrange this with the suppliers.
- *Shipment Problems*: Procurement should inform Inventory of any unexpected delay in shipment and delivery; this would allow Inventory to rearrange the receipt-delivery processes.
- *Materials Expected*: Inventory should be informed about the schedule of material once it is received, to arrange proper storage.

7.3.3.2 Operations and Inventory

Despite the active interdepartmental information sharing and data exchange between Operations and Inventory, some needed information is still either lost or missed when the information is shared, with serious possible consequences for the tasks of both departments, which need sufficient and accurate information, as shown in Tables 25

and 26. The information that Inventory should share with Operations is shown in Table 25.

Table 25: Information sharing from Inventory to Operations

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> • Stock levels. • Rejected parts and quantity. • How much picking can be done daily. • Space available. • Full visibility of inventory. • Availability of material. • Material received and accepted. 	<ul style="list-style-type: none"> • How much picking can be done daily. • Short- and long-term stock turnover. • Storage capacity. • Availability of raw material. 	<ul style="list-style-type: none"> • Short- and long-term stock turnover.

- *Short-/Long-term stock turnover:* Any shortage in Inventory's information related to short- and long-term stock turnover may delay the production of the final product. However, accurate information from Inventory helps Operations to speed up production.

Conversely, the information that Operations should share with Inventory is shown in Table 26.

Table 26: Information sharing between Operations and Inventory

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> • MPS (Master production schedule) and quantity • Production plan • Generate scraping • Material requirement plan 	<ul style="list-style-type: none"> • Mass production schedule (MPS) • Production plan. • Rejected parts and quantity. • Report on Ready-to-go Parts • Generate Scraping. 	<ul style="list-style-type: none"> • Report on Ready-to-go Parts • Rejected parts and quantity.

- *Rejected Parts and Quantity*: Some serious damage and spoiled quality discovered in the production lines can delay or interrupt the production schedule; this, in turn, increases the cost of replacement. Therefore, Inventory should be kept informed so as to maintain robust control over the quality of stored items.
- *Report on Ready-to-go Parts*: The Operations department should continuously update Inventory with the list of the parts that are ready-to-go, which would simplify the delivery of the finished products to the target customers.

7.3.3.3 Procurement and Operations

Despite the active interdepartmental information sharing and data exchange between Procurement and Operations, some needed information is still either lost or missed when the information is shared. Such gaps may have serious consequences for the departments, which need sufficient and accurate information and data, as shown in tables 27 and 28. The information that Procurement should share with Operations is shown in Table 27.

Table 27: Information sharing from Procurement to Operations

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> • Shelf life • Datasheet (BOM) • Procurement plan • Lead time/arrival time for material • Any delay on delivery date of raw material • Shipping problems • Quality of ordered parts • Availability of material • New technology and data available in the market 	<ul style="list-style-type: none"> • Shipping problems • Rejected parts and quantity • Delivery schedule • Material plan. • New technologies and data available in the market 	<ul style="list-style-type: none"> • Rejected parts and quantity

- *Rejected Parts and Quality:* Missing data on parts and material would lead to delay in feeding the production line with the needed items of the required quality. Therefore, Operations might reject items that had been imported and thus interrupt the production phases of products.

Conversely, the missed information that operations should share with Procurement is shown in Table 28.

Table 28: Information sharing between Operations to Procurement

Information and Data Shared	Information and Data Required	Missing Data
<ul style="list-style-type: none"> • Production plan • Specific material required for production line • Material consumable • Yearly material resource plan • Generate scraping 	<ul style="list-style-type: none"> • Production plan • Production output. • Requirements with specification dates. • Tooling and spare parts needed 	<ul style="list-style-type: none"> • Production output • Tooling and components needed.

- *Tooling and Spare-parts Needed:* Procurement staff should be told exactly what staff in Operations require with regard to on-time spare parts and materials. This would give Procurement the chance to become better acquainted with the markets and suppliers of the required material and spare parts, so as to buy them at the best and cheapest cost.

- *Production Output:* Sharing information about production outputs could offer the Procurement team a sufficient clear comparison between inputs and outputs. This would give them ideas to speed up the production line by supporting the Operations department with new technologies or innovative solutions and with suggestions for producing the needed parts, whether in-house or outsourced. Furthermore, this information could gain enough for the Procurement team to cover the insurance required for the parts that had been used in producing these products through the main producers.

7.4 Summary

This chapter discussed the findings gained from an analysis of the interview responses of the senior managers, along with a statistical analysis of the survey data returned by the juniors. The investigations with both staff lines were on i) the patterns of intra-organisational information sharing amongst the SCM members; ii) the importance of information sharing practices to enhance the capability of each SCM department to implement Tawazun's manufacturing strategy; and iii) the main indicators for assessing the capabilities of the three SC departments.

Most of the senior managers strongly agreed on the profound importance of information as an asset and of sharing it, in building the desired capability of each SCM department. The seniors in all the SCM departments keenly encouraged the staff to practise sharing information actively; they argued that the possession of the right information brings the power to perform a task optimally by helping workers to make the right decisions and improve their capability and the firm's profitability.

The senior managers also proposed a range of indicators to measure the capability of each SCM Department. A content analysis of all the interviewees' responses identifies three main indicators for each SC department: production cost, capacity utilization, and labour and machine productivity for Operations, ii) Procurement cost, defect rates, and on-time delivery for Procurement, and iii) safety stock, inventory cost and turnover for Inventory. These indicators were then used in surveying the junior staff in the three SC departments to evaluate how far these indicators could be applied to gauge the value of the capability-related activities as a result of information sharing. The survey results show that some important indicators (production cost in Production, supplier defects rate in Procurement and inventory turnover in Inventory) were not highly

considered by the junior staff, which may have a negative effect on their department's capabilities.

Most of the senior managers and junior staff paid positive attention to the role of exchanging information with all departments in achieving high capability. By assessing information shared with and required from each SC department, I identified some important missing information that is needed to improve work performance and task achievement in Tawazun which would in turn increase supply chain capabilities.

Chapter 8: Conclusion and Practical Implications

This chapter concludes the dissertation, summarising the overall research findings and their practical implications for members of upper management rank in the UAE's military/defence industry. The chapter also assesses the overall theoretical contribution, offers some key recommendations and suggests ways to disseminate the results of the study.

8.1 Summary and Main Findings

This section presents the findings generated from the analysis of data collected from the interviews, surveys and participant observation. The data were drawn from both seniors and juniors in the three SCM departments of Tawazun's subsidiaries.

8.1.1 Value and Reliability of Information Sharing

Sharing information with other intra-organizational members in the defence environment is considered very sensitive. Our study shows that most senior managers and junior employees in the Tawazun firms were affected by this environment. The current top managers, whose background is military, are still considering all information, technical or otherwise, as a sensitive matter and wrap it in a thick coat of security, although, they know the importance of information availability and that easy access to relevant data is indispensable for sustaining production cost-effectiveness, market competitiveness, and the acquisition of quality raw material and components.

Our study also reveals that most of the interviewees at the same time considered information sharing an important and valuable activity to help them attain their goals,

make the right decisions and implement proper business strategy and resource management.

The investigations also revealed a conflict between the confidentiality of some information and the willingness and ability of the SCM members to share information readily in the workplace. Many senior managers with a military background believe that most of the information that reaches them is confidential and are not willing to share it with other SC members. Moreover, the position, education and professional background of management largely influence the information sharing pattern in Tawazun's supply chain system.

Most of the juniors apparently noted such conflict, which inhibited their keenness to receive and supply information and data when required. In addition, the quantitative analyses showed that in the process of sharing and exchanging, particularly amongst the juniors, a high proportion of the required interdepartmental information and data was omitted or ignored. Such gaps led to severe misunderstanding and wrong interpretation of the content of information, both received and released.

8.1.2 Information Sharing via Communication Channels and SC Capability

Still, the responses obtained from the senior managers and junior staff of the four subsidiaries indicated that most of the communication channels used in SC information sharing were satisfactory to some extent; however, some channels were not activated. The most preferred and convenient channels were found to be a group and face-to-face meetings, phone calls and text messages.

In Tawazun's firms, two channels are used by the SCM members for information sharing and communication: i) the physical approach of face-to-face dialogue and

official or ad hoc meetings; and ii) electronic devices, such as the ERP/GP system, line phones, mobiles, e-mail, video-conferencing, and, recently, the social media. However, staff's willingness to use e-devices regularly is sometimes burdened by worries and caution, along with poor awareness of the security of these devices in information sharing.

The interviews revealed that the physical communication (at meetings) between senior managers was comfortable. In contrast, e-mail was the most common type of communication channel, due to its ease of dissemination amongst the SCM members and the fact that it motivates them to respond actively to feedback. Despite this advantage, e-mail is less important than physical communication, to put it no stronger. Due to a security issue, all SCM members pass confidential documents to the target staff by hand.

The survey results showed that also physical communication (face-to-face and meeting) was often more uncomfortable for the junior staff than electronic channels were. Procurement staff were relying on the ERP/GP system and e-mail for the exchange of information, such as quotations, item specifications, graphic information (e.g., drawings, photos, web snapshots), and delivery schedules, along with reports. The Inventory staffs were relying on the same channels to manage the movement of material in and out of the warehouse, and to contact the logistics team directly to arrange shipments. The survey results also found that the ERP system was not fully activated or used and had a limited range of information management and sharing, such as getting approval for purchase requests (PRs), purchase orders (POs), and printing the POs and 'goods receive notes' (GRNs). The poor use of the ERP is attributed to not knowing how to use its full range of modules.

Both the Senior and Junior staff of the Tawazun subsidiaries prefer to use various secure communication channels in information sharing from top to bottom and *vice versa*, which could impact significantly on the capability of the three SCM departments. Moreover, the indicators concerned cannot be applied nor assessed without receiving the required information from other SCM departments in the organisation.

The communication channels that were involved in intra-organisational information sharing operate through either physical or electronic means. For instance, if the ERP system is adequately activated, it can give the users any desired information, such as specifications, drawings, technical reports (e.g., GRN, QC), and statistical data. The top management must make the data and information available and accessible when they are needed by the users to carry out their tasks and enhance their department's capability. Therefore, the continuous configuration and updating of the ERP data are necessary to make the ERP system useful and advantageous.

Tawazun's subsidiaries should establish an efficient network of communication channels to represent a virtual forum within which the Seniors and Juniors could share work-related information and data, discuss problems, and exchange experiences. Thus, the practice of information sharing in this work environment should not face any restriction or barrier.

8.1.3 Information Sharing and SC Capability

Achieving supply chain capability is a central concern of the top management of Tawazun because of its direct and indirect impact on their company's achievement. However, the interviews revealed that there is an appreciable lack of knowledge in

dealing with issues of capability (i.e., assessment, implementation etc.) The investigations identified the main capability indicators for all the SCM departments (Operations, Procurement and Inventory). For Operations, the main indicators in assessing capability are i) Labour and machine productivity, ii) Capacity utilization and iii) Production costs. For Procurement, the main indicators are; i) Supplier on-time delivery, ii) The defect rate of the quality of material and iii) Procurement cost, while for Inventory, the indicators are; i) Inventory turnover, ii) Safety inventory and iii) Inventory cost.

Although these indicators were mentioned by most of the senior managers, not everyone was aware how they should be used to assess the capabilities in their supply chain departments. Despite my experience in these firms, I have not heard about any indicators used to assess supply chain capabilities, although some of the firms seemed to be willing to use them. Furthermore, I found from the survey results that some important indicators were not highly considered by the junior staff, such as production cost in Production, supplier defects rate in Procurement and inventory turnover in Inventory, which all negatively affect the capabilities of each department.

Regarding the relationship between information sharing and supply chain capability, most of the senior managers and the juniors in the three SC departments paid positive attention to the impact of information sharing among the intra-organisational staff on their capabilities. However, the quantitative analysis of the interdepartmental information sharing and data exchange between the three departments revealed that some relevant information is either omitted or ignored in the process of sharing. The gaps thus created may cause serious side effects on the capabilities of the supply chain.

8.2 Theoretical Contribution of the Dissertation

One important theoretical contribution of this research concern the new SCM theory proposed by Cooper et al. (1997). This is the first study to address the importance of supply chain integration as an organic part of the SCM applications in the defence manufacturing industry.

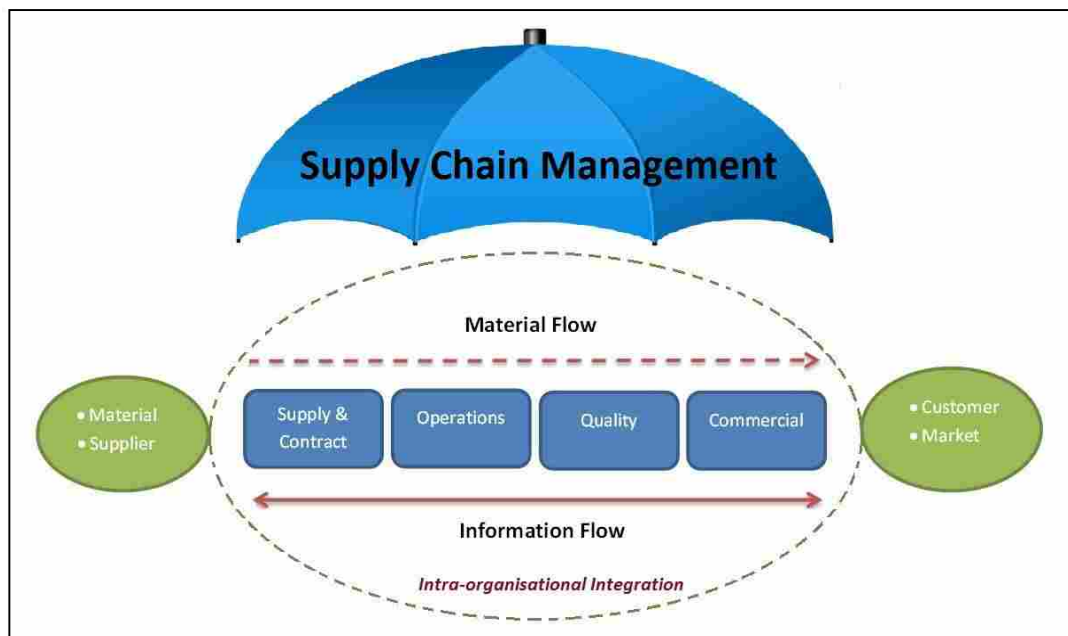


Figure 40: SCM New Concept

(Source: designed by the author)

As Figure 40 shows, the modern concept of the SCM enables a roadmap to be made so that manufacturing organisations can integrate their SCM system in a one-stop platform, from receiving raw materials or core components to the final assemblage or production, i.e., the new SCM paradigm integrates all the production processes in one ribbon or under one umbrella. This new concept also builds transparency, trust,

cooperation, and the transfer of knowledge between members so they can work as teams, increasing their capability and the efficiency of the firm.

The significant contributions of the integration approach are manifested in an effective pattern of interdepartmental management in the SCM system. This paradigm breaks down the barriers between the major units taking care of the success and efficiency of the SCM applications. This borderless condition promotes the flow of raw material across the production lines, and of information sharing and data exchange amongst the SCM members. Furthermore, the new concept can be the major point that can make Tawazun's processes run harmoniously, increasing the integration of its members/departments and encouraging them to exchange information, data, ideas, experience, and consultation with each other. It will also help Tawazun's subsidiaries to be strong competitors in the defence industry. In addition, the new SCM concept will lead Tawazun to consider the various capabilities of Procurement, logistic, Inventory, Operations, Quality and sales as essential components of their SCM activities and processes.

Another theoretical contribution of the research is that it gives due weight to the role of intra-organisational information sharing on supply chain capabilities in the defence manufacturing sector. Many studies have focused on the inter-organisational integration between the company and upstream suppliers and downstream customers. Moreover, all existing researchers have studied the impact of the SCM integration on the company's performance rather than capability, while few have examined the application of supply chain practices in the defense manufacturing industry (military vehicles, ammunition, and more). Although the UAE have only recently been involved in the defence/military sector, they pay great attention to developing it and have spent

a huge amount of money to make it one of their strongest industries. I have tried through this research to support this success. During my DBA journey, I have studied supply chain activities in Tawazun's subsidiaries and seen how intra-organizational information sharing practices can help them to enhance their competencies, productivity and capabilities.

8.3 Practical Implications and Recommendations

This research has tremendous practical implications for the members of upper management in the UAE military/defence industry. Implementing intra-organisational information sharing practices to enhance supply chain capabilities is critical, especially in the firms that are working to develop defence industries in UAE. They want their country to be a leader in this regard in the MENA countries, and also to allow it enough room to develop its own of independence defence arsenal and preserve national security.

Furthermore, running a defence factory requires the use of a new concept of supply chain management, along with an effective logistics system. Tawazun should to consider the results and recommendations in this dissertation if it is to improve its manufacturing costs, production quality, market competitiveness, and importantly keep the loyalty and satisfaction of its customers, suppliers, and other stakeholders.

8.3.1 Information Sharing Value and Reliability

The findings of our research reveal that most of the senior managers put deep trust in the importance and significant value of information sharing as a way of improving product quality and decision-making processes. Moreover, they considered the

reliability of shareable information as a tool for keeping all Tawazun's staff in the loop, increasing their teamwork spirit, and motivating them to learn and respond to new advances in their work domains. The following recommendations will, it is hoped, help top managers and decision-makers in the supply chain for defence manufacture to understand the importance of information sharing value and reliability.

- The top managers (e.g., CEOs, and the like) need to change their view of information sharing because it is of strategic business importance and not to be dealt with as a security matter. Such changes of outlook can pave the way for information sharing amongst the firm's members to flourish. Thus, the top managers can take the credit for widening the circle of the firm's members who are willing to share and exchange information and technical data.
- The top managers should realise the importance of information as a commodity. Sharing it is a key factor for keeping the firm's integrity and survival in a today's complex business environment. In this way, Tawazun's firms can preserve their success by meeting their obligations, supporting the customer's confidentiality, understanding the concept of information sharing and treating it as the first step on the road to success. The management of information flow is an important element in the SCM process because it helps to identify demand, share information, establish expectations, define the scope of the service and the skills required of service providers, and provide feedback on performance (Ellram et al., 2004; Ruggles, 200; Sakun et al., 2017).
- The top managers should enforce a set of policies and regulations that covers information sharing and access across all members/departments. These policies should suggest ways to classify information and to meet the need to share information while preserving the confidentiality of sensitive material. This will

help the defence organizations to secure the willingness to share information among SC members.

- To avoid conflict in information sharing between the top managers (as initiators) and junior staff (as recipients), it is necessary to make data and information shareable amongst all members; moreover, the top managers should encourage the junior members to become involved in the information sharing cycle.
- Effective information sharing and efficient intra-organization integration in the SCM system of Tawazun's subsidiaries could be made possible by changing the attitudes of the top managers to information itself, and by developing a climate of trust for shareable information, a motivating environment of team spirit and cooperation, and transparency between the SCM members.
- The habit of information sharing is particularly important for updating the intra-organisational members; it clarifies the best ways to carry out their tasks and improve productivity. Moreover, continuous updating can help Tawazun's firms to attain their goals and implement their plans.
- Implementing the vision of Tawazun as an information-sharing organism tends to increase the popularity of teamwork among the staff. This, in turn, sparks strong interest in sharing information as an individual initiative in each SCM member. In this case, the project-based manufacturing paradigm may be the most suitable for effectively sharing information in the execution of the firm's business objectives and marketing strategy. Furthermore, listening to the voice of stakeholders can gain their genuine loyalty, confidence, and trust if a firm answers their requests, abiding by deadlines and keeps to the delivery schedule.

My professional experience in NIMR and Caracal suggests that Tawazun needs to hire managers who have accumulated their management experience in a commercial setting; this would blend the military concept of management with a business one. Moreover, top managers in Tawazun should develop the firm's awareness of the importance of information sharing by conducting a series of training sessions and specialised courses.

8.3.2 Information Sharing and Communication Channels

It is now urgently necessary to activate all communication channels for information sharing, to give Tawazun subsidiaries an opportunity to work under one umbrella and to share information effectively among all the SCM workers. The following recommendations will, it is hoped, help Tawazun's sub-firms

- Use communication channels effectively to improve performance, capability and efficiency. The channel of face-to-face or group meetings can help the employees to clarify the information that they require. It may also enable them to learn more from other members of staff and prevent them from being deprived of up-to-date information.
- Tawazun's management should consider the importance of producing minutes from meetings. It must become mandatory, especially from the main meetings that are regularly initiated through senior managers. The benefit from circulating these minutes is that they will update managers about new projects, strategies, decisions, etc. and will inform other staff about their work and make them accountable for carrying it out.
- Using the channel of phone calls and text message in business would help the senior managers to get the information that they require, but this channel

should be made secure (by using the firm's account only); Email too is a quick and useful channel for sending information to many people at once. Messages should be sent only to the intended recipients; otherwise employees can receive confidential information which the management does not want all the employees to share. Furthermore, this channel should not allow all type of file to be sent – those with graphics require huge capacity to deliver. Moreover, email alone cannot present some information clearly enough.

The top management should invest more money in upgrading the ERP/GP system in their firms because of the long-term financial benefits that would accrue from these upgrades. In addition, they should encourage all departments to implement all the modules effectively, conduct training sessions for using these modules and connect the modules with the firm's procedures. Doing this would increase the transparency and knowledge between staff that would help them to work efficiently and thus increase their productivity.

- The decision-makers in these firms should learn the importance of implementing the ERP system and consider it the main artery of the firm, and an advanced technical component of information resources management. They should trust this system and use it as a safe channel for exchanging information and documents among members.

8.3.3 Information Sharing and SC Capability

In this research, we identified the main indicators of capabilities in the three SC departments of Tawazun's firms. It is hope that the following recommendations will help Tawazun's managers to make use of these indicators in a way that will raise the firm's capability:

- Top managers need to implement the proposed indicators to measure and assess the supply chain capabilities in Operations, Inventory and Procurement.
- Top managers and decision-makers need to increase awareness among juniors of the importance of the supply chain capabilities. This could help them to maximize their efficiency at work and increase the firm's competitive power in the market. As Al-Shboul & Anwer (2017) comment, the capability of firms to manage their delivery mode(s) will achieve great benefits by improving their external operations, cost and waste reduction, and be more flexible and fast to meet changes in customer demand to gain sustainable competitive advantage.
- Top managers need to ensure that the interdepartmental information sharing and data exchange between the departments are practised in an efficient way that loses no relevant information from any department, because of the serious consequences of doing so.

Although this study has been applied to defence firms in the UAE, our findings and recommendations could be applied to non-defence firms in the UAE or in other countries, especially the implementation of the new supply chain management concept, which would increase the efficiency of companies and their productive capabilities.

8.4 Dissemination of Results

An important aspect of DBA dissertations is the dissemination of their findings and results. The results of this DBA dissertation will be disseminated as follows:

- a) A summary of the research results and recommendations will be sent to EDIC, Tawazun, MOD and GHQ.

- b) Presentations will be made to practitioners in the SCM field, especially in the defence sector: through these presentations, the new SCM concept can be explained and the importance and role of the intra-organisational information sharing practices can be conveyed.
- c) The results obtained from this research will be implemented in UAE factories. It is planned to implement the new SCM concept in a new car factory in Abu Dhabi where I will be CEO from July 2018.
- d) It is planned to submit one or two papers to academic journals in the SCM field for publication.

8.5 Limitations of the Study

Conducting this research has presented many challenges. One major challenge was to make a case study of the defence industries firm Tawazun, where the military background of the top managers made all information a matter of confidentiality, and the participants in the two types of investigation were very cautious about what they disclosed. However, my affiliation with a subsidiary firm, Caracal, helped to offset this limitation since I was able to promise that their statements would not be passed to any third party and that no named participant would appear in the dissertation contents.

Another limitation of the study is the number of departments examined in this study. The research was limited to consider 3 supply chain departments (Operations, Procurement, and Inventory). Future research could include other relevant departments like Sales, Engineering and Quality. Finally, given the low number of junior participants and their background level in supply chain management, we could not rely on inferential analysis to investigate the role of information sharing on enhancing supply chain capabilities in Tawazun's subsidiaries. However, descriptive statistics

from quantitative data gave us interesting findings and allowed us to provide practical recommendations to decision makers in the supply chain and defence fields.

8.6 Future Research

The motivation for the present research was that SCM applications in the defence industries were not sufficiently investigated from a scholarly perspective. The findings of this research study show that the applications of the modern concept of SCM can significantly improve Tawazun's capabilities, performance, and product quality to support Tawazun's market competitiveness locally and internationally.

This is the first research study conducted in the UAE and the neighbouring region to investigate the role of intra-organisational information sharing on supply chain capabilities in the defence sector. The study paves the way for further related studies in the future; these might include:

- The role of information sharing in the external integration of defence firms with their suppliers and customers.
- Investigating defence firm capabilities from other perspectives (e.g., business, financial, political, socio-cultural, etc.)
- The possible relationship between introducing innovative SCM techniques and the sustained capability of the SC departments.
- SC capabilities in other manufacturing and service sectors in the UAE and MENA region.

8.7 Reflections

I decided to pursue a DBA program to develop my professional career and to be equipped with advanced knowledge and practices that would allow me to contribute significantly to my work in the defence industry. Gathering the content of this dissertation has progressively blended my work experience and expertise with the theoretical and research knowledge to solve potential SCM-related problems in practice.

During my DBA journey, I have been exposed to challenges and have gained in practical knowledge far beyond academic limits as I collected data by interviewing, surveying and observing SCM practitioners. The findings of this study will, as it is hoped, allow me to continue developing advanced research capacity to conduct further scholarly studies on SCM in the UAE manufacturing context.

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Appendix 1: Interview Survey Questions



Research Title: *The role of supply chain information sharing in enhancing the capabilities of a military industries firm: The case of Tawazun's firms*

Date:

Start time:

End time:

Location:

Interviewer:

Interviewee:

Consent form signed? Yes / No

Do you agree to tape the interview? Yes | No

At the beginning of the interview I will follow these steps:

- Identify myself, depending on the interviewee knowledge of my (name, DBA student, etc.).
- Thank the interviewer for participation. "Your input will be very valuable to my research and I appreciate the time you are taking to answer my questions".
- Confidentiality of responses is guaranteed.
- The approximate length of the interview is 50 minutes or so, there are two major areas of questions.
- The purpose of research is to ...

At the end of the interview; I will

- thank the interviewee.
- reassure confidentiality.
- Ask if it is OK to come back later perhaps for clarifying some issues, if needed, in another interview.

After leaving interview venue – Closure; I will

- Note down any observations I have in the interview setting, interviewee office, etc., to do this immediately after the interview.
- Write down any observations I had overall about the interview.

Interview Questions

Background information: 5-10 minutes or so - ask the respondent to give me some background information about themselves, e.g. educational background, career progression, the biggest challenge they faced in their career, etc., (*later this can be used in the analysis, and this will also ease the respondent to talk freely*). My intention is to gain some insights into the sharing information channels among the members in your firm; how the members accept and implement these channels through different ways such as communication and coordination.

A. Operational Capability

Attempt to gauge their transparency around sharing information with other departments among firm, like inform them about the production plan, factory capacity, etc. Likewise, how getting information from other departments that will impact on their capability and the channels that are used to share that information.

- 1) What do you think “information sharing” means in the context of your job?
- 2) In your opinion; why is important to share information across departments?
- 3) How are you sharing this information?
- 4) Could you mention three measures/metrics of operations capability?

- 5) What is the system that is used to control and manage your operations processes? Please point out the benefits from using this system?
- 6) What information is required from the key SC departments (Procurement, Inventory, Operations) that impact positively or negatively on your capability?
- 7) What information is required by the key departments like Procurement Department, Inventory Department or other departments that will impact positively or negatively on their capabilities?

B. Procurement Capability

Attempt to gauge their transparency around sharing information with other departments among firm, like inform them about the raw material, lead time, procurement plan, delivery schedule for raw materials. Likewise, how getting information from other departments that will impact on their capability and the channels that are used to share that information.

- 1) What do you think “information sharing” means in the context of your job?
- 2) In your opinion; why is it essential to share information across departments?
How are you sharing this information?
- 3) Could you mention three measures/metrics of procurement capability?
- 4) What is the system that is used to control and manage your procurement processes? Please point out the benefits from using this system?
- 5) What information is required from the key departments like Operations Department, Inventory Department or other departments that impact on your capability positively or negatively?
- 6) What information is required by the key departments like Operations Department, Inventory Department that will impact positively or negatively on their capabilities?

C. Inventory Capability

Attempt to gauge their transparency around sharing information with other departments among firm, like inform them about the inventory level, raw material availability, etc. Likewise, how we are getting information from other departments that will impact on their capability and the channels that used to share that information.

- 1) What do you think “information sharing” means in the context of your job?
- 2) In your opinion; why is it important to share information across departments?
- 3) How are you sharing this information?
- 4) Could you mention three measures/metrics of inventory capability?
- 5) What is the system that is used to control and manage your inventory processes? Please point out the benefits from using this system?
- 6) What information is required from the key departments like Procurement Department, Operations Department that will impact positively or negatively on your capability?
- 7) What information is required by the key departments like Procurement Department, Operations Department or other departments that will impact positively or negatively on their capabilities?

Appendix 2: Questionnaire Survey - Operations

This survey is designed to study the impact of sharing information among departments on supply chain capability. It also aims to analyse various channels of information and how they affect supply chain capability.

A. General Information

➤ Demography

Gender: Male Female

Educational level:

Age: 20s 30s 40s 50s
or older

➤ Current Work Information

- Company Name:
- Department Name:
- Background: Commercial Military
- For how long have you been working with this company?

Occupation/ Profession:

B. Operations Department

1) Information Sharing with other SC Departments

Key: D= daily W= weekly, M= monthly, Q= quarterly

No.	Question	D	W	M	Q	Other
1	How often is the information related to procurement plan shared by the Procurement with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	How often is the information related to new technologies in product and process design shared by Procurement with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	How often is the information related to quantity and quality of raw materials shared by the Procurement with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	How often is the information related to raw materials shipping problems shared by the Procurement with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	How often is the information related to raw materials availability shared by the Warehouse with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	How often is the information related to storage capacity shared by the Warehouse with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	How often is the information related to stock levels and safety stock shared by the Warehouse with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	How often is the information related to inventory control policy shared by the Warehouse with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	How often is the information related to part specifications shared by the Engineering with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	How often is the information related to inspection and quality of materials shared by the Quality with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	How often is the information related to workforce and staff training shared by the HR with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	How often is the information related to maintenance plan shared by the Maintenance with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	How often is the information related to client feedback shared by the Sales & Marketing with the Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2) Channels of Information Sharing

Key: **SD**= Strongly disagree, **DA**= Disagree, **N**= Neutral, **AG**= Agree, **SA**= Strongly agree

No.	Question	SD	DA	N	AG	SA
14	Currently, the GP/ERP system is the main channel of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Currently, Emails and Text messages are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Currently, Face-to-Face Meetings are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Currently, Phone Calls are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3) Operations Capability

Key: **VH**= Very high, **H**= High, **M**= Medium, **L**= Low, **VL**= Very low

No.	Question	VH	H	N	L	VL
18	Which level of capability related to production costs is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Which level of capability related to capacity utilisation is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Which level of capability related to labour and machine productivity is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 3: Questionnaire Survey - Procurement

This survey is designed to study the impact of sharing information among departments on supply chain capability. It also aims to analyse various channels of information and how they affect supply chain capability.

A. General Information

➤ Demography

Gender: Male Female

Educational level:

Age: 20s 30s 40s 50s
or older

➤ Current Work Information

- Company Name:
- Department Name:
- Background: Commercial Military
- For how long have you been working with this company?

Occupation/ Profession:

B. Procurement Department

1) Information Sharing with other SC Departments

Key: D= daily W= weekly, M= monthly, Q= quarterly

No.	Question	D	W	M	Q	Other
1	How often is the information related to production master schedule (MPS) shared by the Operations with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	How often is the information related to production plan shared by the Operations with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	How often is the information related to part requirements (quantity, quality, delivery date) shared by the Operations with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	How often is the information related to tooling and spare parts needed to be shared by the Operations with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	How often is the information related to raw material availability shared by the Warehouse with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	How often is the information related to storage capacity shared by the Warehouse with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	How often is the information related to stock levels and safety stock shared by Warehouse with Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	How often the information related to goods received notes (GRN) is shared by Warehouse with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	How often is the information related to part specifications shared by the Engineering with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	How often is the information related to inspection and quality of material shared by the Quality Department with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	How often is the information related to workforce and staff training shared by the HR with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	How often is the information related to payments, budget and cash flows shared by the Finance with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	How often is the information related to payments, budget and cash flows shared by the Sales & Marketing with the Procurement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2) Channels of Information Sharing

Key: SD= Strongly disagree, DA= Disagree, N= Neutral, AG= Agree, SA= Strongly agree

No.	Question	SD	DA	N	AG	SA
14	Currently, the GP/ERP system is the main channel of sharing information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Currently, Emails and Text messages are the main channels of sharing information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Currently, Face-to-Face and Meetings are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Currently, Phone Calls are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3) Operations Capability

Key: VH= Very high, H= High, M= Medium, L= Low, VL= Very low

No.	Question	VH	H	N	L	VL
18	Which level of capability related to procurement costs is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Which level of capability related to supplier defect rates is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Which level of capability related to the supplier on-time deliveries is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 4: Questionnaire Survey - Inventory

This survey is designed to study the impact of sharing information among departments on supply chain capability. It also aims to analyse various channels of information and how they affect supply chain capability.

A. General Information

➤ Demography

Gender: Male Female

Educational level:

Age: 20s 30s 40s 50s
or older

➤ Current Work Information

- Company Name:
- Department Name:
- Background: Commercial Military
- For how long have you been working with this company?

Occupation/ Profession:

B. Inventory (warehouse) Department

1) Information Sharing with other SC Departments

Key: D= daily W= weekly, M= monthly, Q= quarterly

No.	Question	D	W	M	Q	Other
1	How often is the information related to shelf life shared by the Procurement with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	How often is information related to procurement plan shared by the Procurement with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	How often is the information related to quantity and quality of raw material shared by the Procurement with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	How often is information related to raw materials shipping problems shared by the Procurement with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	How often is the information related to master production schedule (MPS) shared by the Operations with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	How often is the information related to production plan shared by the Operations with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	How often is the information related to quantity and quality of finished parts shared by the Operations with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	How often is the information related to delivered finished parts shared by the Operations with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	How often is the information related to part specifications shared by the Engineering with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	How often is the information related to inspection and quality of materials shared by the Quality Department with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	How often is the information related to workforce and staff training shared by the HR Department with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	How often is the information related to delivery schedule from client shared by the Sales & Marketing with the Warehouse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2) Channels of Information Sharing

Key: SD= Strongly disagree, DA= Disagree, N= Neutral, AG= Agree, SA= Strongly agree

No.	Question	SD	DA	N	AG	SA
14	Currently, the GP/ERP system is the main channel of sharing information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Currently, Emails and Text messages are the main channels of sharing information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Currently, Face-to-Face and Meetings are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Currently, Phone Calls are the main channels of information sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3) Inventory Capability

Key: VH= Very high, H= High, M= Medium, L= Low, VL= Very low

No.	Question	VH	H	N	L	VL
18	Which level of capability related to safety inventory is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Which level of capability related to inventory costs is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Which level of capability related to inventory turnover is achieved in your Department?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>