

**REPUBLIC OF TURKEY  
ISTANBUL UNIVERSITY  
GRADUATE SCHOOL OF SOCIAL SCIENCES  
BUSINESS & MANAGEMENT DEPARTMENT  
BUSINESS & MANAGEMENT Ph.D. PROGRAM**

**Ph.D. DISSERTATION**

**Examining the Mediating Role of Supply Chain  
Integration on the Relationship Between  
Lean/Agile Supply Chain, and Firm  
Performance**

**Yasemin ÜLKER  
2502180208**

**SUPERVISOR  
Prof. Dr. Güven ORDUN**

**İSTANBUL – 2023**

**ABSTRACT**

**EXAMINING THE MEDIATING ROLE OF SUPPLY CHAIN  
INTEGRATION ON THE RELATIONSHIP BETWEEN  
LEAN/AGILE SUPPLY CHAIN, AND FIRM PERFORMANCE**

**YASEMİN ÜLKER**

Businesses are under increasing pressure to remain competitive, inventive, and sustainable in the current global economic environment. Supply chain integration (SCI) aims to collaborate with various entities (supplier, customer, etc.) enabling them to work together to use company resources more efficiently and effectively and achieve business performance. The main purpose of this study is to strengthen supply chain integration for operational and financial performance by promoting leanness and agility and to observe whether the learning organization model will play a moderator role in this relationship. Incorporating supply chain management approaches with organizational behavior and strategic management perspectives is the study's complementary goal. Recent studies show that supply chain integration is fundamental to logistics and business performance. The terms "lean" and "agile" techniques are relatively recent in the literature on supply chains. The idea of lean production served as the foundation for the lean methodology. It seeks to eliminate any procedure that does not provide value and to prevent all forms of waste. While the agile approach is more focused on the business's strategic direction. An agile strategy is one that adheres to the principles of flexibility, quick change adaptation, and maneuverability. The literature has focused on supply chain integration from various perspectives including process, departmental communication, culture, sustainability, digitalization, and other factors. This study focuses on internal, supplier, and customer integration by considering integration as a whole. A survey method was employed in this study, with 177 manufacturing companies completing the questionnaire, representing one middle or senior manager from each company. The PLS-SEM was employed to analyze the data, using SMART-PLS software to test the research model. The findings reveal that lean and agile supply chains positively influence supply chain integration (internal, external, and customer). While internal and supplier integration positively affects operational performance, the effect of customer integration on operational performance has not been found. Furthermore, it

has been observed that the learning organization has a positive moderator effect on the relationship between the agile supply chain and internal, supplier and customer integration. However, the learning organization has not been found to have a moderator effect between the lean supply chain and internal, supplier and customer integration. Finally, it has been determined that operational performance has a positive effect on financial performance. These findings have important implications for managers, who may want to think about integrating agile and lean supply chain into integration methodologies and developing a learning organization culture to improve performance.

**Keywords:** supply chain integration, lean supply chain, agile supply chain, learning organization, financial performance, operational performance, PLS-SEM

## ÖZ

# YALIN/ÇEVİK TEDARİK ZİNCİRİ VE PERFORMANS İLİŞKİSİNDE TEDARİK ZİNCİRİ ENTEGRASYONUNUN ARACI ROLÜNÜN İNCELENMESİ

YASEMİN ÜLKER

İşletmeler, mevcut küresel ekonomik ortamda rekabetçi, yaratıcı ve sürdürülebilir kalma konusunda artan bir baskı altındadır. Tedarik zinciri entegrasyonu (TDE), şirket kaynaklarını daha verimli ve etkili bir şekilde kullanmak ve iş hedeflerine ulaşmak için kuruluşların hem kendi iç bünyesinde hem de müşteri ve tedarikçileriyle entegre çalışmalarını amaçlamaktır. Bu çalışmanın temel amacı, öğrenen organizasyonlar aracılığıyla yalınlığı ve çevikliği teşvik ederek iş performansı için tedarik zinciri entegrasyonunu güçlendirmektir. Tedarik zinciri yönetimi yaklaşımlarını örgütsel davranış ve stratejik yönetim perspektifleriyle birleştirmek, çalışmanın tamamlayıcı hedefleri arasındadır. Son çalışmalar, tedarik zinciri entegrasyonunun lojistik ve iş performansı için gerekli olduğunu göstermektedir. "Yalın" ve "çevik" terimleri, tedarik zinciri literatüründe nispeten yenidir. Yalın üretim fikri, yalın metodolojinin temelini oluşturur. Değer sağlamayan her türlü prosedür ortadan kaldırmayı ve her türlü israfı önlemeyi amaçlar. Çevik yaklaşım ise daha çok işletmenin stratejik yönüne odaklanır. Çevik bir strateji, esneklik, hızlı değişime uyum ve manevra kabiliyeti ilkelerine bağlı olan stratejidir. Literatür, tedarik zinciri entegrasyonuna süreç, departman iletişimi, kültür, sürdürülebilirlik, dijitalleşme ve diğer faktörler dahil olmak üzere çeşitli açılardan odaklanmıştır. Bu çalışma, entegrasyonu bir bütün olarak ele alarak dâhili, tedarikçi ve müşteri entegrasyonuna odaklanmaktadır. Bu çalışmada, her şirketi temsilen bir orta veya üst düzey yönetici ile 177 imalat şirketiyle anket çalışması yapılmıştır. Araştırma modelini test etmek için SMART-PLS yazılımı kullanılarak verileri analiz etmek için PLS-SEM yöntemi uygulanmıştır. Bulgular, yalın ve çevik tedarik zincirlerinin tedarik zinciri entegrasyonunu (dâhili, harici ve müşteri) olumlu etkilediğini ortaya koymaktadır. Dâhili (iç) ve tedarikçi entegrasyonu operasyonel performansı olumlu etkilerken, müşteri entegrasyonunun operasyonel performans üzerindeki etkisi bulunamamıştır. Ayrıca, öğrenen organizasyonun çevik tedarik zinciri ile dâhili (iç), tedarikçi ve müşteri entegrasyonu arasındaki ilişki üzerinde olumlu bir düzenleyici (moderatör) etkisi olduğu gözlenmiştir. Ancak öğrenen organizasyonun, yalın tedarik zinciri ile dâhili, tedarikçi ve müşteri entegrasyonu arasındaki moderatör

etkisine rastlanmamıştır. Son olarak, operasyonel performansın finansal performansı olumlu yönde etkilediği saptanmıştır. Bu bulguların, performansı artırmak için çevik ve yalın tedarik zinciri entegrasyon metodolojilerini entegre etmeyi ve öğrenen bir organizasyon kültürü geliştirmeyi düşünmek isteyebilecek yöneticiler için önemli çıkarımları vardır.

**Anahtar Kelimeler:** tedarik zinciri entegrasyonu, yalın tedarik zinciri, çevik tedarik zinciri, öğrenen organizasyon, finansal performans, operasyonel performans, PLS-SEM



## PREFACE

The main purpose of this study is to strengthen supply chain integration for business performance by promoting leanness and agility. My thesis process has contributed to my life in a variety of ways outside of its theoretical value. These are just a few examples of how they helped shape my perspective, tenacity, abilities, and particularly how I address the challenges. It inspired me to conduct research on a wide range of sources from numerous different fields besides my thesis topic. This demonstrated once more how science has no boundaries and inspires individuals to push those limits.

I want to express my appreciation to a great number of people for helping me write this dissertation. I want to begin by thanking Prof. Dr. Güven ORDUN, who was my Ph.D. advisor, for his inspiration and extensive expertise. Additionally, I want to express my gratitude to Prof. Dr. Hakkı AKTAŞ and Assoc. Prof. Dr. Turhan ERKMEN for their valuable suggestions, direction and especially for their support during the data collection phase of my thesis. Furthermore, I consider myself grateful to have Prof. Dr. Yavuz GÜNALAY as my department head and member of my thesis committee, I'd like to express my gratitude for his support throughout the entire writing of my thesis and valuable feedback. Finally, I would like to thank Dr. Erdem ERZURUM who helped me to construct the research design from the beginning to the end.

Along with thanking my dear family members (mother, father, brothers and brother's wives) who have never doubted that I will succeed in my life. I would like to express my endless thanks to my dear mommy who is the most powerful woman in my life and thought me to stay strong and to my dad, who encouraged me to be a researcher since I was 8 years old, and to make me believe that perseverance and hard work are the secrets of success. The special thanks to my older brother who support me especially psychologically, finally to my dear uncle for always guiding me and opening my horizons.

Finally, I would like to thank my very dear friends (especially, Eren Şengelen, Elif Dursun and Elif Nur Eken) and colleagues from Bahçeşehir University for both sharing my problems during this process and helping me in data collection process. My colleague, who passed away suddenly on April 28, 2023, I would like to convey my thanks to Dr. Çağkan UBAY and commemorate him with mercy.

I hereby certify that all data in this publication was gathered and presented in compliance with ethical standards and scholarly guidelines.

Yasemin ÜLKER

İSTANBUL, 2023



## TABLE OF CONTENTS

|                       |      |
|-----------------------|------|
| ABSTRACT              | ii   |
| ÖZ                    | iv   |
| PREFACE               | vi   |
| LIST OF TABLES        | xi   |
| LIST OF FIGURES       | xiii |
| LIST OF APPENDICES    | xv   |
| LIST OF ABBREVIATIONS | xvi  |
| INTRODUCTION          | 1    |

### CHAPTER ONE

#### SUPPLY CHAIN INTEGRATION

|                                                  |    |
|--------------------------------------------------|----|
| 1.1. Supply Chain Management (SCM)               | 6  |
| 1.1.1. Top Performing Companies Traits           | 10 |
| 1.1.2. SCOR and CPFR Models                      | 11 |
| 1.1.3. SCM Components                            | 14 |
| 1.1.4. Supply Chain Barriers                     | 18 |
| 1.2. SUPPLY CHAIN INTEGRATION                    | 20 |
| 1.2.1. Supply Chain Integration Types            | 31 |
| 1.2.2. Approaches to Supply Chain Integration    | 34 |
| 1.2.2.1. Resource Based View (RBV)               | 36 |
| 1.2.2.2. Dynamic Capability View (DCV)           | 37 |
| 1.2.2.3. Relational View                         | 38 |
| 1.2.2.4. Social Exchange Theory                  | 38 |
| 1.2.2.5. Knowledge-based View                    | 39 |
| 1.2.2.6. Strategic fit theory                    | 40 |
| 1.2.2.7. Information processing theory           | 40 |
| 1.2.2.8. Transaction cost economics theory (TCE) | 41 |
| 1.2.2.9. Institutional theory                    | 41 |
| 1.2.2.10. Social Network Perspective             | 42 |
| 1.2.2.11. Social capital theory                  | 43 |

### CHAPTER TWO

#### LEAN SUPPLY CHAIN

|                                                       |    |
|-------------------------------------------------------|----|
| 2.1. Industrialization                                | 45 |
| 2.2. The Toyota Production System/ Lean Manufacturing | 46 |
| 2.2.1. Lean Manufacturing and Industry 4.0            | 49 |
| 2.2.2. Lean Thinking                                  | 50 |
| 2.2.2.1. 5 basic principles of lean thinking          | 51 |
| 2.2.3. Waste Resources                                | 53 |
| 2.2.3.1. Muda                                         | 54 |
| 2.2.3.2. Muri                                         | 56 |
| 2.2.3.3. Mura                                         | 56 |
| 2.3. Lean Transformation Method                       | 56 |
| 2.4. The Lean Supply Chain Roadmap                    | 58 |
| 2.4.1. Lean Supply Chain Tools                        | 61 |

|                                                |                                                 |     |
|------------------------------------------------|-------------------------------------------------|-----|
| 2.4.1.1.                                       | Just in Time (JIT)                              | 61  |
| 2.4.1.2.                                       | Kanban (pull system)                            | 62  |
| 2.4.1.3.                                       | Jidoka (automation)                             | 62  |
| 2.4.1.4.                                       | Visual management                               | 63  |
| 2.4.1.5.                                       | Andon                                           | 63  |
| 2.4.1.6.                                       | Poka-yoke                                       | 64  |
| 2.4.1.7.                                       | 5S workplace arrangement                        | 64  |
| 2.4.1.8.                                       | Kaizen (Continuous Improvement)                 | 64  |
| 2.4.1.9.                                       | Gemba walk                                      | 64  |
| 2.4.1.10.                                      | Heijunka (work balancing)                       | 65  |
| 2.4.1.11.                                      | SMED (single minute exchange of die)            | 65  |
| 2.4.1.12.                                      | Total productive maintenance (TPM)              | 65  |
| 2.4.2.                                         | Critical elements for lean supply chain success | 65  |
| <b>CHAPTER THREE</b>                           |                                                 |     |
| <b>AGILE SUPPLY CHAIN</b>                      |                                                 |     |
| 3.1.                                           | What is Agility?                                | 67  |
| 3.2.1.                                         | Characteristics of Agile Organization           | 71  |
| 3.3.                                           | Agile Manufacturing                             | 72  |
| 3.3.1.                                         | Agile Manufacturing and Industry 4.0            | 73  |
| 3.4.                                           | Agile Supply Chain                              | 74  |
| <b>CHAPTER FOUR</b>                            |                                                 |     |
| <b>LEARNING ORGANIZATION</b>                   |                                                 |     |
| 4.1.                                           | The Laws of the Fifth Discipline                | 81  |
| 4.2.                                           | Team Learning                                   | 85  |
| 4.3.                                           | Organizational Learning                         | 87  |
| 4.4.                                           | Agility and Learning Organization               | 88  |
| <b>CHAPTER FIVE</b>                            |                                                 |     |
| <b>THE RELATIONSHIP BETWEEN MAIN VARIABLES</b> |                                                 |     |
| 5.1.                                           | Lean vs. Agile                                  | 90  |
| 5.3.                                           | Lean vs. Agile Supply Chain and Performance     | 97  |
| <b>CHAPTER SIX</b>                             |                                                 |     |
| <b>METHODOLOGY</b>                             |                                                 |     |
| 6.1.                                           | Design of the Study                             | 101 |
| 6.2.                                           | Significance and Aim of the Research            | 102 |
| 6.4.                                           | Hypothesis                                      | 104 |
| 6.5.                                           | Variables of the Research Model                 | 107 |
| 6.5.1.                                         | Independent Variables                           | 108 |
| 6.5.2.                                         | Dependent Variable                              | 108 |
| 6.5.3.                                         | Moderating Variable                             | 108 |
| 6.5.4.                                         | Mediating Variable                              | 109 |
| 6.6.                                           | Sampling and Data Collection                    | 109 |
| 6.6.1.                                         | Manufacturing Industry in Türkiye               | 109 |
| 6.7.                                           | Questionnaire design                            | 111 |
| 6.8.                                           | Sample Characteristics                          | 113 |
| 6.9.                                           | Descriptive Statistics                          | 115 |

|                                  |                                              |            |
|----------------------------------|----------------------------------------------|------------|
| 6.9.1.                           | Lean Supply Chain Scale                      | 118        |
| 6.9.2.                           | Agile Supply Chain Scale                     | 119        |
| 6.9.3.                           | Supply Chain Integration Scale               | 120        |
| 6.9.4.                           | Performance Scale                            | 121        |
| 6.9.5.                           | Learning Organization Scale                  | 122        |
| 6.10.                            | Structural Equation Modelling (SEM)          | 123        |
| 6.10.1.                          | CB-SEM vs. PLS-SEM                           | 125        |
| 6.10.1.1.                        | The Measurement Model                        | 128        |
| 6.10.1.2.                        | Structural Model                             | 130        |
| <b>CHAPTER SEVEN</b>             |                                              |            |
| <b>DATA ANALYSIS AND RESULTS</b> |                                              |            |
| 7.1.                             | The Original Model                           | 133        |
| 7.1.1.                           | The Measurement of Original Model Evaluation | 136        |
| 7.2.                             | The Improved Original Model Evaluation       | 138        |
| 7.2.1.                           | Reliability and Validity Results             | 141        |
| 7.2.1.1.                         | Discriminant validity                        | 141        |
| 7.3.                             | The Improved Structural Model Evaluation     | 145        |
| 7.3.1.                           | Main Hypothesis Results                      | 147        |
| 7.3.2.                           | Moderation Analysis                          | 151        |
| 7.3.3.                           | Mediation Analysis                           | 154        |
| <b>DISCUSSION AND CONCLUSION</b> |                                              | <b>155</b> |
| <b>REFERENCES</b>                |                                              | <b>164</b> |

## LIST OF TABLES

|                  |                                                                                                           |     |
|------------------|-----------------------------------------------------------------------------------------------------------|-----|
| <b>Table 1.1</b> | : Supply Chain Integration Related Literature                                                             | 25  |
| <b>Table 1.2</b> | : Approaches to Supply Chain Integration                                                                  | 34  |
| <b>Table 1.3</b> | : The comparison between Transaction cost analysis, Network perspectives and Resource-based view          | 35  |
| <b>Table 2.1</b> | : History of Industrial Revolutions                                                                       | 45  |
| <b>Table 2.2</b> | : Steps of Lean Implementation through Industry 4.0                                                       | 48  |
| <b>Table 3.1</b> | : Goals of Agile Manufacturing Strategy                                                                   | 71  |
| <b>Table 3.2</b> | : Steps of Agile Implementation                                                                           | 73  |
| <b>Table 3.3</b> | : Company SC Agility Elements                                                                             | 75  |
| <b>Table 5.1</b> | : Selected studies examining the concept of lean and agile together                                       | 90  |
| <b>Table 5.2</b> | : Lean vs Agile Organization                                                                              | 93  |
| <b>Table 5.3</b> | : Similarities and differences between traditional supply chain, lean supply chain and agile supply chain | 94  |
| <b>Table 5.4</b> | : Selected Literature of ASC, LSC and Performance                                                         | 96  |
| <b>Table 6.1</b> | : Selected Literature of Combination of the Proposed Model Variables                                      | 107 |
| <b>Table 6.2</b> | : Contribution of 6 sectors to the Turkish Economy                                                        | 109 |
| <b>Table 6.4</b> | : The Operationalized Scales in This Study                                                                | 112 |
| <b>Table 6.5</b> | : Frequency of Company Characteristics                                                                    | 113 |
| <b>Table 6.6</b> | : Frequency of Respondent Characteristics                                                                 | 114 |
| <b>Table 6.7</b> | : The Mean and Sd Values of LSCM                                                                          | 118 |
| <b>Table 6.8</b> | : The Mean and Sd Values of ASCM                                                                          | 119 |
| <b>Table 6.9</b> | : The Mean and Sd Values of SCI                                                                           | 120 |

|                   |                                                                                               |     |
|-------------------|-----------------------------------------------------------------------------------------------|-----|
| <b>Table 6.10</b> | : The Mean and Sd Values of Firm Performance                                                  | 121 |
| <b>Table 6.11</b> | : The Mean and Sd Values of Learning Organization                                             | 122 |
| <b>Table 6.12</b> | : Decision model mode of Reflective vs. Formative                                             | 127 |
| <b>Table 7.1</b>  | : Scale Items, Reliabilities and Factor Loadings                                              | 134 |
| <b>Table 7.2</b>  | : Reliability and Validity of Original Model                                                  | 136 |
| <b>Table 7.3</b>  | : Reliability and Validity of Improved Model                                                  | 139 |
| <b>Table 7.4</b>  | : Analysis of Discriminant Validity Regarding to HT-MT Approach                               | 140 |
| <b>Table 7.5</b>  | : Analysis of Discriminant Validity Regarding to HT-MT BCa Approach                           | 141 |
| <b>Table 7.6</b>  | : Analysis of Discriminant Validity Regarding to Fornell and Larcker (1981)                   | 142 |
| <b>Table 7.7</b>  | : Analysis of Discriminant Validity Regarding to Cross Loadings Approach                      | 142 |
| <b>Table 7.8</b>  | : Collinearity outer model                                                                    | 144 |
| <b>Table 7.9</b>  | : Collinerity Inner Model                                                                     | 145 |
| <b>Table 7.10</b> | : Variance Explained ( $R^2$ ) and Predictive Ability ( $Q^2$ ) for the Endogenous Constructs | 147 |
| <b>Table 7.11</b> | : $f^2$ effect size                                                                           | 147 |
| <b>Table 7.12</b> | : Model fit results                                                                           | 147 |
| <b>Table 7.13</b> | : Main hypothesis results                                                                     | 148 |
| <b>Table 7.14</b> | : Moderation Hypothesis                                                                       | 149 |
| <b>Table 7.15</b> | : Mediation Hypothesis                                                                        | 152 |

## LIST OF FIGURES

|                    |                                                            |    |
|--------------------|------------------------------------------------------------|----|
| <b>Figure 1.1</b>  | : Summary of the Content of SCM Literature                 | 8  |
| <b>Figure 1.2</b>  | : Supply Chain Management Flow                             | 9  |
| <b>Figure 1.3</b>  | : The SCOR Reference Model                                 | 12 |
| <b>Figure 1.4</b>  | : SCM Components                                           | 15 |
| <b>Figure 1.5</b>  | : Porter's Value Chain                                     | 16 |
| <b>Figure 1.6</b>  | : The Domain of SCM                                        | 17 |
| <b>Figure 1.7</b>  | : Six Pillars of Supply Chain Management                   | 18 |
| <b>Figure 1.8</b>  | : SCI keyword frequency data from 2004 to 2022             | 20 |
| <b>Figure 1.9</b>  | : A comprehensive model for supply chain integration       | 25 |
| <b>Figure 1.10</b> | : Different Forms of Supply Chain Integration              | 33 |
| <b>Figure 2.1</b>  | : 4P model of the Toyota                                   | 46 |
| <b>Figure 2.2</b>  | : The Toyota Production System                             | 47 |
| <b>Figure 2.3</b>  | : The Lean Supply Chain Roadmap                            | 58 |
| <b>Figure 3.1</b>  | : Agile Organization                                       | 69 |
| <b>Figure 3.2</b>  | : Relationship between Flexibility and Company Performance | 70 |
| <b>Figure 3.3</b>  | : External Flexibility Types                               | 70 |
| <b>Figure 3.4</b>  | : Conceptual Framework of Supply Chain Agility             | 76 |
| <b>Figure 3.5</b>  | : Proposed Research Model Related to SC Agility            | 77 |
| <b>Figure 3.6</b>  | : Agile supply chain framework                             | 78 |
| <b>Figure 4.1</b>  | : Team Learning                                            | 85 |
| <b>Figure 5.1</b>  | : Leanness and Agility from different perspective          | 93 |
| <b>Figure 5.2</b>  | : The Significance of Leanness and Agility Features        | 96 |

|                   |                                                 |     |
|-------------------|-------------------------------------------------|-----|
| <b>Figure 5.3</b> | : Evolution of SCM Strategies in the Literature | 99  |
| <b>Figure 6.1</b> | : The Roadmap of the Current Study              | 101 |
| <b>Figure 6.2</b> | : Research Model                                | 103 |
| <b>Figure 6.3</b> | : Lean Practives Implementation Result          | 117 |
| <b>Figure 6.4</b> | : The Structural Model Assessment               | 130 |
| <b>Figure 7.1</b> | : The original structural model                 | 133 |
| <b>Figure 7.2</b> | : The Improved Structural Model                 | 138 |
| <b>Figure 7.3</b> | : Simple Slope Analysis (LO x ASCM -> CI)       | 150 |
| <b>Figure 7.4</b> | : Simple Slope Analysis (LO x ASCM -> SI)       | 150 |
| <b>Figure 7.5</b> | : Simple Slope Analysis (LO x ASCM -> II)       | 151 |

## **LIST OF APPENDICES**

APPENDIX 1: QUESTIONNAIRE FORM IN ENGLISH

APPENDIX 2: QUESTIONNAIRE FORM IN TURKISH

APPENDIX 3: CURRICULUM VITAE



## LIST OF ABBREVIATIONS

|        |   |                                                       |
|--------|---|-------------------------------------------------------|
| 3PL    | : | Third party logistics                                 |
| AM     | : | Agile manufacturing                                   |
| AMOS   | : | Analysis of Moment Structure                          |
| APA    | : | American Psychological Association                    |
| App    | : | Appendix                                              |
| ASC    | : | Agile supply chain                                    |
| ASCM   | : | Agile supply chain management                         |
| AVE    | : | Average Variance Extracted                            |
| CA     | : | Cronbach's Alpha coefficient                          |
| CB-SEM | : | Covariance-Based Structural Equations Modeling        |
| CCA    | : | Confirmatory Composite Analysis                       |
| CEO    | : | Chief Executive Officer                               |
| CFA    | : | Confirmatory Factor Analysis                          |
| CI     | : | Confidence Interval                                   |
| CI     | : | Customer integration                                  |
| COP    | : | Customer-oriented performance                         |
| CPFR   | : | Collaborative Planning, Forecasting and Replenishment |
| CR     | : | Composite Reliability Statistic                       |
| DCV    | : | Dynamic Capability View                               |
| DV     | : | Dependent variable                                    |
| EI     | : | External integration                                  |
| ERP    | : | Enterprise resource planning                          |
| FP     | : | Financial performance                                 |
| GFI    | : | Goodness of fit                                       |
| H      | : | Hypothesis                                            |
| HTMT   | : | Heterotrait-Monotrait                                 |
| ICT    | : | Information and communication technology              |
| IFR    | : | Interfirm relationship Theory                         |
| II     | : | Internal integration                                  |
| IOT    | : | Internet of things                                    |
| IT     | : | Information technology                                |
| IV     | : | Independent variable                                  |

|         |   |                                                        |
|---------|---|--------------------------------------------------------|
| JIT     | : | Just in Time                                           |
| KBV     | : | Knowledge-based view                                   |
| LCSCI   | : | Low carbon supply chain integration                    |
| LI      | : | Logistics integration                                  |
| LISREL  | : | Covariance-Based Structural Equation Modeling Software |
| LM      | : | Lean manufacturing                                     |
| LO      | : | Learning Organization                                  |
| LOC     | : | Lower Order Construct                                  |
| LP      | : | Logistics performance                                  |
| LSC     | : | Lean supply chain                                      |
| LSP     | : | Logistics service provider                             |
| MD      | : | Mediating variable                                     |
| MI      | : | Measurement integration                                |
| ML      | : | Maximum Likelihood Function Distribution               |
| MPC     | : | Manufacturing planning and control system              |
| OLS     | : | Ordinary least squares                                 |
| OP      | : | Operational performance                                |
| p.      | : | Page                                                   |
| PCA     | : | Principal Components Analysis                          |
| Ph.D.   | : | Doctor of Philosophy                                   |
| PLS     | : | Partial Least Squares                                  |
| PLS-SEM | : | Partial Least Squares Structural Equations Modeling    |
| R&D     | : | Research and development                               |
| RBV     | : | Resource-based view                                    |
| RI ,    | : | Relationship integration                               |
| RMSE    | : | Root Mean Square Error                                 |
| SCCI    | : | Supply chain customer integration                      |
| SCD     | : | Supply chain dynamism                                  |
| SCEM    | : | Supply chain event management                          |
| SCI:    | : | Supply chain integration                               |
| SCII    | : | Supply chain internal integration                      |
| SCM     | : | Supply chain management                                |
| SCOR    | : | Supply chain operations reference model                |
| SCSI    | : | Supply chain supplier integration                      |

|           |   |                                                                                                    |
|-----------|---|----------------------------------------------------------------------------------------------------|
| SD        | : | Standart deviation                                                                                 |
| SE        | : | Standart error                                                                                     |
| SEM       | : | Structural Equations Modeling                                                                      |
| SET       | : | Social Exchange Theory                                                                             |
| SI        | : | Supplier integration                                                                               |
| Sig.      | : | Significance                                                                                       |
| SMART-PLS | : | Software with Structural Graphical Interface for variance-based structural equation modeling using |
| SMED      | : | Single minute exchange of die                                                                      |
| SOP       | : | Supplier-oriented performance                                                                      |
| SPSS      | : | Statistical Package for Social Sciences                                                            |
| SRMR      | : | Standardized Root Mean Square Residual                                                             |
| SSI       | : | Strategic supplier integration                                                                     |
| TPI       | : | Technology and Planning Integration                                                                |
| TPM       | : | Total production maintenance                                                                       |
| TPS       | : | Toyota production system                                                                           |
| TQM       | : | Total quality management                                                                           |
| TUSIAD    | : | Turkish Industry and Business Association                                                          |
| TÜİK      | : | Turkish Statistical Institute                                                                      |
| UN        | : | United Nation                                                                                      |
| VIF       | : | Variance Inflation Factor                                                                          |

## INTRODUCTION

The notion of the supply chain, also known as the value chain, first appeared in the literature in the 1980s, and it began to gain strategic importance in the eyes of businesses in the 2000s when it was widely debated. The business world has undergone significant transformations in the twenty-first century, especially after Covid-19 (which pandemic started in 2020) with significant advancements and developments in the global environment. The pandemic, which showed its effects all over the world and in Turkey in 2020, caused countries to change their policies in every field. This situation significantly reduced trade by decreasing the entry and exit within the country and between countries. Many countries have closed their borders to other countries for a long time. Besides, the process of globalization has increased interdependence in the international arena, particularly in relation to economic and political concerns. After globalization, it would be beneficial to draw the general framework of a political, economic, social, ecological, and technological situation in the World and Turkey.

Political: with the phenomena of globalization, a period has begun that stresses the functions of protectionist measures and nation-states, which began in the 2010s. In the period of globalization, new trends toward the internationalization of state-owned corporations, as well as the emergence of inequality, the population crisis, and climate change as a worldwide problem, have pushed the state to the forefront. In Turkey, with the Presidential Government System passed in 2017, the structural transformations in the economy, including technology, energy, transportation, industry, banking and many other sectors, have come to the fore in a way that makes the economic roles of the state more critical. Even small decisions taken by states have serious repercussions on relations both within the country and with other countries. In a country like Turkey, where economy and politics are closely intertwined, it is seen that every small development affects the country's economy and therefore businesses closely.

Economic: with the expansion of global supply chains, global trade, and foreign investment, the world economy has become more interconnected and interwoven. There has been a serious increase in imports and exports between countries with globalization. Businesses and consumers now have fresh chances, however, there are also new dangers and obstacles as a result. Market Dynamics,

product life cycles, currency changes and etc. these are all critical factors affecting the economy.

Ecological: new environmental laws enacted by governments, as well as an increasingly educated and active population concerned about health issues and quality of life, have all played a role. United Nations (UN) has published 17 principles under the name of sustainable development goals. The European Union has set 2030 targets. The Treaty of Paris was accepted by many countries. All these regulations forced companies to start making their partner choices by considering their sustainability activities.

Social: consumer habits and preferences have been changing very vastly. Especially new generation, Z, is described as very innovative and gets easily bored directs them to expect innovative goods and services. Therefore, determining customer expectations became more and more challenging.

Technological: 21st century can be described as social media, the Internet of Things (IoT), artificial intelligence era. While technology allows businesses to be more innovative in their approaches to overcoming obstacles, at the same time it forces companies to become more competitive to take the advantage.

All these perspectives have an impact on the companies' decisions and directly on their supply chain. SCM (Supply chain management) is concerned with how companies take benefit of their suppliers' operations, technologies, and capabilities in order to gain a competitive edge. It's a management approach that goes beyond standard intra-company operations by gathering trading partners to achieve a single aim of efficiency and optimization (Tan et al., 1998). Meier et al. (2004) point out the variety of SCM studies, noting that some academics have concentrated solely on supply chain description, while others concentrate on supply chain concepts in the context of strategic management. SCM is a topic which closely associated with the strategic management approach which concentrates on competitive advantage and gaining profit more than the average. On the other hand SCM is seen as an interdisciplinary area that includes various fields such as;

1. **Operations management** is concerned with the conception, organization, and supervision of the manufacture and provision of goods and services. It

covers the efficient use of resources to produce and provide goods and services.

2. **Logistics:** A crucial link in the supply chain. Transport, storage, and distribution of commodities and materials are covered. It comprises organizing the tasks required to get the goods from the supply point to the client.
3. The administration and sharing of knowledge require the use of **information technology**. Information technologies are utilized in supply chain management, particularly in integration, to quickly deliver the relevant information to the right person through the appropriate channels. The benefits of digitization to the supply chain have been extensively studied.
4. **Marketing** is one of the company's key operations and collaborates closely with the production, sales, and logistics divisions to create strategies and objectives to address the requirements and wishes of customers.
5. **Finance:** Finance, which is one of the fundamental business tasks, is important for budgeting, forecasting, and decision-making about the distribution of resources within businesses and consequently in the supply chain.
6. **Economics:** This field deals with the study of how people and societies make decisions about the allocation of resources. In SCM, economics is used to understand market trends and to develop strategies for managing resources.
7. **Legal:** This field deals with the study and practice of law. In SCM, legal considerations may include contracts, regulations, and intellectual property rights.

Organizations are under tremendous pressure to stay competitive, innovative, and customer-focused in the current global business environment. Supply chain integration is a crucial way for accomplishing these goals. Integration of the supply chain is the process by which several parties work together to increase efficiency and the effectiveness of the supply chain as a whole. On the other hand, agile and lean are two distinct approaches that have generated a considerable amount of interest. Lean approach is based on the principles of reducing waste, increasing effectiveness, and constantly improving processes. Besides, agile approach is based on flexibility, reactivity, and adaptation. Although it has been shown that lean and agile approaches can improve a firm's supply chain performance, it is still unclear how much of an influence these strategies will have on the operational and financial outcomes of the

organization. It is not possible to tell whether one strategy is superior to the other. Which strategy will work best depends on a variety of factors, including the environment, the company's organizational structure, the industry and market segment in which it operates, its culture, the type of product it produces, and many more. While some businesses use either one or the other depending on the situation, some believe that using just one is best for their business.

By the implementation of lean and agile approaches into supply chain, a learning organization can also play a crucial role in supporting supply chain integration. An organization that fosters a culture of knowledge-sharing, experimentation, and innovation is known as a learning organization. Successful supply chain integration requires learning supply chain and businesses, which excel at responding swiftly to changing situations.

As the effects of company activities on the environment and society become more obvious, *sustainability* is a crucial factor for contemporary enterprises. While the agile strategy seeks to increase flexibility and responsiveness to meet shifting consumer expectations, the lean approach shares with sustainability the goal of reducing waste and improving efficiency. Organizations may create a more sustainable supply chain that balances efficiency and flexibility, reduces waste, and produces better environmental and social benefits by combining both lean and agile strategies.

Consequently, the purpose of this study is to investigate how lean and agile approaches might improve operational and financial performance through supply chain integration. The study will also look into how a learning organization might influence the link between supply chain integration and lean/agile supply chain. How much influence does supply chain integration using lean and agile methods have on operational and financial performance, and how does this relationship change in the presence of a learning organization? This is the one of the main research question that drives this study.

The results of this study should add to the body of knowledge already available on supply chain management, particularly when it comes to merging lean and agile approaches. The study will also shed light on how a learning organization can support successful supply chain integration and boost productivity. In the end, practitioners in

the field of operations management who want to enhance the performance of their supply chains will find the insights gleaned from this study to be beneficial.

This thesis contains eight chapters. While the first four chapters indicate the literature review of each component including supply chain integration, leanness, agility and learning organization, the fifth chapter investigates the relationship between all main variables. Methodology and findings are presented separately in Chapter 6 and 7. Lastly, the discussion and conclusion are provided in chapter eight.



# CHAPTER ONE

## SUPPLY CHAIN INTEGRATION

*Thinking is easy, acting is difficult, and to put ones thoughts into action is the most difficult thing in the world.' Goethe*

### 1.1. Supply Chain Management (SCM)

The ancestors of supply chain management are arguable and not clear in the literature. According to some scholars, the origin of the supply chain management concept appeared in Forrester (1961) who explained the demand dynamics in supply chain conditions. Besides this, other scholars argue that SCM concept is based on the system theory. This approach emphasizes instead of focusing on single elements, focusing on the whole system would provide effectiveness. However, Oliver and Webber (1992) claimed in conjunction with Just in Time (JIT), SCM originated in the concept of logistics. As supply chain management (SCM) matures, the debate rages over whether it is a method, a process, a business strategy, or simply an alternative word for logistics (Gibson et al., 2005; Mentzer et al., 2001). While logistics concentrated on minimizing cost, SCM focuses profitability of customers and suppliers in the long term (Lamey, 1996). Larson and Halldorsson (2004) presented various views on the relationship between logistics and SCM:

- Traditionalist: SCM is a little part of logistics.
- Re-labelling: SCM and logistics are identical.
- Unionist: SCM covers logistics. Logistics is just part of it.
- Intersectionist: They are not in a same area but they have common areas.

About 35 years ago, the phrase "supply chain management" (SCM) first appeared in print (Oliver and Webber, 1982). In 2013, the literature first revealed the challenges and lack of coherence about the definition of SCM (Fawcett and Waller, 2013). Zinn and Goldsby (2014) further on this by stating that SCM needs a primary scientific construct that is accepted by SCM specialists. In today's materials management system, the term "supply chain management" is often used and is frequently linked with information systems, speed and responsive logistical service, effective supplier management, and progressively, customer relationship

management (Fawcett and Magnan, 2002). Supply chain management (SCM) is defined as the integration of critical business operations inside and throughout firms that offer benefits to customers and other stakeholders (Cooper et al., 1997). SCM aims to improve a company's competitiveness by tightly connecting internal tasks and effectively connecting them to the external processes of suppliers, consumers, and other channel partners (Kim, 2009).

SCM has existed for a long time, but not in its current form. Companies have been attempting to gain a competitive advantage for decades through inventory control, stronger client relations, lean production, and many other methods. SCM, which was first proposed in the late 1980s and early 1990s, is a concept that combines these strategies to create a harmonized supply chain that benefits both suppliers and customers by reducing cycle times, improving customer satisfaction, and reducing inventory, among other things (Gunasekaran, 2001).

Hill (2000) uses three main stages to explain the beginnings and development of supply chains:

- The integration of the internal supply chain's phases.
- From product development through final product production, procurement fosters collaboration between the processes.
- Coordinating actions between businesses and synchronizing the planning and execution of supply chain activities.

SCM is a notion that considers being associated with collaboration (Fawcett & Magnan, 2002). According to Swanson et al., (2018) one way to describe the character of an area is to describe major issues specific to that area. Their research about SCM by topics indicated that the focus of SCM research is as follows; "relationships and collaboration, purchasing and supply management, strategy, customer service strategy, inventory and sustainability".

Boston Consulting Group Vice President emphasized that with the increase in competition and the change in global balances, the competition of companies' supply chains has become more important than the competition of companies with each other (Henkoff, 1994).

External pressures and the potential benefits of strategic SC alignment are two sources of SCM drivers. Technology advancements and growing client demand across national lines are examples of external pressures. The potential benefits of successful SC cooperation are the second major reason. Unique products and services, quicker R&D processes, higher product quality, cost competitiveness, and a shorter order cycle are just a few examples (Basu, 2001).

Croom et al. (2000) demonstrate a broad extensive literature review in the field, emphasizing that the multi-disciplinarity of supply chain management's antecedent is represented in the absence of adequate frameworks for the creation of theory on the topic (Figure 1.1).



Figure 1.1: Summary of the Content of SCM Literature (Source: Adapted from Croom et al., 2000, p.70)

The Figure 1.2 displays the major supply chain partners. The members of the chain were demonstrated by this well-known figure. A focal company, also referred to

as a manufacturer by certain scholars, is located in the middle. The chain starts with procurement. Acquiring the goods or services from the suppliers' suppliers to other suppliers. Then it arrives at the focal company. From there to wholesaler then retailer it goes. The customer is at the endpoint of the cycle. While the cycle between the partners making up the chain continues, at the same time the flow of products, money and information continues forward and backward. This sequence and the members may change according to each product or service. It doesn't have to include all these partners. However, it is valuable to see the picture as a whole.

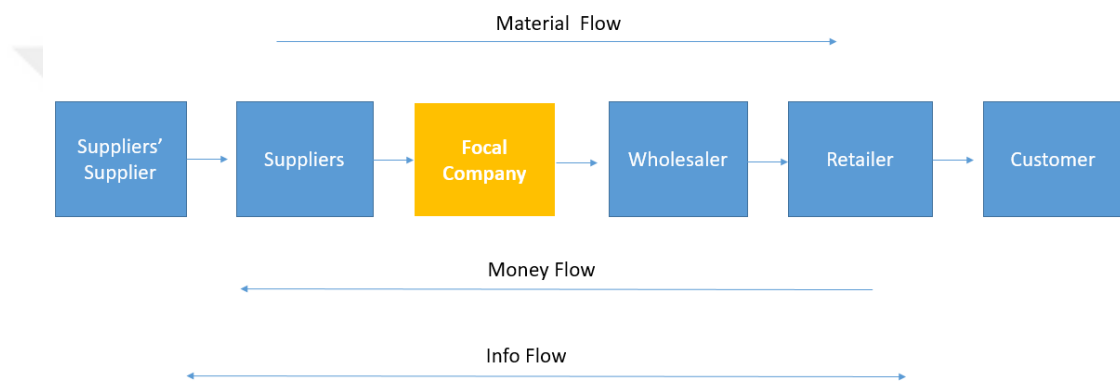


Figure 1.2: Supply Chain Management Flow

A focal organization's supply chain includes its own internal operations, upstream supplier networks, and downstream distribution channels (Handfield and Nichols, 1999).

- Internal Operations it includes order processing and production planning. Order processing is the process of converting consumer requests into certain orders. In many organizations, this also includes comprehensive client involvement in order to establish “partnership connections”, ensuring product description, delivery lead times, and after-sales services. On the other hand, production planning seeks to meet consumer demand while minimizing waste and maximizing efficiency by ensuring that the appropriate resources are available at the appropriate moment.
- Upstream Supplier Networks: a focal company may have many suppliers. When a focal company procures raw materials or services (whatever is needed) from a supplier, it is called 1st Tier Supplier, when it is provided by

the supplier's supplier then it is called 2nd Tier Supplier. This network continues, as supply chains have mainly various connected suppliers.

- Downstream Distribution Channels: warehousing, retailer, after sales services, stock management, etc. are in these channels which aid goods to arrive final destination (Gunasekaran, 2001).

#### **1.1.1. Top Performing Companies Traits**

These three characteristics are maintained by best-in-class businesses: balance, demand visibility and cost reduction. CEO of supply chain consulting firm Tompkins Associates has listed seven features for well-performing supply chains (Jusko, 2009).

1. Companies who have a strategic fit: their supply chain strategies match with their business strategies. For this purpose, those companies must have a well-defined supply chain strategy.
2. These firms are flexible and agile, allowing them to compete in today's fast-paced world.
3. These firms are open and honest with their consumers, with clearly stated performance goals and customer-focused culture.
4. These firms strive for maximum performance by focusing on continued growth all through the supply chain.
5. These firms are aware of their strong competence and inadequacies and engage in benchmarking exercises.
6. These companies concentrate on the operations of plan-buy-make-move-store-sell as part of a comprehensive approach to supply chain management.
7. These firms are focused on the global instead of the local.

R. Michael Donovan & Company also proposed a checklist for determining a well-performing supply chain (Sarah, 2001):

1. Order fill percentages are in line with management's detailed and well-defined client service plan.
2. Competitive and expected delivery lag times
3. Supply chain divisions agree on which goods are make-to-order versus those make-to-stock.

4. The mix and inventory investment are determined jointly by sales and manufacture.
5. Instead of using basic guidelines to determine the necessary mix and levels, proper computations are employed.
6. The stock investment plan and customer service goals of management are compared to the actual outcomes obtained.
7. Short-term prediction variances are being tracked and addressed, and long-term prediction accuracy regularly developing.
8. Inventory reliability of greater than 98 percent on a regular basis.
9. Able to prevent having too many safety stock buffers on hand.
10. Surplus and idle stocks are being measured ( fewer than 1% of total inventory).

Before going through the supply chain integration, discussing the two important supply chain management models would be valuable. These are SCOR and CPFR models.

#### **1.1.2. SCOR and CPFR Models**

By analyzing and designing modifications to improve performance, the SCOR model enables the five integrated supply chain processes (planning, sourcing, making, delivering, and returning) that span the end-to-end process from a supplier's supplier to a customer's customer. The SCOR model is designed to work in harmony with a company's operational plan, work, and information flows (Blanchard, 2021, p.55).

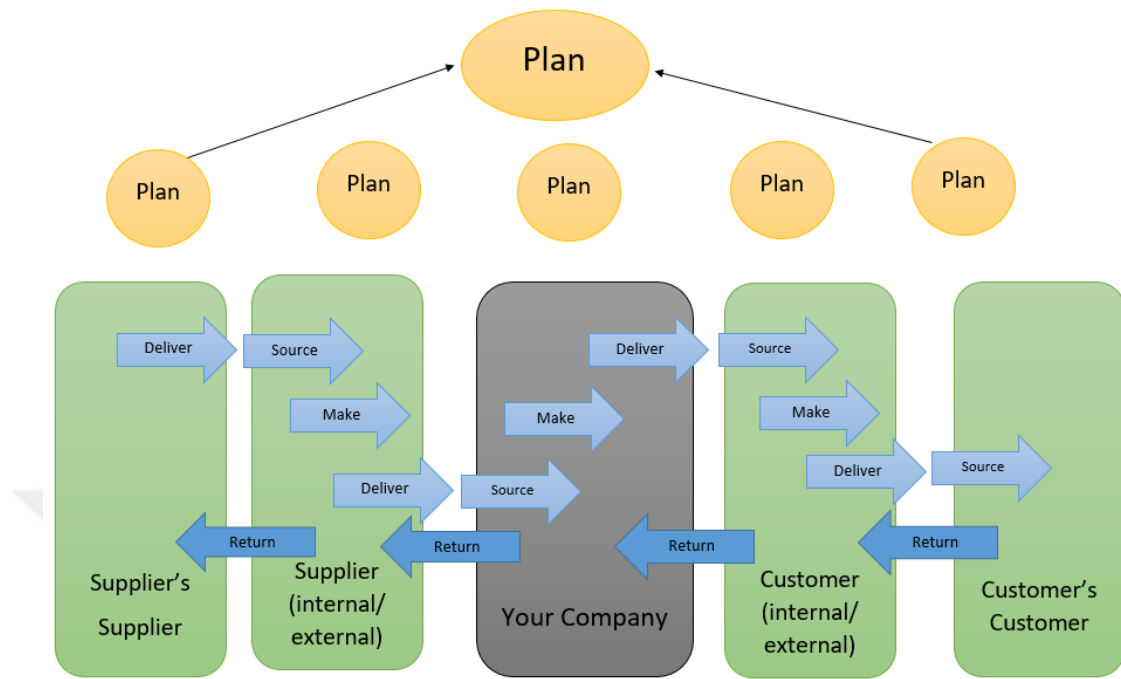


Figure 1.3: The SCOR Reference Model (Source: Supply Chain Council, 2010)

The Supply Chain Council recommends a supply chain operations reference model (SCOR) for benchmarking SC activities and building IT (Information Technology) solutions. SCOR highlights the source, make, and deliver processes, which are all connected by a fourth phase, planning, as shown in Figure 1.3. All four dimensions are active at all supply chain connections. The model was the first cross-industry approach for assessing and developing supply-chain performance and management at the corporate level. It helps businesses to compare their operations with other businesses and to evaluate their own methods to best practices that have been shown (Stewart, 1997).

Bolstorff & Rosenbaum (2007) explained five processes of SCOR model as follows;

1. *Plan*: The planning process starts with a review of the resources that will be needed. Requirements must be gathered for this. Distribution, production, and material requirements, as well as inventory planning, are all taken into consideration. Finally, each product's potential capacity is calculated.
2. *Source*: Following possible capacity planning, resources must be procured and paid for Raw Materials and purchased finished products.

3. *Make*: After the resources are provided, the production must be made, tested and packaged.
4. *Deliver*: Following order management processes and creating offers to ensure that the product reaches the customer in the proper condition; creating a customer database; maintaining a product/price database; managing accounts receivable, loans, and invoicing; executing warehouse operations, including packaging and configuration; creating customer-specific packaging/labeling; managing transportation processes, import/export.
5. *Return*: includes post-sales process: warranty management, receiving and validating defective products: disposal and processing of returns.

A second SCM model called Collaborative Planning, Forecasting and Replenishment (CPFR) makes it easier for trading parties to work together to increase the effectiveness of the supply chain. The flow of goods and services from the producer to the final consumer can be optimized with the help of a number of business procedures, systems, and tools known as the CPFR model. The CPFR model calls for the sharing of information between trading partners in order to implement an organized and coordinated approach to planning, forecasting, and replenishment. Trading parties can decide together on demand planning, production scheduling, inventory management, and order fulfillment thanks to this information sharing. VICS created a CPFR process model in the late 1990s ([www.vics.org](http://www.vics.org)) that focuses on these nine processes (Blanchard, 2021, p.165).

1. Create a contract: Rules should be set by the retailer/distributor and the producer.
2. Develop a cooperative work plan: Partners develop a cooperation strategy, which includes roles, goals, and methods for each category.
3. Set a sales prediction using information from the retailer's point-of-sale system and other sources then the sales estimation is created by using the order prediction.
4. Define the sales forecast outliers: The parties decide on the list of exception items.
5. Work with exception items to solve/cooperate. After that, the partners provide a revised estimate.

6. Make a prediction for orders: To develop a customized order prediction that supports the joint sales forecast and collaborative business plan, parties merge POS data, causal information, and stock strategies. This enables the company to match production capability to demand while keeping safety stock to a minimum. It also gives the store more trust in the delivery of orders.
7. Determine outliers for order prediction based on initial contract's defined parameters.
8. Resolve/collaborate on items that are out of the ordinary, The partners then present another modified projection, just as they did in step 5.
9. Compose an order: The forecasted order becomes a confirmed order.

### **1.1.3. SCM Components**

The supply chain is usually explained as a combination of three layers: a manufacturing focal firm, the first sub-tier of firms (known as the first-tier customer), and the companies' first-tier supplier (known as the first-tier supplier). Internal activities include manufacturing implementation, while logistics activities link firms at different layers. Ideally, all technical applications should line up with the choices of the end customer (Baharanchi, 2011; Pagell and Wu, 2009).

Lamber and Cooper (2000) introduced SCM components that depict a simplified supply chain network topology (Figure 1.4). It also contains business functions such as production, finance, R&D, etc. Business processes are integrated across intra- and inter-firm borders to form supply chain business activities.

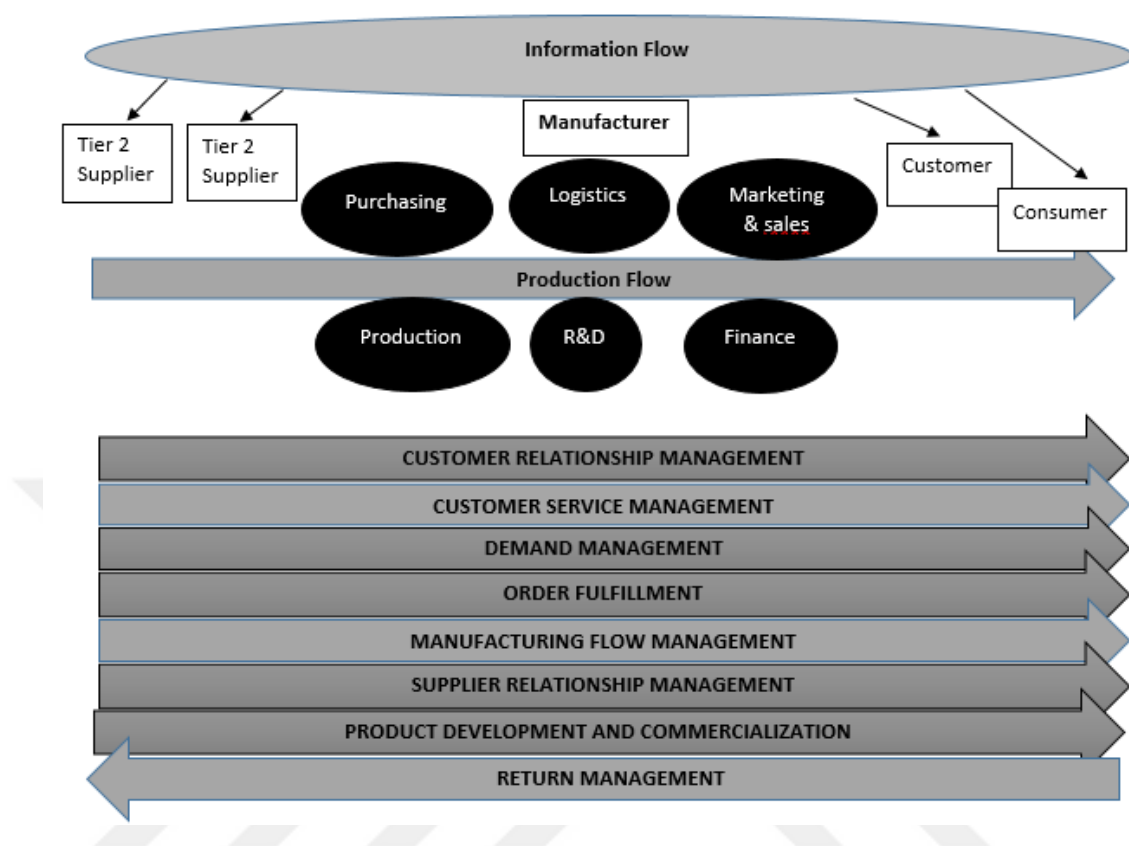


Figure 1.4: SCM Components (Source: Lambert and Cooper, 2000, p.67)

The main goal of every established supply chain is customer satisfaction. The journey where the raw material turns into a product and goes towards the final consumer can be called the “value distribution system” (Kotler et al., 2014).

Porter (1985) analyzed five key operations that can help a company's supply chain become more profitable (Blanchard, 2021). These operations are seen in Figure 1.5.

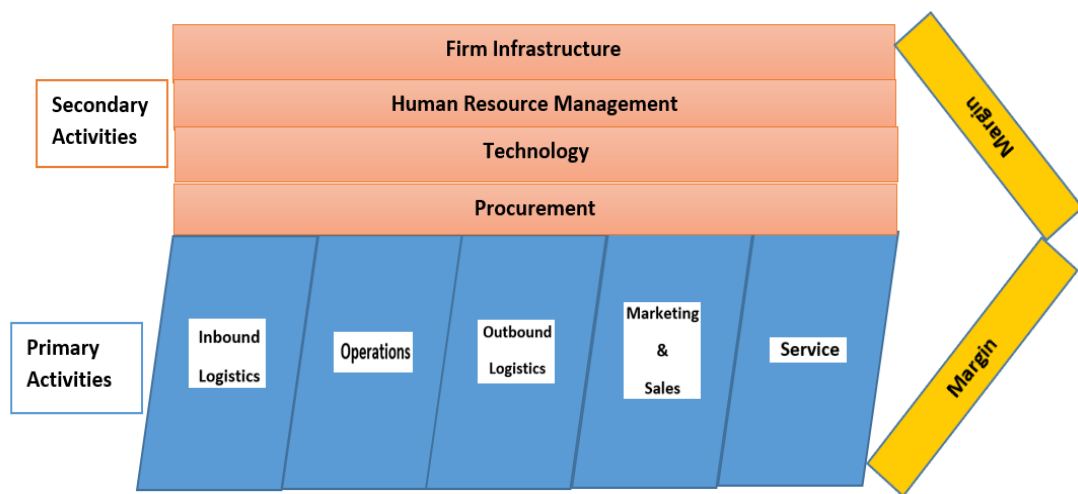


Figure 1.5: Porter's Value Chain (1985)

1. Inbound logistics: Getting, keeping, and dispersing inputs to the product are all part of this process (handling of materials, storing, stock control, transportation planning, and supplier returns).
2. Operations: This includes all the activities involved in changing raw materials into finished goods (processing, boxing, assembling, maintenance of equipment, checking, printing, and facility operations).
3. Outbound logistics: These are the tasks involved in gathering, storing, and physically delivering the product to customers (freight transport, order processing, planning, material handling, storage of finished items).
4. Sales and marketing: Activities that promote and allow purchasers to buy a product in the framework of the supply chain (advertising, promotions, sales force, quoting, channel selection, channel relations, and pricing).
5. Service: Activities involved in delivering service in order to improve or sustain the product's value (assembly, maintenance, coaching, and product tweaking).

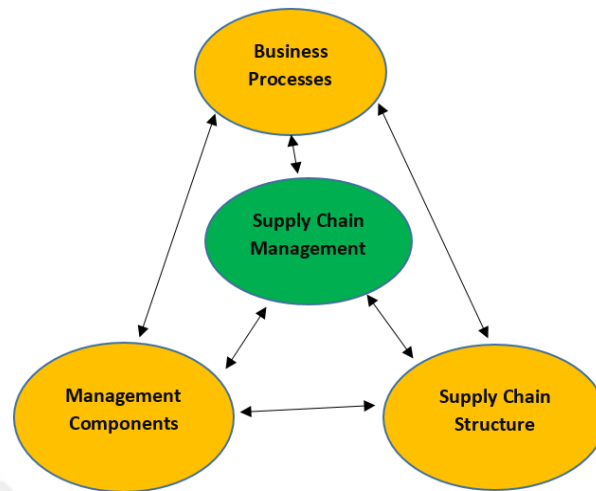


Figure 1.6: The Domain of SCM (Source: Cooper et al.,1997, p.6)

Cooper et al. (1997) seek to incorporate several perspectives on SCM-related issues in order to form the SCM field. Their structure (Figure 1.6) combines business processes (processes that provide a specified output of value to the client), management components (elements that design and govern business processes), and supply chain structure (the arrangement of the firms inside the supply chain).

SCM activities;

- Production planning
- Procurement
- Stock Management
- Order Processing
- Transportation
- Warehousing
- Customer support

The six pillars of SCM are depicted in Figure 1.7. and they are the foundational principles that an organization must adhere to in order to establish a completely integrated Supply Chain Management Program (Gunasekaran, 2001).



- Export limits, security requirements, and Customs clearance concerns
- Senior management's aversion to embracing new technology
- Offshore business costs aren't always obvious (payments and commissions)
- Fuel and safety prices increase
- Choosing the most appropriate metric (to measure transactions and profitability)
- The pressure to complete a large amount of work in a short period of time

Fawcett et al. (2008) has also stated the barriers of SCM as follows:

- Cross-functional disputes,
- A lack of flexibility in organizational systems and procedures,
- A lack of acceptable performance metrics,
- An opposition to alteration,
- An absence of education,
- An absence of support from management,
- Non-harmonized strategic and operating principles

SCM contains many parties in terms of its structure. This chain requires cooperation with more partners in large-scale companies. Therefore, one of the biggest challenges of SCM is to ensure the coordination of all these links and to improve them continuously. Other barriers to SCM are managerial complexity, inability to adapt to partner firms' structures and cultures (Park and Ungson, 2001). Difficulties that are part of the scope of managing complexity include incompatibility with information systems and technologies, inadequate assessment systems, and conflicting organizational structures. As can be seen in examples, integration into supply chain management is one of the most noticeable challenges that companies face.

## 1.2. SUPPLY CHAIN INTEGRATION

In management after the postmodern approach (the 1990s), strategic planning, total quality management, outsourcing, supply chain management and many more approaches gained importance. When company size increase, when they became more global, when they have more employees and partners, they have figured out that they need to integrate their activities to compete in the environment and gain competitive advantage. They included wholesalers, and retailers in the logistics activities and integrate with supply and material management. After that, the term supply chain management became prominent. Supply chain integration is not a novel term, in essence, it is one of the most prominent strengths of supply chain management. It enables companies to collaborate, connect, and communicate supply chain processes internally and externally with both suppliers and customers. The Figure 1.8 (which is generated by Google Trends) approves the popularity of SCI concept. Even though the year 2004 was the most popular year of SCI, the concept still carries its importance.



Figure 1.8: SCI keyword frequency data from 2004 to 2022 (produced by Google Trends)

Integration, according to Kahn and Mentzer (1998, p. 56), is the method of getting units together in a cohesive organization through interdepartmental coordination and collaboration. Flores and O'Leary-Kelly (2002, p. 226) stated that integration refers to the coordinated efforts of several parties to produce agreed outcomes. Interaction and collaboration are the basis of integration. Collaboration indicates the spontaneous, emotive aspect of interdepartmental connections, while interaction symbolizes the systematic character of inter operations (Kahn, 1996). In this way, integration helps to improve relations between parties and reduce conflict.

According to Christopher (2011), integration and coordination are the basic mechanisms that characterize supply chain management. Coordination in logistics processes while expressing forward and backward flow of information and forward material flow; integration is to plan and organize material and information flows (Romano, 2003: 121). Although the explanations in the literature for the supply chain process in which information and products move are different, the common denominator of all of them is, an ideal supply chain covers all the actions of the pre-production "production planning and control process" and the post-production "distribution and logistics process" (Beamon, 1998: 282). "Integration", which is one of the most crucial concepts of today's supply chain management, by itself, provides cooperation, commitment, coordination, communication and information sharing of different parties to deliver success that are agreeable to all parties. It is defined as the degree of working together (O'Leary-Kelly and Flores, 2002: 225). Supply chain integration is one of the most accepted business method to increase performance in today's competitive business world (Narasimhan and Das, 2001: 593). Supply chain performance is determined by how well all parties perform collectively, not by how well each individual works individually, particularly in fast-paced circumstances. The level of integration in a supply chain is also important, but there is no one-size-fits-all approach. Too much integration can have negative effects on a company's performance, so it's important to find the right balance. The level of integration need will depend on the specific characteristics of the company and its supply chain (Van der Vaart, 2008).

The extent to which the focus company strategically works with its supply chain partners and controls internal and external organizational operations collaboratively can be defined as SCI. Its most basic function is to provide maximum benefit by providing an effective and efficient flow of products, services, information, money and decisions in parallel with the most basic principles of the supply chain (Bowersox et al., 1999; Naylor et al., 1999). In brief, supply chain management aims to boost efficiency by integrating all aspects of corporate processes (Bowersox et al., 2002).

The extent and quality of connections in supply chain activities among enterprises is referred to as SCI. Information, operational, and interpersonal integration make it easier for companies to link their supply chain activities (Leuschner et al., 2013).

Supply chain integration aims to coordinate the various supply chain components so that customers receive the most value possible at the fastest possible pace and lowest possible cost. This involves optimizing the flow of products, services, information, finance, and decision-making across the entire supply chain, and operating it as a single, cohesive entity. By doing so, organizations can improve efficiency and effectiveness, and better serve their customers (Flynn et al., 2010).

The increase in markets and competition, the need for outsourcing to reduce the costs of the enterprises, the shortening of the product life cycle, brought the companies to the point where they could not compete on their own and required them to be included in integrated supply chains. The preeminent opinion is that the most prosperous firms are those that operate intimately within their own supply chains and precisely connect their internal activities with external suppliers and customers (Mitra and Singhal, 2008). Establishing a close and integrated relationship between supply chain members not only provides advantages for each business, but also positively affects supply chain performance (Armistead and Mapes, 1993). In varied competitive settings, supply chain integration can help organizations obtain and digest external knowledge as well as build strategic routines for supply chain participants (Huo, 2012).

Only through establishing strong supply chains will companies be able to respond swiftly to client needs and provide the right product to the right customer at the right time. The integration of all actors in this value system, which is trying to produce suitable products for the customer optimizes the performance of the supply chain (Bowersox et al., 2002).

The main consideration of SCM should be how to encourage separate stakeholders to work as a team to achieve a common objective of chain profitability in dynamic market situations (Cooper et al., 1997). Strong cooperation in terms of organizing, planning, and tracking will result in less unnecessary complexity throughout the supply chain, the removal of practices that provide no benefits to clients, replenishment and movement prompted by actual demand rather than long-term estimates, and simpler planning (Samaddar et al., 2005).

Sharing information between parties became one of the most crucial elements of an integrated supply chain. Recent technological improvement makes this purpose

much easier and faster. These technologies let companies track each process and integrated it. From the beginning to the end of the process, with a holistic perspective, it can be planned and monitored where the raw materials will come from, what route they will follow and how they will be stored and distributed throughout the production cycle of a product. This tracking could take place between many different parties in or outside of the enterprise.

According to Handfield and Nichols (1999) for an integrated supply chains companies should set up these three tools precisely:

- Information Systems Management
  - ✓ Electronic Tools and Techniques
  - ✓ Supply chain Software
- Inventory and Time Management
  - ✓ Logistics
  - ✓ Cycle Time
  - ✓ Pull-Push Strategies
- Relationship Management

According to Dyer et al. (1998), companies need to think more strategically and proactively about supplier management and avoid having a one-size-fits-all approach to administrating their supplier relationships. Rather, each supplier must be precisely considered to understand how much their goods or services contributes to the buying firm's core competencies and competitive edge. Because resources are scarce, administrators must carefully divide their suppliers into strategic partners and enduring arm's-length providers to commit various amounts of resources to each category in order to optimize supply chain effectiveness. The capacity of a corporation to strategically segment suppliers in such a way that it reaps the benefits of both the arms-length and intimate partner and strategic alliance models is the way to long-term SCM competitive advantage (Dyer et al., 1998). It is not necessary to have high levels of integration with all supply chain partners.

One of the problem with connecting supply chains is that if only the leading partner makes supply chain optimization decisions, it can lead to an unbalanced allocation of info, stock, and, eventually, bargaining power among the partners (Iacovou et al., 1995). As a result, to optimize the overall supply network

rather than just one or two partners, the businesses must collaborate to make supply and demand decisions that provide long-term value for all parties.

Integration of business operations across corporate boundaries is becoming more important as new market rivalry demand better efficiency and responsiveness. This necessitates increased transparency and stronger ties among supply chain participants. However, as the world becomes more globalized, demand volatility rises, and supply networks get more complicated, supply chain integration becomes more difficult. It is believed that in a fierce competition, highly integrated companies will acquire an edge over more independent businesses in two key ways: first, with increased data visibility and operational knowledge, integrated SC partners may be more adaptive to market changes brought on by constant changes (competition, technology, regulation, etc.) (Grant, 1996). Second, businesses with highly integrated SC may be able to reduce their overall expenses of doing business and the costs that are ultimately passed on to clients (Rosenzweig et al., 2003). According to Stevens (1989, p. 8), when a business reaches this point of [internal] integration, it can truly start to talk about synchronized demand management, which involves aligning the customers' requirements with the production plan and the material stream from providers in order to gain significant advantages by replacing inventory with information.

Good management of supply chains is possible by ensuring the highest level of customer value by working together with each value-creating process (Pagell, 2004, p. 460).

Fawcett and Magnan (2002) stated three stages of supply chain management practices;

1. SCM is defined as the use of advanced technologies to improve the quality of data and the velocity with which it is exchanged among channel participants.
2. SCM practice at the second stage attempts to recognize a group of essential components that drive to tighter channel interactions. The supply chain strategy is frequently ad hoc and scattered.
3. The highest stage of supply chain management is a philosophical or cultural mindset that governs decision-making. Supply chain design and supply chain

integration are skills that are crucial to the achievement of this highest stage of SCM.

As illustrated in Figure 1.9 Zhang et al. (2015) present a complete supply chain integration model that includes strategic, managerial, operational, and fundamental levels. Each level contains different integration elements. While strategic integration is considered under the strategic level, planning and control integration and organization integration are included at the managerial level. Process integration and material, information, knowledge, and financial integration are at the operational level. Lastly, benefit alignment is at the fundamental level. If the incentives of all parties are in line—that is, if the risks, expenses, and benefits of doing business are dispersed equally across the network—a supply chain will function effectively (Lee, 2000).

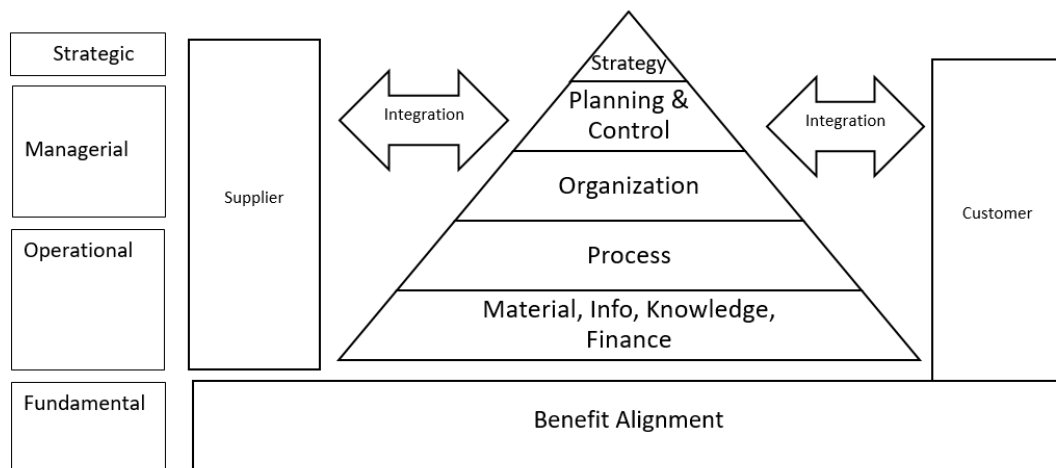


Figure 1.9: A comprehensive model for supply chain integration (Zhang et al., 2015)

Many studies focused on the relationship between supply chain integration and organizational performance. Many of those studies concentrated on the same integration dimensions or added more items. However, it would be valuable to measure attitudes, patterns and practices in SC integration (Van der Vaart & Van Donk, 2008).

Table 1.1: Supply Chain Integration Related Literature

| The Authors & Years         | The Focus of Integration                                                              | The methodology                                 | The Main Findings                                                                                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Armistead & Mapes (1993)    | SCI and OP                                                                            | Survey w/manufacturing                          | With the help of new manufacturing techniques value chain integration has a positive impact on OP.                                                                      |
| Morash & Clinton (1998)     | process integration collaborative/operational integration                             | Total cost and differentiation strategy; Survey | Value chain integration varies significantly between firms and nations, and these variances seem to be connected to cost-cutting vs differentiating tactics.            |
| Johnson (1999)              | Strategic integration                                                                 | Interfirm relationship (IFR) Theory; Survey     | Integration of distributors and suppliers is supported by dependencies, flexibility, sustainability expectations, and relationship maturity.                            |
| Ellinger et al. (2000)      | Internal (Marketing-logistics) integration and FP                                     | Survey                                          | Interdepartmental int. dimensions: consultation, collaboration, info exchange                                                                                           |
| Stank et al. (2001)         | SCI (CI, II, SSI, TPI, MI, RI) and LI to the LP                                       | Survey                                          | improved supply chain logistics integration is related to better business performance. The most crucial differentiators of total FP are the interaction with CI and II. |
| Frohlich & Westbrook (2001) | SI<br>CI                                                                              | Over-arching operations strategy<br>Survey      | Highest levels of performance are strongly correlated with SCI.                                                                                                         |
| Fawcett & Magnan (2002)     | SCI                                                                                   | Surveys and case study interviews               | Different levels of SCM has been identified. SCI integration and design have found to be the highest level.                                                             |
| Narasimhan & Kim (2002)     | SCI on the relationship between diversification and a firm's competitive performance. | Survey                                          | The performance-diversification connection is altered by SCI strategy.                                                                                                  |
| Ragatz et al. (2002)        | SI                                                                                    | Survey                                          | In order to achieve target expenses while lowering                                                                                                                      |

|                          |                                        |                                                                                                      |                                                                                                                                                                                                                               |
|--------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rosenzweig et al. (2003) | SCI                                    | transaction cost economics theory; information processing theory; knowledge-based view (KBV); Survey | new product development costs, it is essential to incorporate the supplier's technology roadmaps into the development cycle. Integration of the supply chain boosts competitive capacities and boosts corporate performance.  |
| Vickery et al. (2003)    | SCI                                    | Survey                                                                                               | positive direct links between (1) integrated IT and SCI, (2) SCI and customer service, and (3) customer service and FP.                                                                                                       |
| Droge et al. (2004)      | EI<br>II                               | Survey                                                                                               | The combination application of EI and II techniques enhances business performance.                                                                                                                                            |
| Homburg & Stock (2004)   | CI                                     | survey and interviews (dyadic data)                                                                  | A occurrence of CI, a high level of CI into value creation, and a high level of product/service innovation were found to have a relatively strong association between salespeople's work happiness and customer satisfaction. |
| Pagell (2004)            | II                                     | Case study                                                                                           | Value chain integration varies significantly between firms and nations, and these variances seem to be linked to cost-cutting vs differentiating tactics.                                                                     |
| Marquez et al. (2004)    | SCI, FP                                | Simulation                                                                                           | Full supply chain integration (FISC) offers greater advantages than any form of partial integration for performance.                                                                                                          |
| Petersen et al. (2005)   | SI                                     | Survey                                                                                               | SI is influenced by taking into account both the culture and the skills of the provider.                                                                                                                                      |
| Gimenez & Ventura (2005) | internal and external relationships on | survey                                                                                               | The degree of EI and the functional areas being merged both have an                                                                                                                                                           |

|                         |                                                     |                                                        |                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|-----------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cagliano et al. (2006)  | the Company's LP. SCI and manufacturing improvement | Survey                                                 | influence on how well II performs. While the deployment of ERP had little impact, the implementation of the lean manufacturing model had a major impact on the integration of physical and informational flows.                                                                                                                      |
| Cousin & Menguc (2006)  | SI                                                  | Resourced based view; socialization concept<br>Survey  | Both supplier communication and operational performance are benefited by supply chain socializing.                                                                                                                                                                                                                                   |
| Das et al. (2006)       | SI                                                  | theory of diminishing utility in operations,<br>Survey | By (a) identifying the many integration applications that are connected to performance and (b) setting and implementing these applications in a way that is specifically connected to optimal performance, effective supplier integration may be established. For performance, supplier integration should take a balanced approach. |
| Germain & Iyer (2006)   | II, Downstream integration<br>LP, OP                | Survey                                                 | SCI does not directly predict financial performance; rather, it communicates the impact of integration on Financial Perf through LP. Financial performance will not be benefited by a lack of II and/or downstream integration.                                                                                                      |
| Chen, H., et al. (2007) | the scope of integration and FP                     | Survey                                                 | Cooperation between marketing and logistics does not directly affect a company's performance. Interaction between marketing and logistics improves business performance by facilitating cross-functional integration across the entire organization.                                                                                 |
| Devaraj et al. (2007)   | CI<br>SI                                            | resource-based view (RBV), relational                  | Both SI and CI are supported by e-Business                                                                                                                                                                                                                                                                                           |

|                                 |                                                                          |                                                                                                 |                                                                                                                                                                                                                                                                                                          |
|---------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |                                                                          | view, and theory of swift and even flow survey                                                  | technology. Integration of suppliers has a positive impact on OP. There is no connection between performance and CI.                                                                                                                                                                                     |
| Koufteros et al. (2007)         | Supplier integration (gray-box and black-box integration)                | social network perspective (SNP); survey                                                        | Only gray-box integration shows a noticeable boost to product creativity. Integration with a black box has very little impact.                                                                                                                                                                           |
| Swink et al. (2007)             | SI, CI, Product-process technology integration                           | strategic fit theory, information processing theory, and the knowledge-based view (KBV); survey | Every method of strategic integration seems to have benefits, however some may also have drawbacks.                                                                                                                                                                                                      |
| Chen, Daugherty, & Roath (2009) | Corporate strategy integration internal and external process integration | Scale development                                                                               | Integration is demonstrated by a company's ability to seamlessly integrate its internal business operations or to interact with external partners. Similar to this, eliminating redundancies and finding better ways to streamline work processes (i.e., simplicity) are further markers of integration. |
| Eltantawy et al. (2009)         | SI Supply management performance                                         | Survey w/ SC professionals                                                                      | Prior to SCI and performance, strategic abilities and perceived status are critical determinants.                                                                                                                                                                                                        |
| Kim (2009)                      | SCM practice, competition capability, the level of SCI,                  | Case study                                                                                      | For sustainable SCM competitiveness, effective SCI may be even more important.                                                                                                                                                                                                                           |
| Flynn et al. (2010)             | CI, II, SI OP, FP                                                        | Survey contingency and a configuration perspective.                                             | SCI is linked to both OP and FP according to both the contingency and configuration approaches.                                                                                                                                                                                                          |
| Lau, Yam, & Tang (2010)         | SCI and modular product design                                           | Survey                                                                                          | Within SCI, sharing information, developing products together, and coordinating internal operations are essential organizational functions.                                                                                                                                                              |

|                                 |                                                                                                                 |                                                                          |                                                                                                                                                                                                       |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fabbe-Costes and Roussat (2011) | LSPs' roles in supply chain integration                                                                         | Case Study/survey                                                        | The LSP performs three functions as a supply chain integrator: it provides integrated solutions for the chain, which integrates services; it also organizes internal resources with outside partners. |
| Wong et al. (2011)              | SCI-environmental uncertainty<br>OP                                                                             | contingency and organizational information processing theories<br>Survey | When there is a lot of uncertainty, there will be a stronger correlation between SI/CI and delivery and flexibility performance as well as II and product quality and production costs.               |
| Prajogo & Olhager (2012)        | integrations of information and material flows between partners, LI, OP                                         | Survey                                                                   | OP is significantly impacted by the LI. LI is significantly influenced by both IT capabilities and information sharing.                                                                               |
| Huo (2012)                      | II, CI, SI<br>SOP, COP, FP                                                                                      | Survey<br>organizational capability perspective                          | EI is improved by II, which benefits performance.                                                                                                                                                     |
| Basnet, C. (2013)               | Internal SCI                                                                                                    | Survey<br>w/manufacturing firms                                          | Three integration dimensions were categorized: Affective relationship, coordination and communication.                                                                                                |
| Leuschner et al. (2013)         | SCI, FP                                                                                                         | Meta analytic approach                                                   | SCI and FP have a considerable and favourable link.                                                                                                                                                   |
| Lee, Seo, and Dinwoodie (2016)  | supply chain dynamism (SCD is about product or service innovation)<br>SCI; LP                                   | Survey/<br>manufacturing companies                                       | When SCD levels are high, SCI can improve LP, but at low SCD levels, those impacts are less clear.                                                                                                    |
| Liu et al. (2020)               | low-carbon supply chain initiatives of third-party logistics service providers (3PLs) in the logistics industry | Social network perspective<br>Survey w/ 3PLs                             | Government environmental rules as well as client outsourcing scope had favorable effects on the 3PL-initiated LCSCI.                                                                                  |

II: internal integration, EI: external integration, SI: supplier integration, CI: customer integration, OP: operational performance, SOP: supplier-oriented performance, COP: customer-oriented performance, FP: financial performance; RI: relationship integration, SSI: service supply integration, TPI: technology and planning integration, MI: measurement integration, LSP: logistics service provider, 3PLs: 3<sup>rd</sup> party logistics, LCSCI low carbon supply chain integration

### 1.2.1. Supply Chain Integration Types

According to Stevens (1989), supply chain integration would be categorized by two main issues: hard and soft. While hard refers to technological advances, soft attributes relations. Technological advances accelerate and complement the integration needs. Some software programs enable to fulfill these needs such as Enterprise Resource Planning (ERP), and Supply Chain Event Management (SCEM). Manufacturing planning and control system (MPC) is the hypernym for these systems. Information and Communication Technology (ICT) will be used to connect these MPCs across the supply chain. Aryee et al. (2008) combined four integration models and propose maturity models. According to this model, SCI can be accomplished in four ways;

- Integration of processes
- Collaborative methods
- MPC and ICT levels
- Technological competence

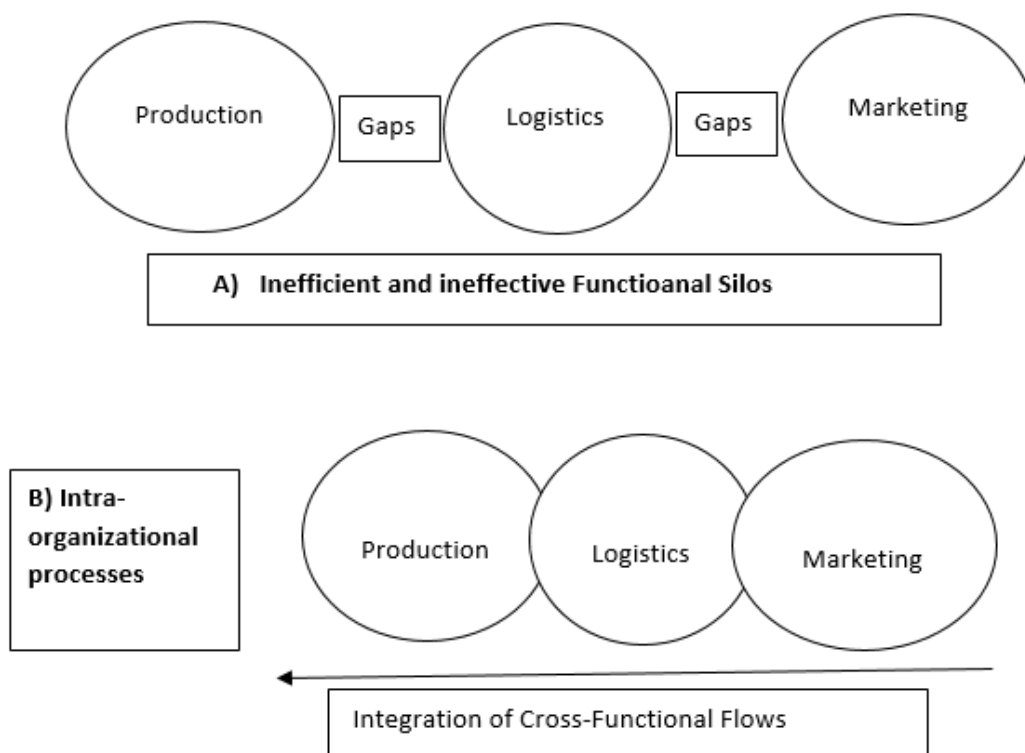
Fawcett and Magnan (2002) have categorized SCI in four types:

- The essence of supply chain projects has been identified as internal, cross-functional process integration.
- Second-tier suppliers (i.e., the suppliers' suppliers) were included in backward integration.
- Integration with the customers' customers (forward integration)
- Full forward and backward integration: This was defined as integration from the suppliers' suppliers to the customers' customers.

Morash (1998) has listed SCI in three forms in Figure 1.10 The first one is intra-organizational processes where the internal departments work closely. This integration can be simply called internal integration. The second and third integration

types are external integration where both suppliers and customers are included. Instead of separating customer and supplier integration, he proposed to approach the integrations from different perspectives: the first one is more about soft issues such as relationships, and the second is more about hard issues such as operational works.

According to Morash et al. (1996), logistics is in a favorable position to facilitate integration. Internally, production and marketing must be closely organized, coordinated, and integrated.



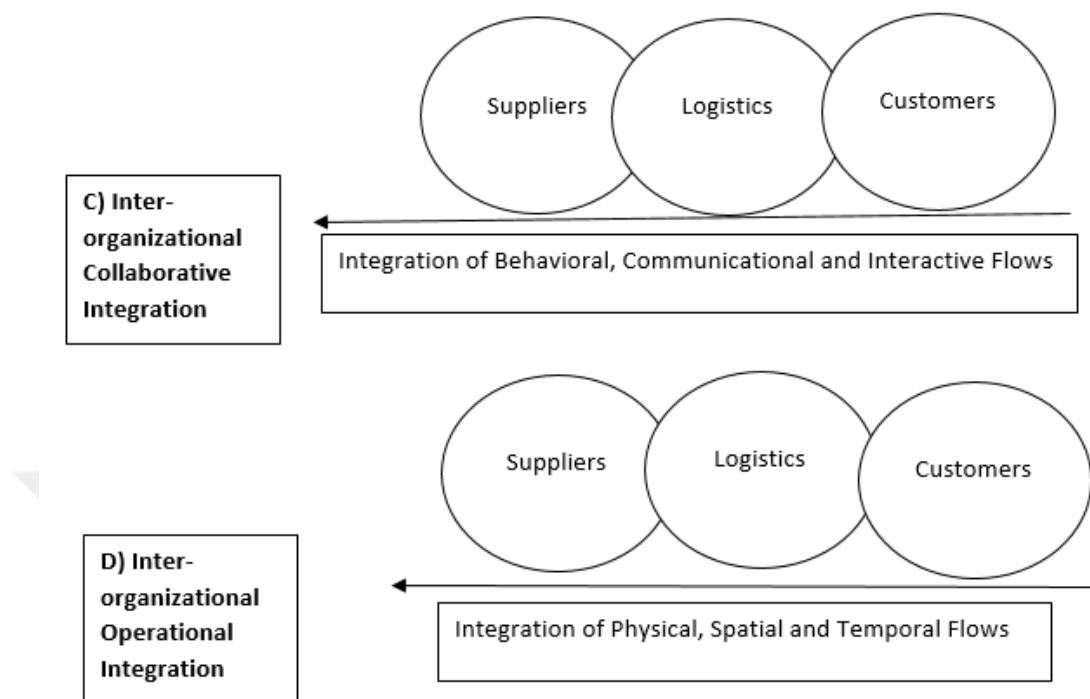


Figure 1.10: Different Forms of Supply Chain Integration (Morash, 1998)

The various aspects of SCI can be simplified down to three: customer, supplier, and internal integration. External integration generally refers to the integration of customers and suppliers (Stank et al., 2001b). Customer integration entails key competencies acquired from key customer coordination, however supplier integration entails strategic capabilities derived from crucial supplier coordination (Bowersox et al., 1999).

However, many studies in the literature have used the two types of integration: external and internal. SCI can be categorized into three dimensions: customer, supplier and internal integration. As customers and suppliers are external stakeholders of the firm, customer and supplier integrations are often included in external integration which refers to how much external partners are able to synchronize the procedure, strategies and processes of the focal company (Stank et al., 2001). Internal integration looks at how different sections of a single company work together, whereas external integration looks at how different companies work together (Pagell, 2004). Stock et al. (1998) also defined internal integration that

crosses functional boundaries within a firm. The degree to which logistics operations connect with different domains determines the level of internal integration.

Businesses that want to improve internal integration should concentrate on training employees on how to coordinate multiple company procedures, offer additional focus by creating shared goals, specifying clear objectives, and using common standards for each process, and concentrate on ensuring that internal processes are compatible and able to communicate with one another. Coordination, compatibility, communication, and other features are extended to other partners by external integration (Chen et al, 2009). In supply chain management, first of all, internal integration should be provided within the focal company, and then external integration with suppliers and customers should be integrated (Gimenez and Ventura, 2003; Stevens, 1989). Zhu et al. (2018) have suggested similar approach, before engaging in effective external integration, organizations must first create the former through system, data, and process integration.

### 1.2.2. Approaches to Supply Chain Integration

Researchers use various approaches for supply chain integration which are mostly strategic management approaches. Grant (1996) pointed out that scholars develop hypotheses to explain phenomena and either use the ideas individually or in combination. Theories of strategic management combine propositions, executions, and values (Raduan et al., 2009).

Table 1.2 indicates the scholars who applied the SCI approaches in their studies. The most popular approaches to SCI will be briefly explained after the table.

Table 1.2: Approaches to Supply Chain Integration (SCI)

| Approaches used for SCI | Authors who applied the approaches                                                                                                                                                                                                                                                                                                              |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resource-based view     | Cao and Zhang (2011); Alfalla-Luque et al. (2015); Bruque-Cámara et al. (2016); Huo et al. (2016b); Cousins and Menguc (2006); Huo et al. (2015a); Huang et al. (2014); Liu et al. (2015); Huo et al. (2019); Fawcett et al. (2011); Narasimhan and Kim (2002); Rai et al. (2006); Kim (2009); Ganbold et al. (2021); Pradabwong et al. (2017); |

|                                   |                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   | Kim (2017); Zhang and Huo (2013); Yu et al. (2021); Flynn et al. (2010); Huo et al. (2016a); Kaliani Sundram et al. (2016); Xu et al. (2014); Danese et al. (2013); Wang et al. (2016); Yang (2016); Yu et al. (2017); Yuen et al. (2019); Wong et al. (2017); Halldorsson et al. (2007); Ramanathan and Gunasekaran (2014) |
| Relational view                   | Abdallah et al. (2017); Alam et al. (2014); Cao and Zhang (2011); Kim (2017); Chen et al. (2013); Cousins and Menguc (2006); Huang et al. (2014); Kumar et al. (2016); Devaraj et al. (2007); Schoenherr and Swink (2012); Pradabwong et al. (2017)                                                                         |
| Social Exchange Theory            | Zhao et al. (2008); Nyaga et al. (2010); Thornton et al. (2016); Bruque-Cámara et al. (2016); Singh and Power (2014)                                                                                                                                                                                                        |
| Knowledge-based View              | Willis et al. (2016); Rosenzweig et al. (2003); Wong et al. (2011); Swink et al. (2007); Wong et al. (2015)                                                                                                                                                                                                                 |
| Information processing theory     | Rosenzweig et al. (2003); Swink et al. (2007); Zsidisin et al. (2015); Flynn et al. (2016); Narayanan et al. (2011); Srinivasan and Swink (2015); Yu et al. (2019); Danese and Bortolotti (2014); Bae (2017); Flynn et al. (2010)                                                                                           |
| Social Network Theory             | Koufteros et al. (2007); Liu et al. (2020); Halldorsson et al. (2007)                                                                                                                                                                                                                                                       |
| Dynamic capability view           | Song et al. (2019); MoyanoFuentes et al. (2016); Alam et al. (2014); Jajja et al. (2018)                                                                                                                                                                                                                                    |
| The network theory                | Alam et al. (2014); Liu et al. (2020)                                                                                                                                                                                                                                                                                       |
| Social capital theory             | Cai et al. (2016); Jacobs et al. (2016); Yu et al. (2013)                                                                                                                                                                                                                                                                   |
| Institutional Theory              | Huo et al. (2013), Yang et al. (2020)                                                                                                                                                                                                                                                                                       |
| Transaction cost economics theory | Ketokivi & Mahoney (2020); Dekkers et al. (2020)                                                                                                                                                                                                                                                                            |

Table 1.3 shows the characteristics of transaction cost analysis, network perspectives and resource-based view together.

Table 1.3: The comparison between Transaction cost analysis, Network perspectives and Resource-based view (Halldorsson, Kotzab, Mikkola, & Skjøtt-Larsen, 2007)

| <b>Characteristics /Theories</b> | <b>Focus of Analysis</b>                        | <b>Main Interest</b>                              | <b>Problem orientation</b>                                      |
|----------------------------------|-------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------|
| <b>Transaction cost analysis</b> | Transaction attributes (e.g. asset specificity) | Exchange and transaction                          | Why do businesses exist if their governance is effective?       |
| <b>Network perspectives</b>      | Inter-firm relations                            | Processes of exchange and adaptation              | Embedded dyadic interactions in networks                        |
| <b>Resource-based view</b>       | Resource attributes                             | Production and company capabilities and resources | Development of internal competencies: Why do businesses differ? |

#### 1.2.2.1. Resource Based View (RBV)

The resource-based view is a theoretical strategy that places an emphasis on how a firm's internal assets and skills help it to gain a competitive edge. This concept can be applied to supply chain integration to examine the ways in which a firm's distinctive resources and skills can be utilised to facilitate more efficient integration and coordination with other enterprises in the supply chain. For instance, a business with great logistical capabilities could be able to leverage such capabilities to enhance the flow of information and goods throughout the supply chain, giving it a competitive edge over rivals. A company can position itself for success in a fiercely competitive and dynamic supply chain environment by concentrating on the development and deployment of its special resources and competencies.

Based on Penrose's study, Wernerfelt (1984) developed the RBV model as a simple instrument to quantify a company's resource capabilities in specific industries. According to Wernerfelt (1984), numerous resources are required to make products, and resource management is a vital role in strategic management. Furthermore, Wernerfelt (1984) developed the RBV for companies that operate in a competitive rather than collaborative context. According to the resource-based perspective (RBV), valuable, rare, inimitable, and non-substitutable resources (VRIN) are what make companies competitive (Barney, Wright, and Ketchen 2001). The resource-based

view (RBV) proposes that businesses are collections of resources that comprise both tangible and intangible assets (Xu et al., 2014). The resource-based view (RBV) is primarily concerned with articulating the concept of strategic resources and competencies within a company as sources of economic value and long-term competitive edge (Barney, 1991).

The resource-based view is one of the most used approaches to supply chain integration. Many authors have used different dimensions as a competency. Cousin and Menguc (2006) assumed socialization is a strategic capability of the firm. They proposed that supply chain integration and socialization will result in improved supplier communication and operational performance based on this relevant theory. Devaraj et al. (2007) looked for support of e-Business technologies on customer and supplier integration for organizational performance. In this context, they assumed ebusiness as a strategic capability.

#### **1.2.2.2. Dynamic Capability View (DCV)**

The dynamic capability approach can be applied to supply chain integration to examine how enterprises in the supply chain build and employ internal and external capabilities to promote more efficient coordination and collaboration. This can involve the invention of novel technologies and information systems, the establishment of open data standards and protocols, and the promotion of an innovative organizational culture. Focusing on the development of dynamic capabilities will help businesses position themselves to adapt quickly to changes in the supply chain environment and gain a competitive edge.

Although there are many similarities between this strategy and RBV, the primary distinction is that RBV places a greater emphasis on a firm's resources and skills and how those might be exploited to create a sustainable competitive advantage. The DCV framework, places a strong emphasis on a company's capacity to develop, integrate, and reorganize its resources and capabilities in response to shifts in the business environment. The RBV has been chastised for failing to explain how these assets (VRIN) produce value over time (Rajaguru and Matanda 2019). As a result, experts have advised that organizations create new organizational competencies in order to thrive in dynamic contexts. The ability of a corporation to establish, integrate, and reconfigure internal and external capabilities to produce

sustained competitive advantages is defined by this DCV, which originated from RBV (Teece, Pisano, and Shuen 1997).

#### **1.2.2.3. Relational View**

The Relational View (RV) theory was developed by Dyer and Singh (1988) to account for the benefits and drawbacks of linkages between the company and the SC network. Collaboration, communication, engagement, integration, social capital, and trust are the RV theory's fundamental competences (Wieland & Wallenburg, 2013; Xu et al., 2014).

According to the Relational View theory of supply chain integration, the relationships between the many participants in a supply chain are crucial to the chain's success. It implies that in order to increase efficiency, lower costs, and provide better customer service, these ties should be solid and cooperative. According to the theory, these partnerships should likewise be built on trust, and each partner should communicate openly and work together to solve problems. The premise is that the supply chain will become more successful, efficient, and cost-effective when all parties collaborate.

#### **1.2.2.4. Social Exchange Theory**

An economic theory called Social Exchange Theory (SET) explains how supply chain integration functions. It is predicated on the notion that value is exchanged in interactions between suppliers and customers. This value exchange is based on the parties exchanging commodities, services, and information. For long-lasting, fruitful collaborations, SET advises that suppliers and customers should share mutual trust, understanding, and dedication. According to the notion, consumers must have faith in their suppliers to deliver value, and suppliers must have faith in consumers to pay for the products and services they receive.

Blau (1964) created the SET to extend the exchange theory and stretch the constraints of company structures, interactions, social changes, and stability frameworks. SET was straightforward and reasonable, according to Black (1965). Grant (1996), on the other hand, created a book with a broad focus that included a variety of issues that perplexed readers trying to understand SET. The SET was updated to include company governance as well as two key relationship concepts:

trust and commitment (Zubir & Pandiyan, 2014). Because trust and commitment are two SET constructs that are necessary to creating SC relationships, social exchange theory can either help or impede CI and SI (Xu et al., 2014; Zubir & Pandiyan, 2014).

#### **1.2.2.5. Knowledge-based View**

The Relational View is expanded upon by the Knowledge-based View (KBV). It implies that a supply chain's success is influenced by both the knowledge and skills that each partner contributes to the chain as well as the relationships that exist between the partners. Sharing this information will boost productivity, cut expenses, and enhance customer service. Drawing upon the KBV, Kogut and Zander (1992, p. 384) assert that organizations are social creatures, thus it becomes crucial to coordinate goods and services with the exchange of information and experience, which eventually has an economic value. Internal integration is crucial for knowledge transfer, in particular. It enables all internal groups to collaborate effectively. According to KBV, it is very difficult to imitate integrated supply chain (Rosenzweig et al., 2003).

If knowledge is a crucial element into all manufacturing processes, if efficiency necessitates its creation and storage by persons in specialized forms, and if production necessitates the use of a wide range of specialized knowledge, then the firm's principal job is knowledge integration. But why do "companies" need to be created in order to integrate knowledge? It is due to the inefficiency of the options. Cognitive limitations restrict an individual's ability to integrate knowledge: it is not possible for each person to learn the knowledge of other professionals (Grant, 1996).

How can businesses combine knowledge to build organizational capability? Because of its intrinsic communicability, explicit knowledge poses few integration challenges. The simplicity with which explicit knowledge may be encoded, conveyed, absorbed, stored, and retrieved has considerably aided the integration of explicit knowledge thanks to technological innovations (Rockart and Short 1989). The integration of tacit knowledge, on the other hand, is one of the most engaging and difficult challenges. According to the knowledge-based view, partners should utilize common technology to encourage communication and information sharing. This can entail utilizing communication tools like video conferencing, online collaboration tools, and other electronic devices. The parties can collaborate to strengthen the supply

chain and build an integrated, robust system for everyone's benefit by exchanging knowledge and skills.

#### **1.2.2.6. Strategic fit theory**

According to strategic fit theory, strategic integration is significant in the formation of organizational competencies that contribute to competitive advantage (Lawrence and Lorsch, 1967; Powell, 1992). Strategic integration enables companies to link asset allocations to strategic demands, resulting in a match between manufacturing competitive capabilities and the environment. Effective strategies, according to Wheelwright (1984), are characterized by synergy across major decision domains. He went on to establish the term "strategic fit," emphasizing the importance of alignment between manufacturing and business plans, as well as other strategic choices and the competitive environment (Swink et al., 2007). Integration operations should lead to high level manufacturing competitive capabilities, according to all three viewpoints, strategic fit, information processing, and the KBV.

#### **1.2.2.7. Information processing theory**

A theoretical framework called information processing theory focuses on how businesses handle and manage information. Information processing theory can be used to examine how supply chain enterprises exchange and use information to coordinate their activities and make choices in the setting of supply chain integration. While both the knowledge-based view and information processing theory are interested in how businesses employ information to acquire a competitive edge, the knowledge-based view is more comprehensive, considering a variety of intangible assets beyond information, and it places more emphasis on the creation of long-term knowledge-based resources and capabilities. On the contrary hand, information processing theory has a more restricted emphasis on the cognitive processes necessary for making decisions and solving problems.

Rosenzweig et al. (2003), as environmental uncertainty grows, so does the requirement for internal integration, according to Galbraith's (1973, 1977) information processing theory, because more information must be handled among decision-makers to reach a certain level of performance. But how does this data processing take place?

The impacts of strategic integration operations can be better understood using an information processing perspective (Galbraith, 1973). Because value-added and non-value-added practices are more easily identified, rich interactions between production decision makers, employees, and external sources of information and knowledge related to necessities, abilities, technologies, and strategies influencing the production facility should jointly lead to increased opportunities for reducing waste (Rosenzweig et al., 2003). Likewise, these connections allow the manufacturing facility to foresee and reply more completely to variations in customer wants, new markets, and technical prospects (Grant, 1996).

#### **1.2.2.8. Transaction cost economics theory (TCE)**

TCE views business and market organization as different models of governance, where governance is the means to impose order, hence decreasing conflict and generating mutual benefits. This is in accordance with the laws of technology. Transaction costs are not zero, but rather positive, according to TCE (Williamson, 2013, p.8). A theory focuses on the expenses involved in carrying out commercial transactions and how these costs affect the choices that organizations make.

Transaction cost economics can be used in the context of supply chain integration to evaluate the advantages and disadvantages of various integration strategies and to comprehend how businesses might save transaction costs by working more effectively together. A company might decide to vertically integrate its supply chain, for instance, by buying its distributors or suppliers, in order to cut the expenses of managing and coordinating those connections. To benefit from economies of scale and specialization, a company may instead decide to rely on outsourcing or other types of external sourcing. Businesses can manage their supply chain more effectively by understanding the transaction costs linked to various integration options.

#### **1.2.2.9. Institutional theory**

The theory is concerned with how institutions both allow and restrict how people and organizations function. It is frequently applied to the study of sociology, politics, and economics.

There are several ways institutional theory can be used to examine supply chain management and integration. It can be used, for instance, to comprehend how the norms and rules created by various institutions, such as governments, business associations, and professional bodies, affect supply chain actors' behavior and the degree of integration in a certain supply chain. Furthermore, the impact of institutional forces on the deployment of an innovation in supply chain can be investigated. Overall, the study of the complex forces that influence supply chain integration and the actions of supply chain actors can be framed within the framework of institutional theory (Huo et al., 2013).

#### **1.2.2.10. Social Network Perspective**

The origins of social network theory is related to the 1960s and 1970s research on the establishment of relationships between social care institutions (Gulati, 1998). The literature used the open systems model as a starting point, but added an exchange viewpoint to it. It argues that companies will form alliances if they can feel strategic interdependencies between them (e.g., Hage and Aiken, 1967; Levine and White, 1961; Whetten, 1977) or see their resources complementing one another (Arora and Gambardella, 1990; Richardson, 1972).

The concept is mostly centered on Lin's (1999) model of social capital network theory. Embeddedness is the first feature. The company is thought to be embedded or positioned within a network of links or ties. Ties are viewed as channels through which an actor can acquire resources, according to Borgatti and Foster (2003). Close and confidential commercial interactions characterize buried links (Uzzi, 1997). These relationships are formed and mobilized by rational agents in order to earn returns. Firms can join a network and adopt a collaborative mindset, allowing for the development of strong and amicable relationships with suppliers. A company may choose suppliers with significant product development skills to simplify access to suppliers and potentially secure financing within the network. Additionally, it can reduce the size of its supplier base (i.e., rationalize the supply base) in order to incentivize existing suppliers to collaborate by offering them better volume and other options. While providing access is important, actively mobilizing suppliers for product development is much more important. Activating suppliers in the context of product development can occur in two forms: gray box integration and black box integration. Suppliers can help with product development by sharing their implicit expertise,

abilities, knowledge, and technology with the constituents of their customers. Some suppliers, on the other hand, may take up the development of full parts on behalf of its clients.

Organizations and individuals are viewed as interdependent instead of separate in the social network perspective (Choi and Kim, 2008). Additionally, relational connections between members are viewed as information and asset transmission pipes as well as bonding processes that "form a cohesive framework out of otherwise autonomous entities" (Borgatti and Li, 2009, p. 5). The social network perspective should be useful in conceptualizing complex relationships among Third Party Logistics (3PLs), their clients, and the government encompassing both assets and restrictions, since 3PL-initiated LCSCI captures the mixture of 3PLs' interfirm low-carbon initiatives with external SCI (in relation to customers) (Liu et al., 2020).

Carter et al. (2015) take a network approach, viewing the supply chain as a network of nodes and linkages. More specifically, they describe a node as an institution that has the potential to make choices and maximize its own profit within the constraints of its environment (e.g., manufacturers, warehouses, transportation carriers, and financial institutions). A link is defined as a link between two nodes. Links between nodes reflect transactions involving the flow of products, information, and/or money.

The social network approach can be used to examine how companies in the supply chain collaborate and interact with one another, as well as how these interactions affect the supply chain's overall performance, in the context of supply chain integration. This can involve looking into things like communication, trust, and how information and knowledge move through a network. Organizations can create strategies for better integration and collaboration by comprehending the network of interactions inside the supply chain.

#### **1.2.2.11. Social capital theory**

Putnam defined social capital as characteristics of social organization, like trust, norms, and networks that can boost the efficiency of a community by enabling arranging actions, instead of as a control of individuals but rather as a right of organizations, communities, or governments (Putnam, 1993: 167). Focusing on the significance of trust and reputation in facilitating coordination and collaboration among

supply chain actors is one way to approach supply chain integration from a social capital theory perspective. This may entail looking at how reputation and trust are developed and preserved inside and across firms as well as how they assist the integration of various supply chain components. Studying how social networks within and across firms enable access to priceless resources and knowledge that can aid supply chain integration is another strategy. Analyzing these networks' organizational structures, the norms and values that guide their operation, and the manner in which they facilitate the flow of resources and information that promote supply chain integration can all help with this. In general, a social capital theory approach to supply chain integration places a strong emphasis on the role that social networks, trust, and reputation play in promoting coordination and collaboration among supply chain actors.

## **CHAPTER TWO**

### **LEAN SUPPLY CHAIN**

The greatest way to comprehend a structure, concept, formation, or paradigm is to begin with its history. It is vital to understand the culture in which a building is placed in order to interpret history appropriately. To fully comprehend the lean management method, it is important to understand the environment, time period, and cultural structure in which it arose. In the classical approach, the worker is obliged to fulfill the given task. There is no attempt to contribute to the system's development or to change a broken structure. The focus of the system in the Toyota style, on the other hand, is on individuals. It is a system in which employees are proactive, pioneers, and volunteers for development, in which employees' contributions are valued, and in which employees themselves are valued. It's about culture, not Toyota-style improvement. And there is a greater reliance on the employee in this culture. A perpetual problem-solving situation exists. Employees will become more solution-oriented as a result of this process. Overall, before jumping into lean management then Toyota production system (TPS), history of industrialization and Industry 4.0 have to be briefly explained.

#### **2.1. Industrialization**

With the advent of industrialization in the second half of the 18th century, the structure of production in the residential environment paved the way for the construction of the factory structure. James Watt's invention of the steam engine in 1764 marked the beginning of the factory's development. Following it, many concepts for managing manufacturing began to emerge.

Freyer (2014, p.39-42) has categorized the industry revolutions under six waves. These are listed as follows;

1. Wave: weaving industry
2. Wave: iron and steel engine
3. Wave: age of transportation
4. Wave: chemical age
5. Wave: electricity industry
6. Wave: age of gasoline engine

Table 2.1: History of Industrial Revolutions

| Industrial Revolutions  | Time Period           | Born Place   | Inventions                                        |
|-------------------------|-----------------------|--------------|---------------------------------------------------|
| 1.Industrial Revolution | Late 18th Century     | England      | Mecanization, stem, power, weaving loom           |
| 2.Industrial Revolution | Early 20th Century    | Germany; USA | Mass production, assembly line, electrical energy |
| 3.Industrial Revolution | Early 1970s           | -            | Automation, computers, electronics                |
| 4.Industrial Revolution | After 1990s           | -            | Internet of things, networks                      |
| 5.Industrial Revolution | Today and Near Future | Japan        | Robotic tech                                      |

## 2.2. The Toyota Production System/ Lean Manufacturing

The Toyota Production System (TPS) intersects with supply chain management and logistics ideas. The goal of the supply chain is to manage the process from raw materials to completed goods in an effective and efficient manner. The idea of logistics, or delivering the right product to the right customer at the right time and in the right quantity, is also included. The Toyota manufacturing system also embodies a mindset that attempts to meet this need. It's not enough to call it a method; it's also a point of view, philosophy that should gradually become ingrained in the company's culture.

Toyota's operational excellence is the key to their success. The tools and quality improvement methodologies utilized by Toyota, such as just-in-time, kaizen, one-piece flow, jidoka, and heijunka, contribute to this operational excellence. These methods are thought to be the premises of lean manufacturing. Toyota's ability to utilize these techniques is due to its profound business philosophy, which is centered on human comprehension and motivation. This ideology is centered on the way to thrive leadership, teams, and culture, as well as generate strategy, build supplier connections, and keep a learning organization (Liker, 2004, p.18).

Many firms have placed too much emphasis on tools like 5S and just-in-time, neglecting to see lean as a system that must be integrated into the company's culture.

TPS is dedicated to instilling in a company's management and employees a culture of continual investment and improvement (Liker, 2004, p.23).

Toyota proposed 4P model which is depicted in Figure 2.1. Philosophy (long-term thinking), Process (eliminating waste), People and Partners (respect and employee/ partner development), Problem Solving (continuous improvement and learning).

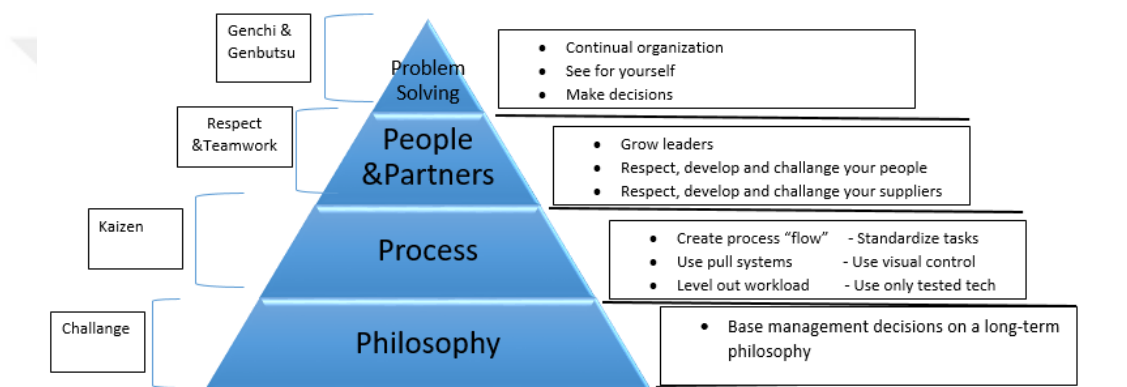


Figure 2.1: 4P model of the Toyota (Liker, 2004, p.19)

When it comes to procurement, the main issue is to manage the process. As Womack and Jonas mentioned in their Lean Solutions book, the strategy and finance departments of the companies depend on senior management. Although many companies seem to have process improvement units, it has been observed that these units generally cannot provide permanent solutions to the processes, and they extinguish the fire instead of preventing the fire from reoccurring by focusing on the cause of the fire. And the most important point in process management is to go outside the company and look at the processes through the eyes of external stakeholders. The key external stakeholders here are also customers. While designing or improving processes, customer experiences should be used mainly.

For each process, supply maps should be created for both the supplier and the customer, and value maps should be drawn by combining these 2 maps. In this way, the estimated time spent on each flow is calculated by specifying the processes in terms of both the supplier and the customer. In this direction, necessary

improvements are made by considering customer expectations. Another advantage of creating these maps is that they are measurable. Performance evaluations and subsequent comparisons can be made in line with these measurements.

Strategy comes before process, process comes before structure. First, value must be defined, then a process that provides the desired value must be defined, and then an organization that can manage this process must be defined.

In modern production, the TPS house diagram (depicted in Figure 2.2) has become an icon. The house is designed with a holistic (systems) approach. A single defect might cause the entire system to malfunction. The aims of greatest quality, lowest cost, and shortest lead time are written on the roof of the house. Jidoku and Just in Time (JIT) are the house's two outside pillars. While Jidoku's goal is to avoid a mistake from being sent to the other side, JIT refers to creating the correct product in the right quantity at the right time. The system revolves around the human being. Several fundamental factors make up its foundation, including heijunka, which refers to balancing the production schedule in terms of volume and variety.

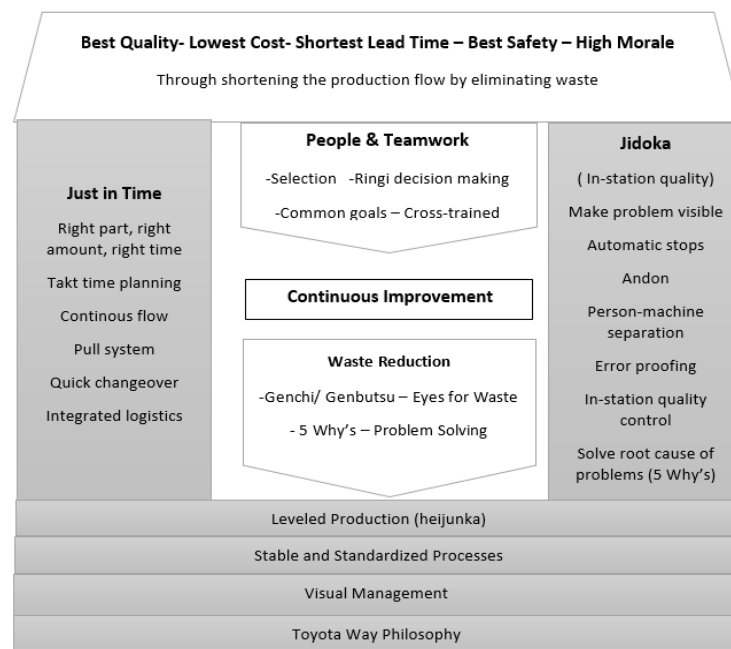


Figure 2.2: The Toyota Production System (Liker, 2004, p. 48)

Japan, which was defeated after World War II, did not have enough power in terms of both economic and human resources. Aiming to advance in the automotive

sector, which provided great profit to the United States, Japan had to find a different path due to a lack of resources. It should create value with fewer resources, save as much as possible, and therefore avoid anything that does not create value. In America, the foundations of the lean management approach were laid by adding an understanding that would eliminate waste and increase efficiency to Henry Ford's mass production approach. This production model was implemented by the Japanese company Toyota. The concept of lean management was used for the first time in the literature by John Krafcik in 1988.

Since it is thought that today's competitive advantage will be provided by supply chains, simplification of the supply chain is also important in terms of gaining competitive advantage. What is meant by the concept of lean supply chain is the elimination of each process that does not add value, by reducing the waste throughout the entire process from raw material to the end consumer, and progressing the whole process in line with customer expectations.

#### **2.2.1. Lean Manufacturing and Industry 4.0**

A useful strategy to boost productivity has been lean manufacturing, and Lai et al. (2019) have demonstrated in their study that impending Industry 4.0 technologies have the potential to boost this even further.

Lean manufacturing integration into Industry 4.0 has been a significant study for a while. This integration has benefited greatly from manufacturing automation. Industry 4.0-related technologies have done a great job of addressing lean manufacturing deployment difficulties regarding suppliers, customers, processes and controls, and human elements (Pramanik et al., 2020).

Table 2.2: Steps of Lean Implementation through Industry 4.0

| Phase title                      | Steps required                                                                                               |
|----------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Lean preparation phase</b>    | 1. Enables lean manufacturing instruction and on-the-job training                                            |
|                                  | 2. Assemble a lean team of key stakeholders.                                                                 |
| <b>Lean implementation phase</b> | 1. Map out the processes' value streams to find wastes.                                                      |
|                                  | 2. Present Six Sigma using the DMAIC methodology                                                             |
|                                  | 3. Employ TPM processes                                                                                      |
|                                  | 4. Develop a pull system as opposed to a push system.                                                        |
|                                  | 5. Eliminate waste from service and production processes                                                     |
|                                  | 6. Identify areas that could be automated, such as with cyber-physical systems and smart production control. |
|                                  | 7. Examine validity using simulations and breakout sessions                                                  |
| <b>Lean stabilization phase</b>  | 1. To optimize manufacturing, use process simulations                                                        |
|                                  | 2. Continuous improvement                                                                                    |

Source: Adopted from Amjad, 2021

Amjad (2021) has demonstrated the steps of lean implementation phases through Industry 4.0 in Table 2.2 with the aid of Industry 4.0 technology, lean manufacturing ideas are carried out more successfully, and a coordinated application is necessary for enhanced economic and environmental performance. While the value stream mapping and six-sigma lean approaches serve to increase the performance of both production and service, the TPM strategy delivers the operational effectiveness of equipment.

### 2.2.2. Lean Thinking

A significant amount of organizational will, dedication, and participation from everyone is needed to develop the abilities and leadership necessary to sustain a lean organization. Lean thinking has not always been easily incorporated into processes like procurement in some businesses because these new concepts must essentially fight with the way they used to operate. This idea has gained a lot of popularity and has been used in various business sectors as a result of the "lean"

manufacturing systems' tremendous success in the sector. There is no question that modern lean manufacturers are enlarging their borders with their suppliers and customers in order to add more value. "Lean business", "lean supply chain," etc. are used in this context. It draws greater attention and is really well-liked. Similar notions are growing and spreading quickly. Applying Lean principles to particular interests is difficult to translate, though. Lean business creates value for customers by removing inefficiencies and putting the customer at the center of the supply chain (Eyong, 2009, p.19).

Applying some of the lean principles, such as cutting back on suppliers and improving product quality, customer focus, demand generation, etc., can reduce or eliminate waste. Flow, pull system, kanban, 5S (Just in time), total production maintenance (TPM), poka-yoke, participation, etc. are a few examples of lean activities. Its main goal is to continuously reduce waste in order to deliver the finest quality at the most affordable price in the shortest amount of time. As a result, the lean system needs constant or ongoing modifications to boost productivity and cut waste. Supply chain design is included in a company's other activities under the lean method. The company's external relationships with its customers and suppliers are impacted by the lean system in this situation (Eyong, 2009, p.20).

#### **2.2.2.1. 5 basic principles of lean thinking**

Lean thinking is an antidote for the business to get rid of all processes that do not create value but consume its resources. According to the lean management approach, in order to simplify a process, all 5 basic principles must be achieved. Failure to comply with even one of these principles hinders the provision of lean management (Kabadayı, 2021).

1. Value: Value is not the best set by the managers, but the best fulfillment of the customer's expectation, in other words, what the customer really expects. It is also the first principle of the lean management approach.

Businesses should identify processes that do not add value, that is, the factors that cause waste. For this, business analyses should be made from the eyes of the customers. The concept of value should be created after businesses have a clear understanding of customer expectations.

A study from Cardiff Business School found that 60% of work done in manufacturing operations does not create value.

2. Value stream: The most critical stage in lean management is the creation of value stream maps. Mappings need to be done separately for each product. Value stream maps are a visual representation of all the process steps of a product or service and all the resources used. Therefore, value stream maps can be considered as a part of the planning phase, which is the first of the management functions. Without planning, neither the future can be predicted, nor a target can be set, nor a value can be determined. Value stream maps have a serious time cost as they have to be made separately for each product and service. For this reason, companies often try to be lean without fully fulfilling this phase. However, it should not be forgotten that a lean management approach cannot be applied before all phases are completed.

Value stream maps can be created macro or micro. While micro maps include more detailed product processes, macro maps give a more general perspective to all processes of the company and are used when making strategic decisions.

3. Continuous flow: According to this principle, the obstacles to be created must be eliminated in order to ensure the continuity of the flows created according to the value stream maps. What is meant by obstacles here is any activity that disrupts business processes, causes waste and does not create value.
4. Pull: While the pushing system is recommended in classical production systems, the pull system is supported in lean management. In the drawing system, production is made by taking into account the demand of the real customer. Care is taken not to make products based on assumptions. In this way, stock keeping and excess production waste are prevented.
5. Perfection: According to lean philosophy it is always possible to reach to better situation or results. The target should be perfectionism but it should be also known that it is not possible to be purely perfect or perfect enough. So lean philosophy is a long way and never ends up. It should be sustainable and never ending.

### 2.2.3. Waste Resources

To be lean, you must create a value stream that will assure there is no waste of any kind, including time (Naylor et al.,1999). Administrators have been able to prevent unit cost increases and decrease lead or cycle times thanks to the lean method. It provided producers with more control over the way their operations were run and additional opportunities to further the exploitation of workers (Manthou, 2001).

The essence of the lean management approach is based on eliminating waste. Anything that does not create value within the business or may cause a loss of value is considered waste. This applies to all aspects of the firm, not just production. In the *Toyota production system*, waste resources are gathered in 7 categories. It is possible to summarize them as follows (Ordun, 2020, p.516):

1. Overproduction: This causes many negative outcomes; overwork of employees or machines, disruptions in planning, increase in storage costs, etc. affects many areas.
2. Stocks: All kinds of raw materials that are not actively used in the production process are the inventory of finished products. Inventories are considered waste as they are linked to many resources (capital, storage space).
3. Layout plan: Inability to design production areas and machine layouts correctly, not determining employee competencies correctly and not making the right distribution of employees in this direction.
4. End-of-sale processes, customer complaints, failure to implement warranty and legal processes also indicate defectiveness. This is also considered a type of waste.
5. Shipment: Incorrect loading, transportation problems, failure to determine the right personnel, suitable vehicle, and correct loading area can be listed as waste items that can be experienced during shipment.
6. Unnecessary operations and processing time: use of faulty equipment, incorrect materials.
7. Waiting times: Covers both the employee and the machines used. Inability to make the right planning in workflow and processes.

According to Japanese literature, there are 3 main waste resources which are abbreviated as 3M. 3M is the combination of Muda, Muri and Mura words. Muda

refers to the waste of resources which is not valued according to customer perspectives. Muri refers to over workload for both work machines and labors while Mura emphasizes an imbalance between labor workload and changes in production capacity (Kabadayı, 2021).

#### **2.2.3.1. Muda**

This principle is similar to the sustainability philosophy. Sustainability characterizes the continuity of a business, and in doing so, it requires the least possible damage to the environment and additional contributions in economic and social terms. According to Japanese culture, the word translated as "waste", that is, "mura" in Japanese, is considered a sin in the lean management approach. What is meant by waste here is not only the overuse of resources but also that processes do not create value. Lean management, it is aimed to make resources with less energy, less time, fewer resources and better quality. There are 2 types of muda. The first is the type of waste that is necessary to get the job done but does not create value for customers. Type 2 muda, on the other hand, is waste that does not add value in any way, exploits resources and must be destroyed. There are 8 deadly Type II mudas (Liker, 2004). These waste types are abbreviated as TIM WOODS.

- **Transportation:** Covers the waste resulting from the unnecessary transportation of a physical asset from one point to another. Excessive (unnecessary) transportation causes waste due to many reasons such as wrong planning of the workflow or workplace, and failure to plan the delivery times correctly. Unnecessary transportation also increases carbon emissions and seriously harms the environment. For this reason, unnecessary transportation should be prevented with proper planning in order to prevent damage to the environment and to save resources.
- **Inventory:** More than needed is considered as stock. While the push method is used in classical production systems, the use of the pull method in lean production prevents stock keeping, because, in this way, production is made on demand and not kept in stock. Another problem with keeping in stock is that product diversity and competition increase too much, resulting in a shortening of product life cycles. Since the shortening of the product life cycle will reduce the demand for the product over time, keeping the product causes more harm than benefit. Finally, stock causes many

problems indirectly, but it may not be understood that the problem that occurs at the beginning is due to stock. Therefore, problem determination should be made with precision and it should be investigated whether it is caused by stock. However, even though it is not very possible to keep zero stock in the supply chain, it is important to minimize the stock. One of the biggest reasons for stock holding is the bullwhip effect. In order to prevent the bullwhip effect, customer demand information must be shared with the entire supply chain at the right time.

- **Motion:** Unnecessary circulation within the workplace is also a type of waste. Excessive circulation can cause overworking and fatigue of employees, as well as overworking machines. This causes extra energy costs and a decrease in efficiency.
- **Waiting:** The most important output of this type of waste is customer dissatisfaction. When customer dissatisfaction is reflected in the employee, it causes a decrease in employee motivation and later in employee performance. Unnecessary waits are often caused by incorrect job design and lack of communication between departments. For this reason, the information flow should be provided bidirectionally.
- **Overproduction:** Overproduction causes excess inventory. For this reason, it is directly related to the stock, which is the second type of waste. More production than demand causes the storage costs to increase and the products not to be delivered to the customer on time.
- **Overprocessing:** If the extra functionality added to a product or service does not add value from the customer's point of view, it is also a waste. So if the customer does not agree to overpay for the newly added feature, it is unnecessary to add this new feature. Sometimes a function that is very important in the eyes of the manager should be eliminated if it is unimportant in the eyes of the customer.
- **Defects:** The biggest output of faulty production causes loss of customer loyalty and even loss of customers. The expenditure of extra resources to correct the error also doubles the waste. Faulty production is mostly caused by the carelessness or lack of training of the employees.
- **Unused skills:** Employees may lose both their sense of belonging and their motivation in the long run if the job is not designed to provide

maximum benefit from the knowledge and abilities of the employees. Employees may feel worthless when they cannot use their skills and knowledge. For this reason, the abilities of the employees in the workplace should be analyzed and when the need arises, the employees should be able to be shifted in that direction.

#### **2.2.3.2. Muri**

The word Muri means "overload" in English. The overloaded party is meant for not only human but also machines. If the human or machine is exposed to excessive load, its efficiency decreases over time, and in the long run, it affects the performance negatively, not positively. Wrong work arrangements arise due to wrong production planning.

#### **2.2.3.3. Mura**

The word Mura means variability, imbalance, and inequality in English. It arises due to variable production volumes. Producing in large volumes can cause instability (Kabadayı, 2021). Mura happens when there are inconsistencies or imbalances in the production process, which leads to inefficiencies, delays, and mistakes. This may occur as a result of changes in the production flow, unequal workloads, or a lack of resources. Lean philosophy encourages the use of instruments like value stream mapping, process flow analysis, and standardized work practices to find and remove inconsistencies in the manufacturing process in order to eliminate mura. As a result, work flows more easily and consistently, lead times are shortened, and quality and efficiency are increased overall.

### **2.3. Lean Transformation Method**

Womack and Jones (2015, p.166) explained lean transformation methods. For transformation many common and basic features can be listed:

- The purpose of the process should be clearly stated. It should be determined what both the customer and the company need in terms of value acquisition.
- A performance appraisal measure should be developed to show whether the goal can be achieved. In doing so, it can also be an indicator of how well the process measures the problem. Must be able to measure total flow

time and stocks. Ultimately, it is important to identify the difference between acceptable and unacceptable performance.

- Process steps (process maps) should be written from beginning to end for both the supplier and the consumer. Here, steps should be recorded based on on-site observation rather than default steps. There is likely to be some difference between the default process and the actual running process. The important thing is to be able to detect this difference.
- Each process step should be evaluated and it should be determined whether it creates value for both the consumer and the supplier. In this direction, it is essential to make the eliminations.

Briefly stating the purpose of the process, identifying the needs of suppliers and customers, creating simple process maps that every employee can understand, measuring current performance are the basic steps to be implemented in process improvement. After these are done, the question of “how” comes next.

Process improvement is possible by providing the following 3 conditions: if they can see the whole process; if they understood the logic and need of the whole process; It is possible if they believe in the necessity and success of the new process.

Some ideas for lean management are presented below;

- Renewing the stocks of big stores from regional distribution centers during the day
- Replacing the stocks of regional distribution centers from supplier factories, not from internal supplier warehouses, but with many made-to-order items
- Eliminate random storage locations in department stores.
- Using more knowledgeable store personnel to stock goods, take customer payments and direct them to other jobs according to demands
- Requesting the stocks of neighboring stores from big stores at appropriate times
- Receiving online orders from stores during low demand hours to avoid opening a separate warehouse

## 2.4. The Lean Supply Chain Roadmap

Srinivasan (2011) has listed the lean supply chain roadmap as the following steps.

*Step 1 Establish System Approach Skills:* This step emphasizes the importance of a holistic view. All the processes are supposed to tie each other and cannot be isolated from each other. Instead of local optimization, there should be overall (system) optimization. Optimizing each unit individually does not mean that the system will be optimized as a whole. For example, it does not mean that what is ideal for the purchasing unit will also be optimal for the production unit. Each unit should be synchronized with each others while determining the most ideal and should determine the optimization as an institution. This paradigm is defined in the literature as the systems approach. In lean management philosophy, each unit must be lean in itself, but in this simplification process, the whole must be taken into account. It should be valuable to consider below three questions while evaluating decisions based on system thinking;

- If the decision will increase the organization's profit?
- If the decision decreases working capital?
- In the long-term decision will decrease fixed expenses?

*Step 2 Concentrate on Throughput:* Throughput can be defined degree of fulfilling the company goals. The profit is the indicator of throughput which is directly related to the growth. Minimizing the cost would be another way to achieve growth but this is a different perspective than growth orientation. In a supply chain many independent processes and actors work together in order to improve the objects. But the ability to improve this object is restricted because the chain is as powerful as its weakest tie. Therefore, strengthening the weakest tie has to be the priority. Improving the other links would not intensify the whole chain.

*Step 3 Provide Products and Services that Meet the Needs of Customers:* This step is another main philosophy of the lean supply chain which focuses on customer expectation and satisfaction instead of company expectations. If the product or service don't match customer expectation then it is not creating value which means it should be eliminated. To match customer orders on time lead time carries a critical importance because it would cause making stocks more than is needed. For that

reason, customer demand should be calculated precisely and stock should be located in a strategic location.

*Step 4 Build a Competitive Operations Strategy:* There is a difference between operational effectiveness and operational strategy. Operational effectiveness aim is to improve each process and in the end increase productivity while operations strategies aim to form strategic flexibility for competitive advantage. Operation strategies should also be aligned with marketing strategies. The main aim of marketing strategy is to understand customer needs and wants for value propositions while the operations function is to deliver value. If these two functions (marketing and operation) conflict, then the main aim would not be achieved.

*Step 5 To Build Strategic Collaborations Acquire Supply Chain Partners:* Strategic collaboration or alliances generally form between suppliers and customers to match the objectives of both sides. In these alliances each partner must have advantages on behalf of their organizations, it should be in win-win situations.

*Step 6 Streamline The Value Stream:* This step focuses on removing all the activities which do not add value that is classified as Muda, Mura, Muri in Japanese philosophy.

*Step 7 Create Flow along the Supply Chain:* Setting and following the flow is necessary for sustainability of the lean supply chain. For this purpose, the flow should be in balance. If one party or process goes faster than other then the speed of flow would be damaged at the end. To understand this, bottlenecks item due to unnecessary activities should be identified. Building a smooth flow of products across supply chain should be provided.

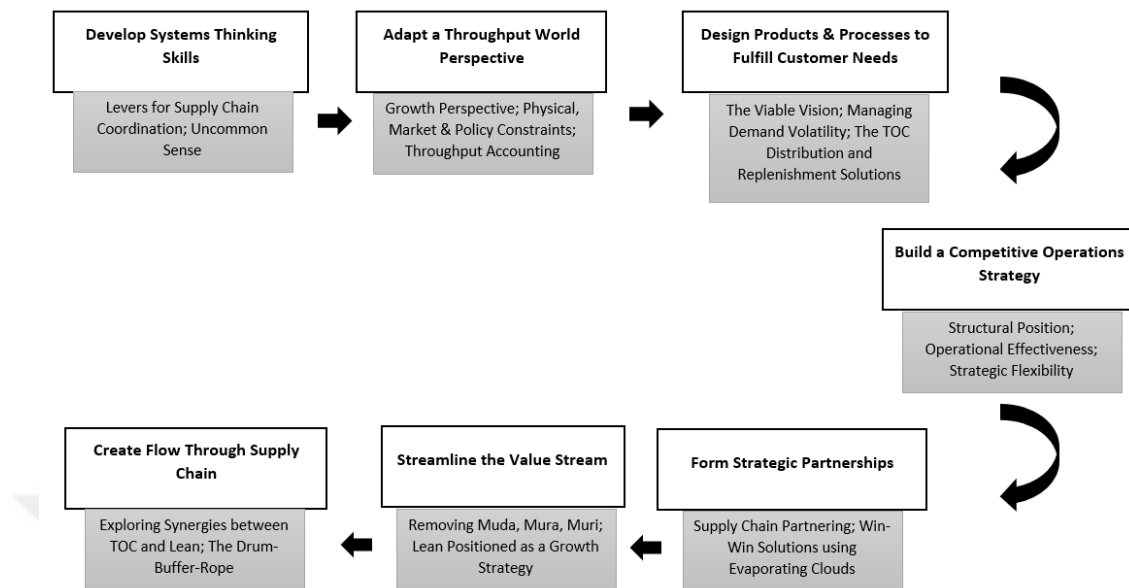


Figure 2.3: The Lean Supply Chain Roadmap, Srinivasan (2011)

Srinivasan (2011) proposed 16 principles of a lean supply chain.

- Principle 1: Improving each subsystem individually is not enough for the performance of the system, the impact of each subsystem on the system as a whole needs to be looked at.
- Principle 2: While focusing on lean supply chain performance, don't forget the supply chain ecosystem.
- Principle 3: Wasting time (more than it should) on a bottleneck resource results in a loss of efficiency in the entire supply chain.
- Principle 4: Decisions should be focused on increasing throughput.
- Principle 5: Product design should be made according to consumer needs and expectations.
- Principle 6: Undifferentiated from stocks should be maintained if this is economically viable.
- Principle 7: The design of products and processes should have strategic flexibility by keeping track of changes in customer preferences.
- Principle 8: Demand changes should be buffered by capacity, not stock.
- Principle 9: Collaborations should be made with supply chain stakeholders in order to deliver products and services in the fastest and most efficient way.
- Principle 10: Supply chain performance metrics should be created to increase productivity.

- Principle 11: Forecasting should be done while planning. A system that responds to pull signals will have less change than a push system.
- Principle 12: For higher throughput, differences (variations) in the operating system need to be reduced.
- Principle 13: Bottleneck resources should be planned first and other resources should be synchronized accordingly.
- Principle 14: Instead of focusing on balancing capacity, focus should be on synchronizing flow.
- Principle 15: The focus should be on the completion time of the project, not the completion times of the tasks.
- Principle 16: To get rid of inefficient multitasking, bottleneck resources should be allowed to flow through the system.

Lean supply chain refers to an ideal supply chain in which the processes in the supply chain are integrated with each other and products and services are delivered to the consumer quickly and economically (Srinivasan, 2011).

#### **2.4.1. Lean Supply Chain Tools**

Kabadayı (2021) listed some of the lean supply chain tools:

##### **2.4.1.1. Just in Time (JIT)**

The concept of just-in-time production is one of the most well-known and most important tools of lean management. In fact, this concept is more known than lean management itself. Its main goal is to prevent waste and ensure customer satisfaction. Market leaders or large-scale companies tend to outsource the stock to small companies to avoid this waste. However, this is a situation that should be avoided by small companies because this excess inventory slows down cash flow and can collapse companies in the long run. The product life cycle is critical for its implementation. If the product has just entered the market, its availability must be high so that the product can be easily accessed. The most appropriate stage for the implementation of JIT is the maturity level of the product. At this level, the demand structure has formed and it is easier to forecast if there is no extraordinary situation (Kabadayı, 2021).

JIT has given businesses that want to enhance their operations the ideal circumstances. JIT enables businesses to lower costs, inventory, unpredictability, and enhance throughput. Effective cooperation between buyers and sellers is necessary for JIT to work. JIT is a method that manufacturing organizations employ to boost productivity and efficiency by reducing waste (Malakouti, 2017).

Implementing JIT strategy is one of the most important goals of SCM since it delivers items to clients at the proper location, time, and quantity. Successful JIT implementation results in good Agile SCM (Malakouti, 2017).

#### **2.4.1.2. Kanban (pull system)**

It is a scheduling system that visually presents the workflow. Kanban means card in Turkish. Cards can be physical as well as electronic. The number of cards shows the business processes. It is used to prevent surplus and faulty products (Kabadayi, 2021). A pull-based inventory control system called Kanban is used to govern the flow of information and resources within a value stream. Kanban, which means "signboard" or "billboard" in Japanese, refers to a system that uses visual cues—such as cards or boards—to notify when supplies or parts need to be restocked and to start the production of goods or services in response to demand from customers. An inventory management and multiple phases production planning system is called kanban. Production stream and inventories are managed using these cards. High production volume and high capacity utilization are made possible by this technology, together with decreased production time and work-in-process (Sendil Kumar and Panneerselvam, 2007). Lean manufacturing and supply chain management both use kanban as a crucial tool to help firms cut waste, boost productivity, and provide more value to consumers.

#### **2.4.1.3. Jidoka (automation)**

Jidoko means “automation with a human touch” in English. Jidoko is a tool developed to detect and prevent errors that may occur in the production line as soon as possible. The most important point here is that the person preventing this error is the machine, not the human. According to lean management, people are a very valuable resource and should not work just to detect life. For this reason, the machines must be programmed to detect and stop when faulty production is made.

Jidoka is a lean manufacturing concept that emphasizes integrating quality into a process rather than only examining it after the fact. Jidoka stresses the value of having devices and procedures that can recognize and fix mistakes without the need for human participation. This can be done by utilizing sensors, alarms, and other technologies that can recognize a problem when it arises and take appropriate corrective action, such as stopping the manufacturing line or starting a repair. Businesses can save waste, enhance productivity, and raise the caliber of their goods and services by integrating jidoka into their operations (Tekin et al., 2019).

#### **2.4.1.4. Visual management**

Due to the nature of the human brain, it responds more quickly to visual content. Increasing the visibility in the workplace helps to attract the attention of the employees and to prevent possible mistakes faster. It is most undesirable to have unnoticed errors. In order to prevent this, this awareness must be created. For this purpose, it is important to diversify the visuals and to inform them in this direction.

#### **2.4.1.5. Andon**

Turkish meaning is a lamp. Light and signs are called andon. This target, which shares the same goal as the purpose of visual management, is used to detect errors as soon as possible and to speed up taking action (Kabadayı, 2021).

A system of visual signals used to notify staff members and managers of issues or anomalies in a production process is known as a "Andon" in lean manufacturing. The system employs lights, flags, or other visual indications to show when a problem has occurred and to indicate the need for action. The word "Andon" is Japanese for "paper lantern." The goal of Andon is to enable employees to promptly identify and address issues in the manufacturing process in order to reduce waste and increase productivity. By reducing the response time to concerns, the Andon helps lean reduce waste. The technology is designed to provide supervisors with an immediate visual picture of operations (Hirvonen, 2018, p.1). Organizations can use andon to increase the quality and dependability of their goods and services while lowering the need for pricey inspections and rework.

#### **2.4.1.6. Poka-yoke**

Poke means difficult to avoid error understanding, while yoke means precaution. This tool means error prevention before it causes an error. E.g; USB disks cannot be inserted in the reverse direction. It is poka-yoke that the system does not allow it, even if a careless operation is performed. This tool adopts a proactive approach.

#### **2.4.1.7. 5S workplace arrangement**

According to lean management, 5 steps need to be applied to workplace arrangement. The first of these, Seiri means sorting. In this process, it is the removal of unused products before starting work. Seiton, which means order, is the ordering of materials to be used according to frequency of use and degree of importance. Seiso, which means cleaning the third, ensures that the materials to be used are kept in the right place in order to maintain the order provided in seiton. Seiketsu, which stands for standardization, emphasizes the need for controls to ensure order. Finally, Shitsuke, which means discipline, states that in order for these processes to be sustainable, less training and discipline should be given to the employees so that they become a habit.

#### **2.4.1.8. Kaizen (Continuous Improvement)**

Kai means change and zen means good. According to the Kaizen philosophy, there is always something to improve. This approach is closely aligned with the philosophy of the learning organization. Just as learning is endless, so is development. There is definitely a point that needs improvement. In this, change should not be resisted, one should be open to learning. Kaizen is not process-oriented, but people-oriented and it cannot be expected to produce successful results unless it becomes a corporate culture. According to this approach, each problem is the key to developing a new approach. For this reason, when a problem arises, instead of blaming the employee, it should be directed to a solution and the employee should be encouraged to new approaches.

#### **2.4.1.9. Gemba walk**

Regular visits should be made to the actual spot where the work is done so that kaizen can take place. Gemba means where the real work is done. Just as a

problem arises, it is necessary to look at the source of the problem, in order to understand the business processes in general, it is essential to make on-site observations of the source of the work.

#### **2.4.1.10. Heijunka (work balancing)**

Heijunka means leveling. The right amount of the right product must be balanced to increase efficiency throughout the value stream. It allows the most efficient use of production capacity.

#### **2.4.1.11. SMED (single minute exchange of die)**

It is aimed to realize mold/model change in production in less than 10 minutes. It is used to avoid wasting unnecessary time wasted. It is a critical tool for the effective use of JIT. Tekin et al. (2019) stated the benefits of SMED as follows;

- Possibility of producing in small quantities with faster mold changes (no waiting time, no stock)
- Capability for flexible production and timely delivery (no time wasted)
- Working with smaller parties results in less inventory (zero stock).
- Requires less working capital
- High-quality production with improved mold upkeep (production with no defects)
- A larger area for routine stocking (zero stock)
- Quickly changing product options and labor efficiency (no lost work)
- A rise in output (unnecessary process loss).

#### **2.4.1.12. Total productive maintenance (TPM)**

A tool aimed at maximizing equipment efficiency and minimizing failures. In this way, work accidents are prevented and faulty production is prevented. This approach builds on the 5S Job editing tool. Quality and planned maintenance, early equipment maintenance, occupational health and safety, training are the main elements of TPM.

#### **2.4.2. Critical elements for lean supply chain success**

Kabadayı (2021) stated the critical elements for lean supply chain success:

- While lean production is only the responsibility of the top management at the organizational level, in lean supply chain management, those responsible for the entire process from raw material to the end customer are responsible, and for this to happen, waste must be prevented in all these processes.
- Establishing long-term systematic relations with suppliers and customers and closely monitoring customer expectations are of great importance for the realization of simplification.
- The number of suppliers and the location is very important in order to obtain the product from the suppliers at the right time. In particular, it must be located in the right place for the JIT policy to be implemented. Working in close proximity with a small number of suppliers is among the recommendations.
- In order for just-in-time production to be carried out, a two-sided information flow must be provided from supplier to company and from company to customer.
- In order for the logistics activities, which have the most problems in the supply chain, to be carried out smoothly, an order should be established according to the JIT philosophy. It is recommended that production planning be made in line with customer demands by minimizing the stock policy to be applied in this direction.
- Benchmarking will also be beneficial in this process. Following the companies that successfully implement the lean supply chain should be taken into consideration when determining the strategies.
- Another obstacle to being lean is the imbalance in customer demands. Decisions such as promotions and price changes, which may cause fluctuations in demand on the customer's side, should be made carefully. Stocks should be kept accordingly. Therefore, the bullwhip effect that causes demand fluctuation should be eliminated.

Along with the advantages of lean manufacturing, its drawbacks are also discussed in the literature. For instance, there are various uncertainties on whether lean manufacturing is applicable to all goods and markets especially in light of the range of goods. The lack of flexibility is one of the primary causes of this. The creation of schedules beforehand ensures the synchronization of material movements. This is complicated by the presence of tools like the ringji system, which slows down decision-making (Christopher et al, 2016, p.61).

## CHAPTER THREE

### AGILE SUPPLY CHAIN

*“There isn’t the luxury of time. We used to say, ‘Wait until this crisis is over and we get back to normal,’ but that never happens. We have to be ‘change animals.’”*

*— Michele McKenzie, President and CEO - IBM 2010 Global CEO Study*

#### 3.1. What is Agility?

In general, dictionaries define agility as being swift, quick, and energetic. This differs from flexibility, which in the context of production also refers to adaptation and versatility. The competitive forces of now demand flexibility, yet flexibility by itself cannot produce agility (Gunasekaran et al. 2001, p.25). Agility is a concept about what the organization is rather than what it does. Agility refers to adapting quickly and effectively to changing conditions. Agility alone is not enough and is sustainable for organizations. Organizations must strive to remain resilient to unexpected, disruptive change. The ability to step back and be intuitively aware of threats is essential to resilience. In addition, being able to turn back quickly from a wrong decision is also an indicator of endurance. In order to be an agile and resilient organization, employees are expected to be alert to possible changes and risks and to constantly develop awareness. While developing these skills, they should be able to develop the ability to obtain the right information and use it correctly. Agility is more about the intangible assets of the organization (Ordun, 2020).

Since its origins in the early 1990s, agility as a novel approach for increasing competitiveness has attracted much interest. In some business environments, the concept, in its different manifestations, is now considered a successful strategy for growth, if not an essential one for survival (Ismail & Sharifi, 2006). According to the Agility Forum at Lehigh University in Pennsylvania, agility is the capacity of a company to succeed in a dynamic, uncertain business environment. Agility "relies on some distinctively American qualities, such as entrepreneurship and information systems technology," even though Japan has "won the lean manufacturing race." (Christopher et al, 2016, p.62). Since agility is the degree to respond to changes quickly it can be

affected by multiple sources. Lin et al. (2006) have stated these sources as; marketplace, consumer desire, technology, social factors and competition.

The four main concepts of agility have been identified by Goldman et al. (1995) These are:

- Providing value to customers,
- Being flexible,
- Respecting human knowledge and abilities,
- Building virtual collaborations.

Katayama and Bennett (1999) introduced the competitive priority of agility;

- Changing the design of a product quickly
- Adjusting volume quickly
- Changing the product mix quickly
- Providing prompt service
- Creating a product that is easily accessible
- Product customization

### **3.2. Agile Organization**

Agile businesses actively welcome change. Alteration and unpredictability are self-renewing sources of opportunities from which agile competitors can create ongoing success. Agility, therefore, depends to a hitherto unheard-of extent on human initiative, ability, knowledge, and information access. An agile organization is one whose administrative procedures and organizational architecture permit quick and seamless conversion of this initiative into profitable business operations. When it comes to generating potential for expansion and profit, agility is aggressive. Due to their awareness of the ways in which industries and client needs are moving, agile competitors create new markets and new customers (Gunasekaran et al. 2001, p.25).

Agile businesses aim to bring together the benefits of time compression with methods to lower the cost of diversity. The objective is to provide virtually immediate delivery of limited quantities of goods that adhere to precise requirements. To fulfill the demands of clients for customization and responsiveness, a company must reinvent its processes and goods (Gunasekaran et al. 2001, p.25).

How can a business adapt to this sudden change in client needs in a world that is altering so quickly? Agile procedures and techniques can be used to handle such unforeseen developments in the industry in this situation. Fueled by digital technologies, the agile business has changed the corporate landscape through its capacity to not only quickly and cost-effectively adapt to changing consumer needs, but also to foresee these shifts and cope with them by taking the required actions (Eyong, 2009, p.12). Agility is the ability to capture lucrative chances in a turbulent market by using market information and a virtual organization (Naylor et al.,1999).

Two crucial building elements in the shift to agile business are an organization's people resources and its capacity for innovation. Change is a fundamental component of all operations for any organization that aspires to be agile. New concepts and solutions are generated during the transition process by human resource, which fosters innovation inside the company. A variety of technologically sound goods and services that can compete in a crowded market are produced thanks to innovation and human resource inventiveness. In this regard, a corporation that adopts agile concepts has an advantage over rivals in addition to sustaining it in the marketplace. Since the market is continuously changing, an agile company must also adapt frequently in order to stay up with these changes. As we'll see later, this modification presents a chance to do more and acquire an advantage over a rival (Eyong, 2009, p.12).

According to Gehani (1995), an agile organization is able to rapidly fulfill client orders, release new goods on a regular basis, and even enter and exit key collaborations quickly. Reichardt and Holweg (2007) summarized the 4 external needs for supply chains to be more proactive and employ an agile approach as follows: demand uncertainty and variability, product variation and lead-time pressure.

As competitive forces continue to grow, agility is being stressed as a prerequisite for achievement and even survival in the manufacturing environment. A fundamental element of an agile organization is its capacity to react swiftly to changing market opportunities by employing agile business procedures. To be an agile business, companies must focus on four areas. Supplier relationships, customer relationships, organizational procedures, and the entire system are among these areas (Sarkis & Talluri, 2001). It is possible to list some of the features that show that an organization is agile as follows: quick decision-making and implementation, high

performance culture, a structure that supports teamwork, flexibility of management practices and resources. Agile organizations also dominate the lean organization philosophy. The process that does not create value is eager to quickly remove the structure. The ability to learn forms the basis of agility and resilience. An organization that cannot learn cannot be agile (Ordun, 2020, p.529).

The components of organizational agility and resilience are outlined in the framework in Figure 3.1. It lists some of the inputs—skills, materials, and other enablers—as well as the activities or interventions—necessary to develop flexibility and resilience. Additionally, outcomes that are quantified on a bigger scale, like quickness and invention, stable financial performance, favorable business reputation, pleasant employment relationships, etc. It also includes information on various outputs and repercussions, such as outcomes, which could have short-, medium-, or long-term effects. The people and culture that are present in every dial are at the model's core.

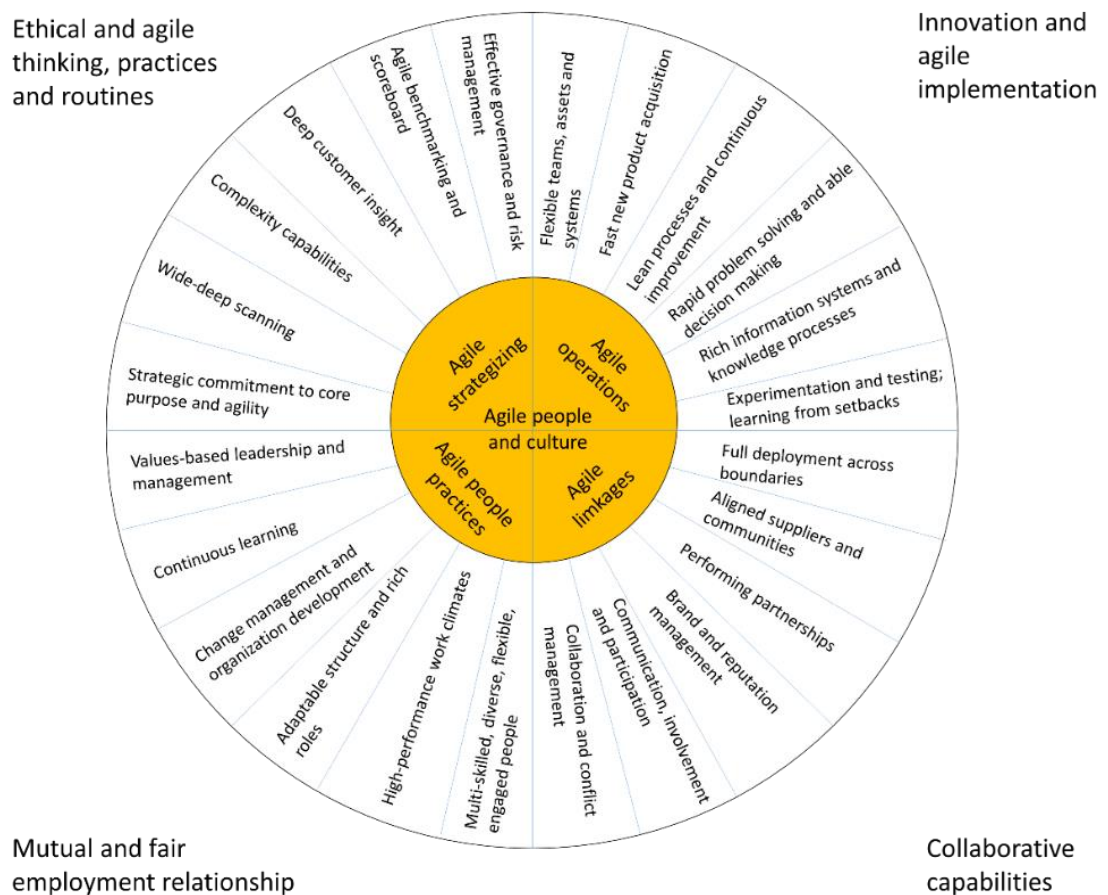


Figure 3.1: Agile Organization (Holbeche, 2018, p.54)

### 3.2.1. Characteristics of Agile Organization

Lean approach, attempts to limit internal and external changes as much as possible while imposing tight constraints on flexibility, in contrast, the agile approach has to be flexible and thus resilient to changes or disruptions (Naim, 2008). According to Slack (1987), flexibility depending upon internal resources have a positive impact on external flexibility which in turn can improve supply chain performance and overall company performance. Naim et al. (2006) also added that a mix of internal types could result in one or more external types.

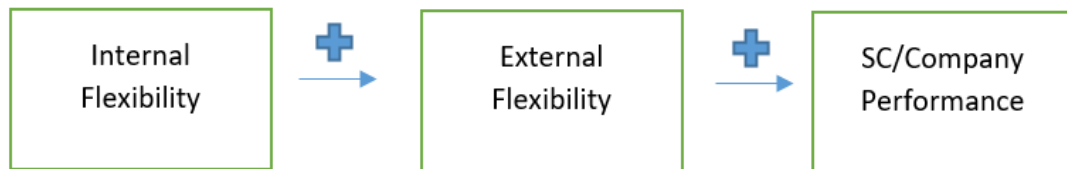


Figure 3.2: Relationship between Flexibility and Company Performance (according to Slack, 1987)

Baker (2006) mentioned that flexibility is more about operational level strategies while agility and leanness are associated with business level strategies. Power et al. (2001) have added agility should be accepted as a holistic rather than departmental or tactical importance.

| External Flexibility Types | Definitions                                                             |
|----------------------------|-------------------------------------------------------------------------|
| New product flexibility    | The range of, and ability to accommodate the production of new products |
| Volume flexibility         | The range of, and ability to accommodate changes in production output   |
| Mix flexibility            | The range and ability to change the products currently Being produced   |
| Delivery flexibility       | The range of and ability to change delivery dates                       |
| Access flexibility         | The range and ability to provide extensive distribution coverage        |

Figure 3.3: External Flexibility Types (Source: Naim et al., 2006, p.299)

### **3.3. Agile Manufacturing**

Agile manufacturing involves the focused application of well-known ideas and techniques, such as lean and flexible manufacturing, to significantly increase goods, customer responsiveness, creativity, and adaptability. Companies with agility have a decisive competitive advantage in the market (Gunasekaran et al. 2001, p.25).

The goal is to establish a manufacturing company that can concurrently produce in large quantities and diversity for certain market segments. Companies must create a manufacturing strategy that is motivated by client demands and takes advantage of manufacturing agility by reshaping market opportunities. A strategically driven manufacturing reaction is necessary for agile manufacturing. The creation of a suitable manufacturing strategy is expected to have a significant impact on a firm's survival, success, and growth as markets become more dynamic and competition is based more on increased quality and customer response (Gunasekaran, 2001).

Agile manufacturing system cover "S.T.O.P"

- S (Strategy): Companies need to have appropriate manufacturing strategies for their firms.
- T (Technology): Technology is an inevitable element in today's World. It should be able to provide the demand.
- (O) Organization: An organization where everything needs to be solved.
- P (People): Employees need to be educated properly after all these changes.

Kidd (1994) has listed goals in Table 3.1 that companies should keep in mind as a part of agile manufacturing strategy.

Table 3.1: Goals of Agile Manufacturing Strategy (Gunasekaran 2001; Kidd 2004)

|                                       |                                                                                                                             |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Goals of Agile Manufacturing Strategy | A quicker reaction to extremely fluctuating client demand patterns                                                          |
|                                       | Increased output                                                                                                            |
|                                       | Possibilities for systemic innovation, education, and enhancement                                                           |
|                                       | Higher standard of the goods                                                                                                |
|                                       | Improved capital allocation and ROI                                                                                         |
|                                       | Enhanced industry and customer orientation, better comprehension of client requirements, and improved client relationships; |
|                                       | Ability to handle a variety of lot size, including unique manufacturing, and a variety of products                          |
|                                       | Including suppliers in the processes used in product development and manufacture                                            |
|                                       | Having the capacity to act quickly when new chances comes                                                                   |
|                                       | Being able to multi-venture through virtual organizations                                                                   |
|                                       | Decreased costs for indirect employment and other administrative expenses                                                   |
|                                       | More time and chances for management to address issues                                                                      |
|                                       | System durableness and unity                                                                                                |

Gunasekaran (2001) has outlined the major enablers of agile manufacturing;

- when the company is virtual;
- when the teams are geographically dispersed;
- when the information system is integrated;
- when the partnerships are quick;
- when e-commerce is present;
- when the company is able to prototype quickly;
- when concurrent engineering techniques can be applied then a suitable environment will be created for the implementation of agile manufacturing.

### 3.3.1. Agile Manufacturing and Industry 4.0

Table 3.2 indicates the steps of agile implementation phases through Industry 4.0. Lean and agile manufacturing concepts are performed more effectively with the help of Industry 4.0 technology, and a coordinated application is required for improved economic and environmental performance. Agile methods of technology integration

and adaptable equipment aid in meeting the changing product demand (Amjad, 2021).

Table 3.2: Steps of Agile Implementation

| Phase title                       | Steps required                                                                        |
|-----------------------------------|---------------------------------------------------------------------------------------|
| <b>Agile preparation phase</b>    | 1. Identify the agile manufacturing mindset                                           |
| <b>Agile implementation phase</b> | 1. Describe industry 4.0's smart design process for strong customization.             |
|                                   | 2. Industry 4.0-based smart manufacture of products with additional value             |
|                                   | 3. Using Internet of Things and cyber-physical technologies to improve responsiveness |
|                                   | 4. Bringing technological fusion through corporate resource planning and automation   |
|                                   | 5. Advocate for business process redesign.                                            |
|                                   | 6. Use simulations to test the validity.                                              |
| <b>Agile stabilization phase</b>  | 1. Initiate reengineering business operations.                                        |

Source: Adopted from Amjad, 2021

### 3.4. Agile Supply Chain

It is crucial for relationships between suppliers and their interactions to be adaptable in terms of providing services or goods and responsiveness in agile supply chain systems (Malakouti et al., 2017). For competitive advantage, it is necessary to have not only speed but also agility, that is, the ability to maneuver quickly. Agile supply chain management is based on flexible manufacturing systems. The concept of agility is also closely related to the concept of flexibility. Thanks to the automation system, adaptation to changes has accelerated and the flexibility of companies has increased. In the literature, the concept of agile organization has been evaluated from many different perspectives. While predicting possible environmental changes or market dynamics and taking action accordingly is the definition of agility, in another definition, agility is the ability to use market information in the face of changing conditions (Kabadayı, 2021, p.129). The idea of agility is a recent addition to the lean manufacturing philosophy that claims to fulfill the demands of market-aware supply

chain processes (Goldman et al., 1995). The idea of flexibility and responsiveness, which is deeply ingrained in the concept of an agile supply chain, is the idea of viewing business in a new manner and providing products and services to satisfy client needs promptly and efficiently. A cutting-edge, unique product or anything slightly different from the company's prior offerings may be required by the client consuming your item or service (Eyong, 2009, p.12).

Physically efficient supply chain methods are best for functional products with predictable demand, while innovative products require "market-aware" supply chain operations that prioritize speed and flexibility over cost (Fisher, 1997). Although many firms have been adopting their philosophy into lean management in recent years, they are striving to forecast customer needs and demands in order to provide the exact needs at an appropriate time. This situation occurs because there is a lack of agility (Abdelilah, El Korchi, and Amine Balambo (2021). Agility is the degree to take action at a high speed. Being agile may vary from situation to situation.

In the literature, agility studies are mostly concentrated around two types of research areas. The first focuses on lean management, focusing on the production side of the supply chain, while the other focuses on the management area, focusing on supply chain integration (Abdelilah et al., 2021).

#### **3.4.1. Agile Supply Chain Dimensions**

Foundational social and life science theory identifies five firm supply chain agility dimensions, including alertness, accessibility, decisiveness, swiftness, and flexibility (Gligor, Holcomb, & Stank, 2013). According to Gligor et al. (2013), a firm's supply chain agility is demonstrated through the company's cognitive and physical abilities that allow an organisation to quickly determine the changes, opportunities, and dangers (alertness), connect necessary data (accessibility), make forceful decisions on how to respond (decisiveness), rapidly take actions (swiftness), and revise its scope of supply chain strategies and operations to the extent needed to implement a decision. While swiftness and flexibility are categorized under physical dimensions, the rest three of them are under cognitive dimensions. Information processing, decision making, and brainstorming are all cognitive features, whereas physical aspects are more about action and enabling firms to take the proper actions. These dimensions can also be seen Table 3.3 below.

Table 3.3: Company SC Agility Elements

| Elements      | Explanation                                                           | Category  |
|---------------|-----------------------------------------------------------------------|-----------|
| Alertness     | the capacity to recognize opportunities, dangers, and changes swiftly | Cognitive |
| Accessibility | having access to essential information                                |           |
| Decisiveness  | ability to decide with tenacity                                       |           |
| Swiftness     | ability to act rapidly on decisions                                   | Physical  |
| Flexibility   | ability to change the variety of strategies and actions as necessary  |           |

Source: Gligor et al. (2013)

According to Li et al. (2008) a firm's supply chain agility is the outcome of merging the supply chain's alertness to variations (opportunities/challenges) – both externally and internally – with the supply chain's ability to use resources in answering (proactively/reactively) to such changes, all in a quick and flexible way. Strategic vigilance, Strategic response ability, Operational vigilance, Operational effective response, Episodic vigilance, and Episodic effective response are the six aspects identified by Li, Goldsby, and Holsapple (2009). Christopher (2000) listed agile supply chain capabilities as;

1. Responsiveness (degree to respond changes)
2. Competency (capacity of realizing the company's goals and objectives)
3. Flexibility (to reach same purpose using various facilities and capacity to implement other processes)
4. Speed (degree to accomplish task as fast as possible)

The common building blocks of agile supply chains are flexibility, customer diversity, mobilization of core talents, organizational structure, change, responsiveness, speed and integration (Alzoubi and Yanamandra, 2020). Customer satisfaction, quality improvement, decreased costs, delivery time, product releases, service level development, and lead-time decrease are all factors that contribute to SC agility (Agarwal et al., 2007).

The connection between the firm and the market is referred to as agility. It is essentially a collection of skills for addressing a wide range of customer needs in terms of pricing, specification, quality, quantity, and delivery. Market Sensitivity and

Response Capability can be characterized by internal agility (Lee, 2004). Sensitivity is the first requirement for an agile supply chain. That implies it must be able to detect and answer to real-time demand. The assessment of prospective industry requirements for new items can be accomplished by collecting developing industry dynamics, hearing from clients, and tracking actual demand through sale records. In rapid markets, the capacity to react to market flashings and produce actual demand projections (and adjust them depending on existing data) is crucial (Lam and Postle, 2006). It is critical to assess market requirements, however considering the short product life cycles, capable of delivering the goods on time is also needed. Tachizawa and Thomsen (2007) highlighted the primary ways for improving the supply chain's overall responsiveness: flexible sourcing and flexible suppliers.

Lin et al. (2006) stated the basis of the agile supply chain as the combination of customer sensitivity, business, operations, connections, and information systems. They have proposed a conceptual model for agile supply chain management which is depicted in Figure 3.4.

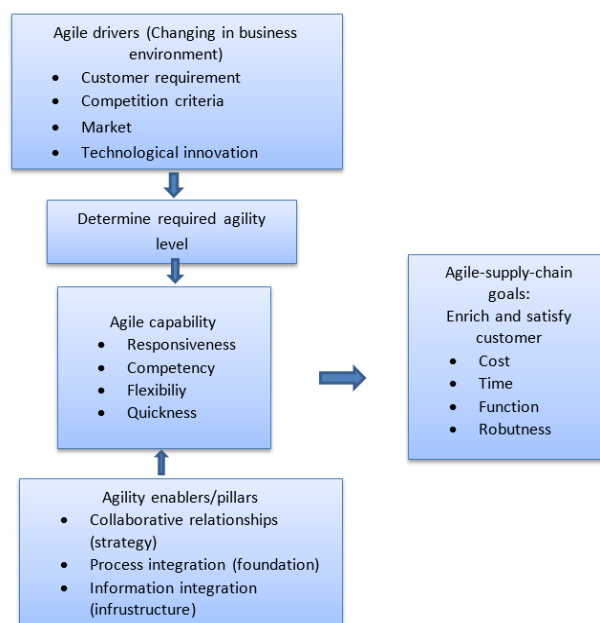


Figure 3.4: Conceptual Framework of Supply Chain Agility (Lin, Chiu, & Chu, 2006)

Supply chain agility is about a complicated philosophy of cooperation and integration among multiple parties and roles along the value chain, rather than rules

and regulations that can be readily applied or duplicated. By continuously perceiving market changes and promptly responding to these changes, SCA helps to maintain a competitive advantage. Organizations that seek to obtain a competitive edge through supply chain agility should devote resources to developing IT, operational, and managerial capabilities (Ngai, Chau, & Chan, 2011). SCA is usually viewed as an important factor affecting a company's strategic level competitiveness. This is because organizations with SCA perform better in responding to unforeseen circumstances (Tse, Zhang, Akhtar, & MacBryde, 2016).

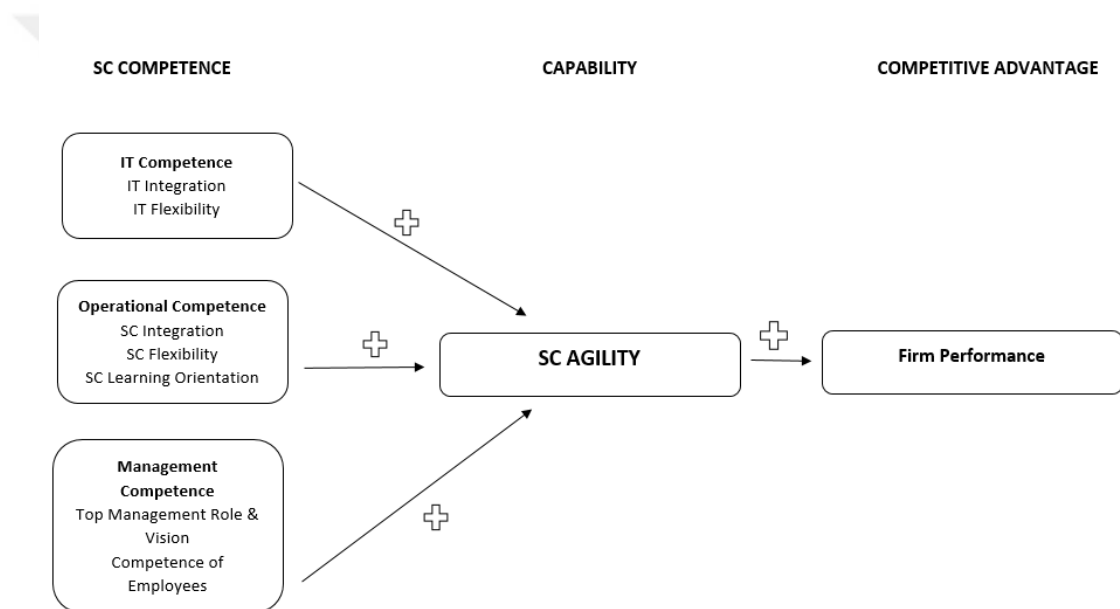


Figure 3.5: Proposed Research Model Related to SCA (Ngai et al., 2011)

The primary issue in the context of designing and operating an agile supply chain is presumably how agility can be defined in terms of SC operations strategy and integrated into each part of the channel's plan (Ismail & Sharifi, 2006). Ismail & Sharifi (2006) proposed an approach which integrates product and supply chain design, taking into account the influence of market, product, firm, customer and supplier factors. This approach consists of three stages. The first of these is that the product features meet customer expectations. The second stage is based on using the company's resources, competencies and strengths. The third is to create a supply chain structure that includes the time and effort needed to maintain the capabilities-based supply chain. In this direction, the agile supply chain structure will try to meet

customer expectations in the most appropriate and fastest way. The driving forces behind the demand for supply chain agility are analogous to those that led to the adoption of the agile manufacturing theme, and they arise from the speed with which the business environment is changing and uncertain (Sharifi, Ismail, & Reid, 2006).

The Figure 3.6 described below yields two outcomes: a list of essential product attributes that can quickly satisfy market demand on the one side and viable business expansion strategies on the other. By identifying supplier characteristics, the architecture can connect them with both current and potential providers. Its power comes from its capacity to combine the perspectives of the industry, product, firm, and supply chain into a single evaluation approach. As a result, the final product is a compromise that satisfies both supply chain agility capability and market demand. The implementation of the model creates a common structure for connecting the various stages of market research, development, outsourcing, production, and distribution without precluding employing well-established instruments at any one of those phases.

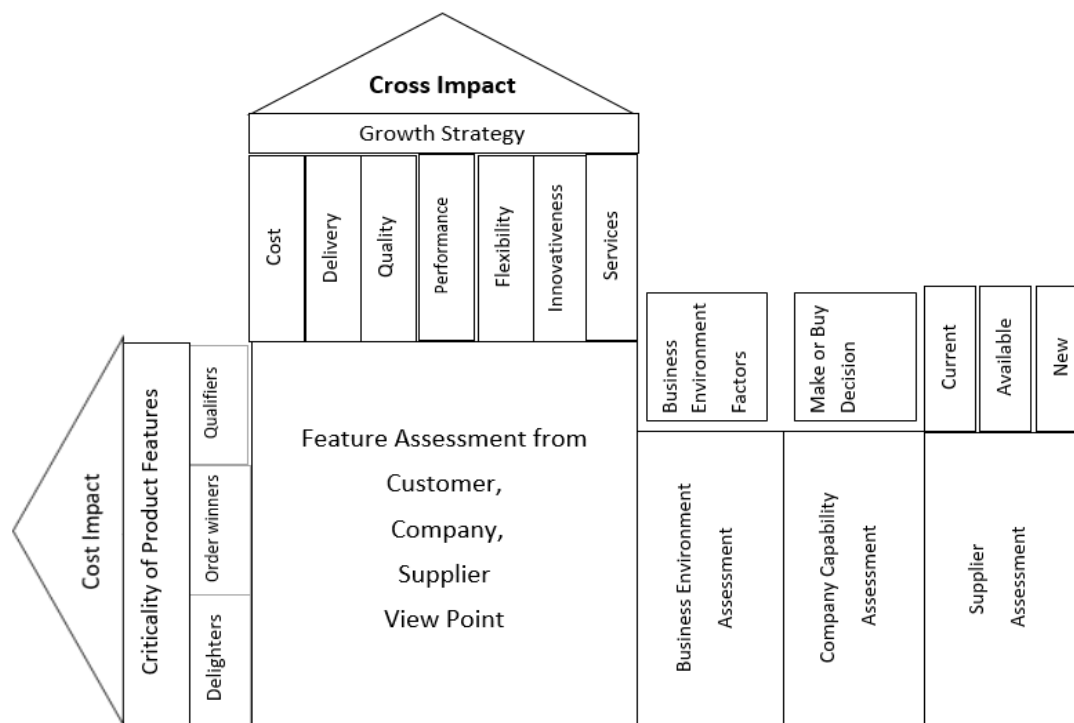


Figure 3.6: Agile supply chain framework (Sharifi et al., 2006).

## **CHAPTER FOUR**

### **LEARNING ORGANIZATION**

While new technologies boost the industry, businesses must be adaptable in order to keep up with the pace of change and avoid falling behind. The speed with which companies acquire information and act determines their agility. Although it may appear to be simple to obtain information, it is critical for a company's future success to obtain the correct information, to make this knowledge sustainable, and to make the information permanent by properly disseminating it to all employees. As Arie de Geus, head of planning at Royal Dutch/Shell, said, the ability to learn faster than your competitors may be the only competitive advantage you can hold onto. In the usual order, it is not very likely for companies to protect their future assets if the leader or manager thinks and decides on their own and other employees follow it. It is not as easy to acquire the right information as it is to transfer the right information and make it permanent. For this reason, it is essential for companies to systematize their information and carry it to the future without causing information loss. When an employee or employees leave the job, regardless of blue or white collar, in any unit of a company, when there is a disruption in the work done due to lack of information, this means that the information has not been adequately transferred to the company. Companies become learning organizations when the information is transferred to the company in the right way and can be conveyed correctly to the newcomers, regardless of the actor.

Businesses operate in unpredictable economic, political, and technical situations. Organizational learning is a continual and chronic feature of society, not an ad hoc or episodic occurrence. However, it is not quite entirely obvious for a company

to learn. It's also unclear how researchers might help firms learn more effectively (Argyris, 1978, p.9).

According to Redding (1997); Gephart and Marsick (1996) a business is only a Learning Organization if it has built its ability to learn as a unified system in all of the key areas:

- Vision,
- Strategy,
- Leadership,
- Culture,
- Structure,
- Systems,
- Processes

Learning organizations are those that prioritize; a methodical approach to spotting patterns and issue resolution, organizational learning from expertise, and curating and transferring knowledge (Ruyle, De Meuse, & Hughley, 2021).

#### **4.1. The Laws of the Fifth Discipline**

To establish a learning organization, Senge proposes systems thinking. Personal mastery, shared vision, mental models, and team learning are the top 4 disciplines. Permanent learning is possible when these four concepts are united, and systems thinking is necessary for this. Thus, it regards it as the fifth discipline. In his book (Laws of fifth discipline), Peter Senge lists the eleven organizational learning disciplines) (Senge, 1990, p.42-52).

1. Today's problems come from yesterday's "solutions".

Some decisions made in the past to save the day may have had long-term detrimental implications. For example, a company may sell a large quantity at a significant discount, and consumers believe they will not have another opportunity, so they purchase the surplus and the goods they will purchase in the future. This circumstance has a negative impact on the company's long-term revenue. It's possible that the cause of today's crisis is related to earlier mistakes.

2. The harder you push, the harder the system pushes back.

The more work you put into better things, the more effort appears to be needed. When a firm's product suddenly loses interest in the market, the firm resorts to more aggressive marketing strategies. For example, the company may lose a lot of money while undertaking marketing activities, and although the company manages to win back its customers in the short run, its long-term expenses may cost the company great losses. In other words, compensating feedback is a consumer in the long run and can be very damaging to the company.

### 3. Behavior grows better before it grows worse

In most cases, compensating feedback entails a "delay," or a period of time between the short-term gain and the long-term disadvantage. When a common remedy first relieves the symptoms, it feels fantastic. Now things are looking up; in fact, the problem may have vanished entirely. It could take years for the problem to resurface, or for a new, more serious condition to emerge.

### 4. The easy way out usually leads back in

It is usually preferable to use well-known or simpler procedures to arrive at a solution. However, this does not totally resolve the issue. Every time, the same issue arises. The vicious loop is still going on. As a result, it's critical to avoid relying on familiar solutions while the underlying issues persist.

### 5. The cure can be worse than the disease

An unsystematic solution method may increase the severity of the disease rather than improve the situation. When the person starts to use alcohol to reduce his stress and causes alcohol addiction in the long run, the individual becomes both stressed and addicted to alcohol.

### 6. Faster is slower

The best rate of growth is slower than the fastest achievable rate. At the end of the business, the company may experience entropy, which means that everything will come to a standstill.

### 7. Cause and effect are not closely related in time and space.

The root of the problem may not always be the source of the problem. There is a common misconception that where there is a problem, there is also a solution, but this is not always the case. According to the systems perspective, a problem in the sales department could be the result of a problem in the quality or manufacturing departments, not the sales department itself.

8. Small changes can produce big results—but the areas of the highest leverage are often the least obvious.

Focusing on underlying structures rather than occurrences, or on the process of change rather than immediate happenings, can be a good place to start.

9. You can have your cake and eat it too—but not at once.

For a long time, American manufacturers were split between producing high-quality goods and producing goods at a lower cost. They assumed that high-quality production would be more expensive. It took some time for them to realize that they could cut expenses while also enhancing quality. While poorer-quality production lowers production costs, greater customer complaints lessen loyalty and sales, while advertising costs must rise to raise sales. When both are achieved, the true cost benefit can be realized, allowing the right stages in the process to be taken.

10. Dividing an elephant in half does not produce two small elephants

Although the systems approach necessitates examining all pieces at once, this does not always imply examining the entire system. It's also crucial to consider how each component interacts with one another. It's also vital to consider how that entire interacts with the rest of the industry.

11. There is no blame.

In systems thinking, there is no such thing as external. The source of the issue is contained within a single system. The solution is in your adversary's relationship with you.

The main factors of learning in organizations are defined as vision, culture, strategy and structure. A vision and strategy that is not supported by the organizational culture and core values has no chance of success. Hofstede defines culture as the mental program of human. If the organization is the hardware and the

culture is the software, the two must be compatible in order to work well and give high performance (Ordun, 2021, p. 549).

In terms of competitiveness and cost advantage, it is critical for the learning organization to focus on its own skills. This isn't to say that it ignores other aspects of the value chain. Focusing on the proper core competencies will help to accelerate business operations and improve customer satisfaction. For example, an organization can achieve faster delivery by managing distribution processes in cooperation with another company whose core competence is distribution and logistics, and which focuses on development and learning processes in this direction (Ordun, 2021, p. 553).

Suppliers and other stakeholders also form part of the learning processes. The learning organization tries not only to improve its own development but also to improve the performance of its collaborating organizations and suppliers. For example, the company that outsources the production can provide a competitive advantage by improving the working principles, techniques and personnel quality of the subcontractor workshops. Every part of the procurement process is also a function of the value creation process (Ordun, 2021, p. 553).

The importance of knowledge in a learning organization is determined by the ability to access it. Organizations can access information from external sources by hiring databases, educators, experts, consultants, making comparisons, participating in congresses, conferences and fairs, and developing collaborations with other organizations. Learning organizations should pay attention to the development of masters and transfer their knowledge to others and systems in order to have their own memory. Keeping information as well as obtaining it is of great importance for learning organizations. If the information is not classified correctly, it becomes difficult to reach the information and this causes a waste of time. Accurate classification of information, reliability and openness of information are also important for the storage system. The analysis and interpretation of the stored information with various techniques will also contribute to the formation of the company's strategic goals and plans (Ordun, 2021, p. 554).

Learning levels consist of three sub-components individual, team and organizational. Experience, prediction, and activity are used to classify learning into

three categories. When people are motivated, they learn more effectively. The basic components of learning, according to social learning theory, are attention, storage, imitation, and motivation (Ordun, 2021, p. 541).

According to Argyris (1978, p.20) organizational learning can not be achieved without individual learning however, achieving individual learning is not enough to succeed in organizational learning, either. If individual learning is recorded in the memory of an organization then it can be accepted as organizational learning. Argyris (1978, p.20) has also suggested asking some questions in order to understand the occurrence of organizational learning. These question can be listed as follow:

- Did members notice if the outcome met or exceeded their expectations?
- Is there any study that has resulted in discoveries, innovations, or discussions about organizational tactics and assumptions?
- Are these findings depicted in drawings and maps that are used for control, decision-making, and instruction?
- Was there any follow-up action taken by members to apply new organizational practices?
- Is there a way to streamline these changes in pictures, maps, and organizational processes such that they aren't changed if someone leaves?
- Do new members pick up on these new aspects of organizational action theory as part of their onboarding process?

Each of these questions identifies a potential source of organizational learning failure as well as a potential source of organizational learning capacity.

#### **4.2. Team Learning**

A team is a group of people who put forth their feelings, thoughts and efforts towards a common goal. Team-based structures give organizations flexibility in line with change, and they can also find solutions to problems more easily because they learn faster. In short, team-based structures should be preferred when tasks are variable in sociotechnical systems, when they require mutual coordination, and when environmental changes are rapid (Ordun, 2021, p.334).

Senge (1990, p.351) has summarised the team learning's practices, essences and principles below Figure 4.1.

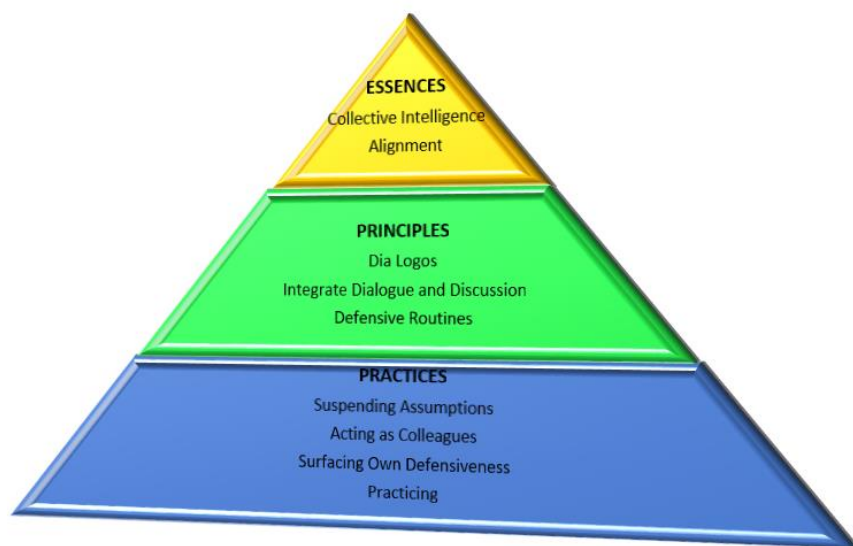


Figure 4.1: Team Learning (Source: Senge, 1990, p.351)

Individual learning is no longer the primary learning unit in modern businesses; instead, team learning is the primary learning unit. When teams really learn, not only do they produce excellent results, but the members of the team also improve themselves faster. Learning as a team requires discipline, and this discipline begins with the development of dialogue within the team. Dialogue is the ability of individuals to put aside their own assumptions and prejudices and to think as a group.

Learning is a lifelong action. Just as individual realize and learn how many unknown things they learn, they cannot say the same as an organization if a person cannot say it is over. Although the concept of learning and the concept of acquiring knowledge seem to be synonymous, they do not have the same meaning in essence. Just as people do not learn to knit a sweater when they read a book on how to knit a sweater, so is learning and acquiring knowledge. With learning, people become a part of production and creation. Organizations that can continuously expand their capacity to create their future are learning organizations. It is not enough for learning organizations to survive or adapt. To this must be added producer learning.

Individual interests are less important in team learning than the team's vision and goals. Their joint vision also fuses with or becomes a part of their own vision in some way. The fact that individuals are always learning does not imply that organizations are learning as well. Team learning, on the other hand, reflects progress along the organizational learning path. In organizations, there are three crucial components to learning as a team. The first is to understand how team intelligence differs from personal intelligence and how to maximize this potential. Second, team members must be on the same page, which necessitates operational trust. Members of the team are aware of one another and work together to advance. The final factor is that members of one team educate other teams on how to do things. The learning team has a lot of promise in terms of teaching other teams. Both discourse and discussion are part of team learning. While there is an attempt to comprehend the other side by suspending one's own thoughts while initiating a dialogue, there is also a defense by providing diverse points of view in the discussion. Discussion and dialogue are complementary (Senge, 1990, p.257).

The main purpose of learning in teams is not only to solve problems but also to understand the parts and relationships of the system. The learning team should have team intelligence. Team intelligence is defined as the ability to act collectively and jointly develop solutions (Ordun, 2021, p. 541).

#### **4.3. Organizational Learning**

Individual learning is necessary for organizational learning, but organizational learning does not necessarily happen simultaneously with individual learning. Individual and organizational learning varies significantly depending on whether discoveries, results, inventions, evaluations, and corrections are retained in the organizational memory. Individuals can learn in the absence of this, but businesses cannot. Individuals may have fixed issues based on their own experiences, expertise, and mental processes, but the company has no idea why it happened or when it might happen again (Ordun, 2021, p. 541).

At the organizational level, learning occurs in line with the common knowledge, foresight, and mental models of the employees, and ensures that past experiences and information are kept, protected and implemented in line with basic strategies and policies (Ordun, 2021, p. 541).

Learning speed, learning depth, and learning breadth are the three essential components of organizational learning. The learning rate is the time it takes for an organization to complete one cycle of learning (planning, implementation, supervision). Learning depth, on the other hand, refers to how thoroughly the organization's fundamental assumptions are put to the test through learning processes and cycles, as well as how much future learning capacity is produced. Learning breadth, on the other hand, refers to an organization's ability to transfer knowledge and solutions from one function, team, or process to other functions, teams, or processes. Training may not be directly related to the strategic goals and mission of the enterprise, therefore it focuses on shorter-term results, whereas learning is directly related to the vision of the enterprise, long-term results are aimed at which learners actively participate.

Organizational learning aims to address the issue of "how," whereas learning organizations seek to answer the question of "what." Structures, systems, teams, and concepts are all connected with the learning organization; however, organizational learning focuses on building the skills to access and use information.

#### **4.4. Agility and Learning Organization**

Agile businesses are always willing to pick up additional knowledge in order to take advantage of new possibilities (Gunasekaran et al. 2001, p.25). Agility is more likely to be associated with a corporation that has a high level of organizational learning (Antonacopoulou and Chiva, 2007; Bennet and David, 2004).

Learning from upstream suppliers and learning from downstream customers are two types of external learning in the context of SC (Tse, 2016). External learning can be the driving force behind SC agility, requiring faster customer and demand responsiveness in SC. Moreover, IT integration, internal and external integration and process integration can be viewed as SC integration to directly measure the impact on SC agility (Tse et al., 2016). Firms can use external learning to catch up with competitive and unpredictable environments. As a result, external learning is likely to have an impact on a firm's responsiveness, such as customer and demand response, which are also components of SC agility (Tse, 2016).

Both the agile manufacturing and lean manufacturing approaches place a strong emphasis on organizational learning and try to get rid of these learning

obstacles: seeming to know something and being ignorant. For example, Custom Cable (2010) claims that the main objective of AM approach is to address organizational learning via teams. For a team of creative and innovative ideas, the agile teams need to be fluid. This is a key element of AM since the relationship between market demand and advancements in technology that accelerates time to market is so obvious (Flumerfelt, 2012).

Scholars and businesses agree that Agile Supply Chain (ASC) techniques and tactics contribute to increasing efficiency, creating more revenues, and lowering recursive business-related expenses. Furthermore, in today's competitive market, businesses must use agile and adaptable supply chain strategies that enable them to use an effective supply chain information system (Alzoubi and Yanamandra (2020). Alzoubi & Yanamandra (2020) found in their study that, the relationship between Information sharing strategy and ASC have a positive influence on supply chain performance.

Khan and Wisner (2019) investigated the connections between performance, learning, agility, and supply chain integration. According to study results, internal learning was found to have a considerable impact on business performance and to be significantly connected with both internal and external learning. In this study, the mediating effect of supply chain agility on firm performance was also investigated. The linkages between supply chain integration, external and internal learning, and firm performance were mediated by supply chain agility.

## **CHAPTER FIVE**

### **THE RELATIONSHIP BETWEEN MAIN VARIABLES**

#### **5.1. Lean vs. Agile**

Studies conducted in recent years have mentioned the concepts of lean and agile together. Lean approach is considered more philosophical, while agile approach is considered more strategic. The lean concept first focused on eliminating all factors aimed at preventing waste in manufacturing. And over time, this method has penetrated into areas such as lean management and lean supply chain as a way of thinking. The concept of agile, on the other hand, has started to take its place among the high-level strategies of companies from a strategic point of view. The concept of agile has more complementary features than a concept that will create a competitive lean concept. Although neither of them is better than the other, depending on the firm, industry, and market circumstances, it is decided from a situational point of view whether one or both can be used.

The consumer is widely acknowledged as the most fundamental force shaping the market. Sometimes using lean production techniques alone is insufficient for the consumer. While delivery time has a big impact on customer satisfaction, lean manufacturing strategies cannot do this on their own. Lean is combined with the agile methodology to satisfy client demand. Although the Toyota manufacturing company is where the majority of the literature on the notion of lean originates, its key principles may be applied to other parts of the supply chain and have a positive relationship with the concept of agility. The automobile industry, which is based on lean principles, is one of the least agile industries, according to Christopher (2005), who also notes that "leanness" can be an element of "agility" in certain situations. However, simplicity by itself won't enable the organization to meet the customer's precise needs more sensitively (Eyong, 2009).

Goldman et al. (1995, p.328) define agile manufacturing as the integration of all flexible manufacturing technologies along with experience gained from total quality

management (TQM), employee empowerment, JIT manufacturing or logistics procurement, manufacturing resource planning (MRP II), and lean manufacturing. This definition supports the idea that lean manufacturing and agility are compatible with one another. He said that this represent significant turning points in his quest to become more agile.

Table 5.1: Selected studies examining the concept of lean and agile together

| Authors/ Year                                                      | Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sharp et al. (1999)                                                | According to Sharp et al. (1999), lean manufacturing ignores hierarchy in favor of technology and the removal of waste. Workforce considerations and teamwork are prioritized in lean production. It and its suppliers are reliant on one another. Their methods are consistent at all times. Monthly product development studies are ongoing. During the transaction, it offers the consumer a high-quality goods. On the other hand, qualified workers are a part of agile production. concentrate on its workers and information systems. Teams that have been formed can handle their own job without supervision from higher management. The utilization of technology is done in a very efficient way. Weekly product development is continued by agile production, which also worries about product quality after sales and employs cooperation at all levels. |
| Naylor et al. (1999);<br>Inman et al. (2011); Yao & Carlson (2003) | Agility and leanness are complementary concepts. They should be implemented together.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Hormozi (2001)                                                     | Lean manufacturing is less focused on the individual than agile production. More assistance is given to informatics. Technology equipment is given significant weight in lean production.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Gunasekaran & Yusuf (2002)                                         | Lean manufacturing is insufficient for customer satisfaction, agility is needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jin-Hai et al. (2003)     | While lean manufacturing focuses on efficiency and productivity, agile manufacturing focuses on speed and being a learning organization.                                                                                                                                                                                                                                                                                                      |
| Goldsby et al. (2006)     | lean manufacturing and agile manufacturing are contradictory concepts                                                                                                                                                                                                                                                                                                                                                                         |
| Gunasekaran et al. (2008) | Agility is one step further than leanness.                                                                                                                                                                                                                                                                                                                                                                                                    |
| Flumerfelt et al. (2012)  | There are some operational variations between LM and AM systems. Although they have diverse functions, their overall goal is fairly similar. These corporate structures excel in complexity control, sustainability, and organizational learning.                                                                                                                                                                                             |
| Elmoselhy, S.A. (2013)    | Planners must do a delicate balancing act. It is necessary to satisfy specialty requests. Finding a balance between quality and cost-effectiveness is difficult. By lowering production costs, lean solutions can boost competitiveness and profitability. Agile business techniques can help organizations manage volatility. For a manufacturing firm to handle this problem, a hybrid lean-agile approach may be the best strategic blend. |
| Eltawy & Gallear (2017)   | Lean thinking (main principles; work organization): waste elimination, long-term SC partnership, work standardization. Agile thinking (main principles; work organization): meet customer demand, virtual supply chain and self-management                                                                                                                                                                                                    |
| Phadtare (2014)           | Combining agility with lean manufacturing is becoming more popular as a way to increase performance by guaranteeing the productivity of lean production and the flexibility of agile manufacturing.                                                                                                                                                                                                                                           |
| El Mokadem (2017)         | When choosing suppliers, lean firms emphasize variables that boost productivity, whereas agile organizations emphasize factors that strengthen their capacity to tailor their responses to the specific needs of their clients.                                                                                                                                                                                                               |
| Ghobakhloo & Azar (2017)  | These production systems are compatible with one another, and LM is the ancestor of AM. They support a variety of work performance factors. By combining lean and agile technologies, it                                                                                                                                                                                                                                                      |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | is possible to achieve a cost leadership strategy and flexible product mix.                                                                                                                                                                                                                                                                                                                                                                     |
| Lotfi & Saghiri (2018) | The relationship between operational resilience and leanness and agility was investigated, and it was observed that all three concepts contributed positively to operational performance.                                                                                                                                                                                                                                                       |
| Iqbal et al. (2020)    | The performance of a company is improved and complemented by lean manufacturing, AM, and supporting management and infrastructure approaches. They are not competing concepts.                                                                                                                                                                                                                                                                  |
| Rafique et al. (2020)  | This study focuses on lean, agile, resilient, green and sustainability to attain sustainable production.                                                                                                                                                                                                                                                                                                                                        |
| Zaheer et al. (2020)   | In lean manufacturing, the goal is to eliminate "waste," while in agile manufacturing, the emphasis is on having the capacity to understand shifting market dynamics and having resilience. Inadequate planning, monitoring, and a lack of knowledge about shifting market trends are some of the primary barriers to the combined adoption of lean and agile methodologies, but these can be overcome by leveraging the powerful K-Chart tool. |

A lean strategy, in essence, seeks the minimum possible cost with an efficient flow of goods that extinguish waste, reduce inventory, shorten lead times, utilize limited resources, engage less staff, etc. (Bicheno, 2004; Walters, 2007). The agile approach stresses the customer's significance and concentrates on ensuring a high standard of productivity in the presence of uncertainty (Helo, 2004). When cost is the leading factor, the lean approach is most potent; nevertheless, when service and customer value development are important needs for industry winning, agility is more likely to be the crucial factor (Christopher and Towill, 2001).

To emphasize the importance of flexibility in all supply chain models, it's worth noting that agile manufacturing necessitates a high level of quick rearrangement and the removal of as much waste as feasible, but does not require the removal of all waste. According to Katayama & Bennett (1999) adaptability, one of the characteristics of a firm's production systems, refers to the ability to adjust demand according to cost performance. The cost of adaptive manufacturing is higher than the cost of lean production. Lean production is less cost sensitive than adaptable

production. To summarize this comparison, agility, flexibility, and leanness are mutually complementary concepts rather than alternatives.

In Figure 5.1, an agile supply chain could swap between items readily if there are many different products. A disaggregate level of demand will often become more volatile if it comprises a wide range of products (Naylor et al., 1999, p.112).

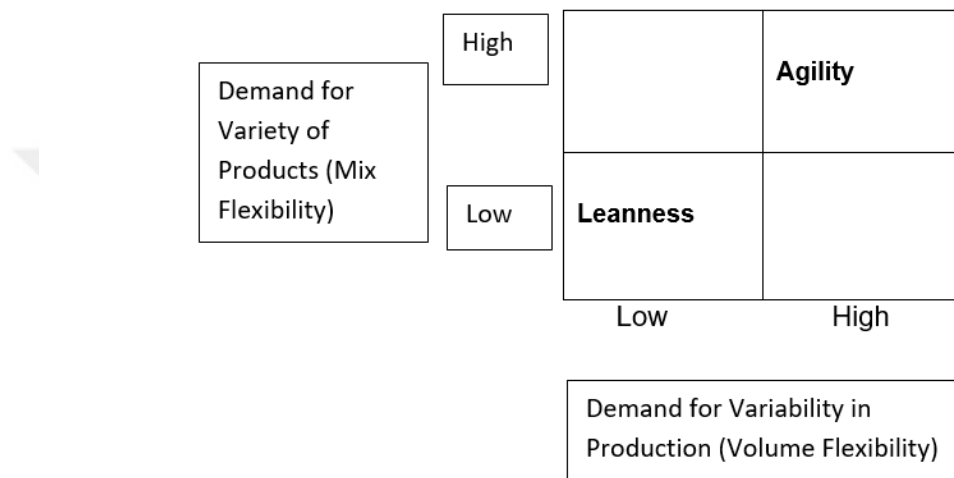


Figure 5.1: Leanness and Agility from different perspective (Adapted from Naylor et al., 1999, p.112).

The comparison between lean and agile organizations is depicted in Figure 5.2.

Table 5.2: Lean vs Agile Organization

| Lean Organization                                                                  | Agile Organization                                                                                              |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Main goal: Accelerating flow and decision processes that add value to the customer | Adapting quickly to change, changing organizational processes as a result of environmental changes              |
| Reducing hierarchy, teamwork, eliminating waste                                    | Flexibility, learning, continuous improvement                                                                   |
| Continuous learning, collaborative work, customer focus                            | Measurable results for customer expectations; scale and feedback mechanisms; ways to design effective processes |
| Plan, do, analyze, check cycle                                                     | Expected competencies of the staff                                                                              |

## 5.2. Agile Supply Chain and Lean Supply Chain

Wherever there is management, a decision mechanism has to work. Supply chain management also has many components due to its structure and requires multiple decision making. It would be useful to list these components as follows: On the actor's side; manufacturers, suppliers, customers, distributors, retailers, warehouses and service providers. Resources; information, material, financial and human resources. Activities; Planning, Sourcing, Production/manufacturing and Service/service activities can be given. In addition to this complex structure, the rapid change of customer demands and needs; there is a great variety of products; increase in the number of competitors; Many other situations such as product life curves, economic imbalances are closely related to the decision-making process. Therefore, using every strategy for every product under all circumstances does not mean that it is the right method (Kabadayı, 2021, p.129).

There are three basic supply structures in the literature: traditional supply chain, lean supply chain and agile supply chain (Kabadayı, 2021, p.129).

Table 5.3: Similarities and differences between traditional supply chain, lean supply chain and agile supply chain

| Types              | Differences                                                                                                                                                                                                                    | Similarities                                                                                                                           |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Traditional</b> | <i>Main focus:</i> high planning and control<br>Based on "push" model, in which production is planned and executed according to a fixed schedule, with inventory being used to buffer against uncertainty and variability.     | Aim to deliver value to customers by ensuring that the right products and services are delivered to the right place at the right time. |
| <b>Lean</b>        | <i>Main focus:</i> minimizing waste and variability.<br>Based on a "pull" model, in which production is triggered by customer demand, and waste is minimized through the use of tools such as value stream mapping and kanban. |                                                                                                                                        |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Agile</b> | <p><i>Main focus:</i> enabling organizations to respond quickly and flexibly to changes in the market.</p> <p>A more recent approach is designed to enable organizations to respond quickly and effectively to changes in customer demand and the market environment. This approach emphasizes flexibility, collaboration, and the use of digital technologies to enable real-time information sharing and decision-making.</p> | <p>Each approach has its own strengths and weaknesses, and the most appropriate approach will depend on the specific needs and goals of the organization.</p> |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|

Source: Author

It has been observed that traditional supply chain practices are not sufficient for today's world, that rapidly changing customer expectations, product diversity and high market variability cannot be achieved with old methods (production by looking at the sales data meant by the old administrations). On the other hand, it would not be correct to say that one of the lean and agile supply chain applications, which are among the other supply chain types, is better than the other. The appropriate one of these strategies should be applied in line with market conditions, customer expectations and product life curves. The most basic goal in the lean supply chain is to avoid all waste factors. For this, excess stock should not be made, the real expectations of the customers should be estimated. While the maturity stage of the product is more appropriate to implement the lean supply chain strategy, it would be more accurate to apply the agile supply chain strategy during the product entry stage. Because the agile supply chain is the most basic issue to meet the demands that are formed according to customer expectations in the fastest way. Apart from the product life cycle, if we consider this on a product and sector basis; The fashion sector is an innovative sector that changes rapidly and it is necessary to be agile in order to adapt to this rapid change (Kabadayı,2021, p.129).

In Figure 5.2, various characteristics of lean and agile supply methodologies are stated. The main differences are seen in robustness and smooth demand. Agile supply chains should be adaptable to changes and disruptions, and it will use this

flexibility to gain a competitive advantage. Lean systems, on the other hand, strive to eliminate as much internal and external variance as possible (Naylor et al., 1999).

| Keyword                                                   | Lean | Agile |
|-----------------------------------------------------------|------|-------|
| Use of market knowledge                                   | +++  | +++   |
| Virtual corporation/Value stream/ Integrated supply chain | +++  | +++   |
| Lead time compression                                     | +++  | +++   |
| Eliminate muda                                            | +++  | ++    |
| Rapid reconfiguration                                     | ++   | +++   |
| Robustness                                                | +    | +++   |
| Smooth demand/Level scheduling                            | +++  | +     |
| Note: +++ = essential; ++ = desirable; + = arbitrary      |      |       |

Figure 5.2: The Significance of Leanness and Agility Features (Source: Naylor et al., 1999, p.109)

### 5.3. Lean vs. Agile Supply Chain and Performance

Scholars have been studying the relationship between Lean supply chain and agile supply chain on performance. Table 5.4 shows these selected studies with their main findings and methodology selection.

Table 5.4: Selected Literature of ASC, LSC and Performance

| Authors (Year)          | Methodology                                                              | Main findings                                                                                                                 |
|-------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Alamsjah & Asrol (2021) | <b>Method:</b> Survey, PLS-SEM<br><b>Target:</b> Manufacturing companies | ASC mediates LSC to improve SC Perf. Inter-island logistics negatively moderates the relationship between an ASC and SC Perf. |
| Fadaki et al. (2020)    | <b>Method:</b> Survey, PLS-SEM                                           | Higher organization performance can be achieved with a balanced supply chain (leanness and agility equal).                    |

|                            |                                                                                                           |                                                                                                                                                                                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Junejo et al.<br>(2022)    | <b>Method:</b> Survey,<br>CBS-SEM<br><b>Target:</b> Drinking<br>water industry                            | ASC and LSC strategies have a positive effect on business performance. The ASC, has a more notable effect on business performance.                                                                                                                                                          |
| Ariadi et al.<br>(2021)    | <b>Method:</b> Survey,<br>CBS-SEM<br><b>Target:</b> Bottled water<br>industry                             | LSC and ASC have positive impact on FP and SCI mediated these relationships. In dynamic condions, ASC is more effective.                                                                                                                                                                    |
| Bekele et al.<br>(2022)    | <b>Method:</b> Survey,<br>Descriptive,<br>Regression<br><b>Target:</b> Automobile<br>industry             | ASCM techniques can be used to improve and achieve operational performance.                                                                                                                                                                                                                 |
| Al-Tit (2016)              | <b>Method:</b> Survey,<br>Regression<br><b>Target:</b><br>Manufacturing<br>companies                      | LSC practices positively influence the productivity. These LSC practices are: waste and cost minimization, producer-supplier-customer relationships.                                                                                                                                        |
| Qi et al. (2017)           | <b>Method:</b> Survey,<br>CBS-SEM<br><b>Target:</b><br>Manufacturing<br>companies                         | While an ASC is good for businesses competing on the flexibility strategy, an LSC is appropriate for businesses prioritizing cost, quality, and delivery strategies. Also, whereas both LSCS and ASCS need higher SCI, LSCSs have a much greater effect on external integration than ASCSs. |
| Abdelilah et al.<br>(2021) | <b>Method:</b> Qualitative &<br>quantitavive, PLS-<br>SEM<br><b>Target:</b><br>Manufacturing<br>companies | Businesses with ASC perform better than those solely focused on implementing LSC or SCI techniques. ASC fully mediates the linkages between LSC/SCI and company's OP.                                                                                                                       |
| Chen et al.<br>(2020)      | <b>Method:</b> Survey,<br>PLS-SEM                                                                         | Organizations should better deploy LSC and ASC methods to increase SC Perf with the aid of big data analytics. The                                                                                                                                                                          |

|                                                                                                                                                                                                   |                                                                                                                |                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                   | <b>Target:</b> multiple industry                                                                               | organization's information system strategy will temper the impact of SC strategy on SC Performance.                   |
| ****Rahimi & Alemtabriz (2022)                                                                                                                                                                    | <b>Method:</b> mixed, fuzzy interpretative structural modeling<br><b>Target:</b> Military product supply chain | Concurrent use of LeAgile approaches will increase SC perf. The strongest factor in this model is supplier relations. |
| LSC: Lean Supply Chain; ASC: Agile Supply Chain; SCI: Supply Chain Integration ; PLS: Partial Least Square; CBS: Covariance-based ; SEM: Structural Equation Modelling; FP: Financial Performance |                                                                                                                |                                                                                                                       |

It may appear challenging at first to combine the objectives of lean and agile solutions. One seeks to reduce costs while prioritizing customer service; the other seeks to maximize customer service while prioritizing cost (Walters, 2007). Lean manufacturing necessitates and encourages a level schedule, while agile manufacturing is particularly fit to meet a changing demand (in terms of quantity and diversity). These significant distinctions between the two perspectives are linked to where the decoupling point is located (Naylor et al.,1999). To integrate these two approaches Naylor et al. (1999) proposed “leagility” concept. Decoupling and postponement concepts could be integrated for leagile approach. Decoupling recommends retaining inventory in a generic or modular condition and only finishing the final assembly or configuration once the exact customer's needs are determined (Christopher and Towill, 2001). Postponement: This is the highest stage upstream from which info about "actual" demand flows, i.e. info that hasn't been tainted by inventory approaches like reorder points and amounts (van Hoek, 1998; Christopher and Towill, 2001).

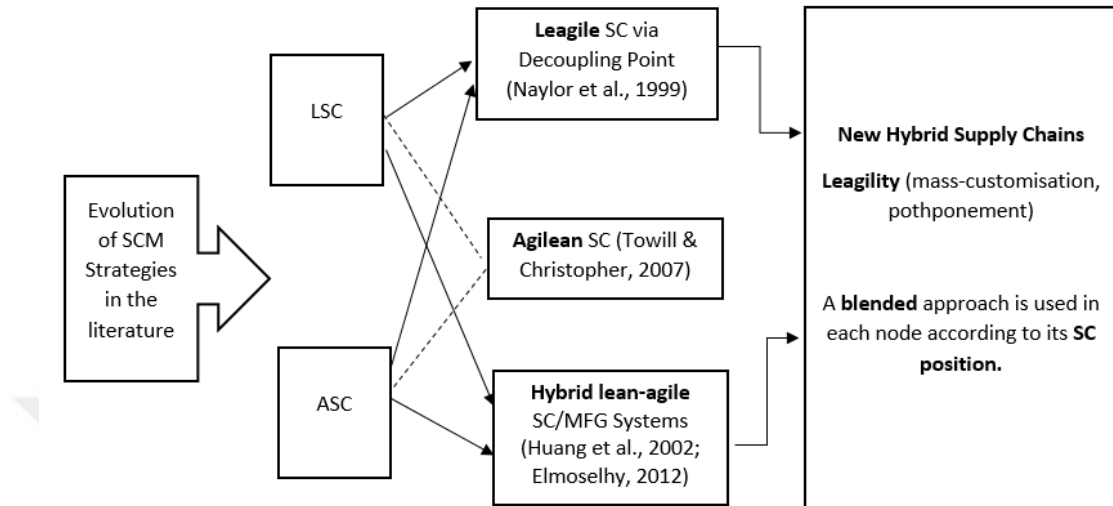


Figure 5.3: Evolution of SCM Strategies in the Literature **Source:** Adopted from Adel (2020)

## **CHAPTER SIX**

### **METHODOLOGY**

In this chapter, the design, significance, method selection, hypothesis, sampling, and data collection of this study will be explained briefly. Furthermore, descriptive statistics results will be provided. This is a quantitative study analysed through structural equation modeling. The main objective of this thesis is to improve supply chain integration for financial and operational performance by fostering leanness and agility through a learning organization.

#### **6.1. Design of the Study**

This thesis employs a quantitative research design with a convenience sampling method. This study is more exploratory than confirmatory since the research model has been created through an in-depth literature review instead of theory. This was one of the reasons to apply Partial Least Square Structural Equation Modelling (PLS-SEM) instead of Covariance based Structural Equation Modelling (CB-SEM). To address the research problems, the primary data of the survey has been collected from 177 companies (only 1 respondent from each company). Once the data were collected, to test the hypothesis which aims to discover whether relationships exist between two independent, one moderating, four mediating, and one dependent variable. Figure 6.1 demonstrates the roadmap of the current study. In this chapter descriptive study results will be demonstrated. The measurement and structural model results will be evaluated deeply.

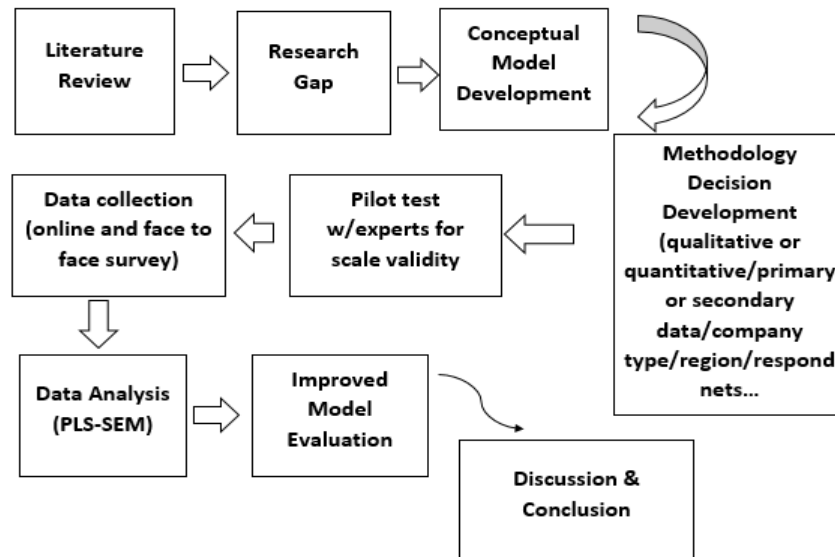


Figure 6.1: The Roadmap of the Current Study

## 6.2. Significance and Aim of the Research

The relationship between this triple variable, agile, lean, and supply chain integration, has been the subject of conflicting findings in the literature. Although some authors contend that the agile strategy will favorably promote integration, some studies support the opposite view. This study's main area of interest is supply chain integration, which is expected to have a positive impact on both financial and operational performance. Application of agile, lean, and learning organization concepts are crucial components to enhancing integration. The organization can take steps to become both more agile and lean if it learns and can make this training permanent and transmit it to convenience. Additionally, the integration between these techniques will be strengthened with the aid of the learning organization approach. The authors' best knowledge the moderator impact of the learning organization on this model has not been studied in the literature. This study aspires to be the first in this regard.

In summary, this study addresses the following research problems:

- Research Question 1: Does lean supply chain affects supply chain integration?
- Research Question 2: Does agile supply chain affects supply chain integration?
- Research Question 3: Does learning organization moderates the link between lean supply chain and supply chain integration?
- Research Question 4: Does learning organization moderates the link between agile supply chain and supply chain integration?
- Research Question 5: Does supply chain integration mediates the link between lean supply chain and operational performance?
- Research Question 6: Does supply chain integration mediates the link between agile supply chain and operational performance?
- Research Question 7: Does operational performance mediates the link between supply chain integration and financial performance?

### **6.3. The Research Model of the Study and Hypothesis**

The Figure 6.2 depicts the study's conceptual framework, which is divided into ten sections: (1) "lean supply chain" (i.e., operationalization, tooling and planning) and their effects on supply chain integration (i.e., external integration, internal integration and supplier integration), (2) "agile supply chain" (i.e., flexibility, responsiveness, speed and competence), on supply chain integration, (3) the connection between supply chain integration and operational performance, (4) the link between operational performance and financial performance. (5) the moderating roles of learning organization (i.e., continuous learning, dialogue and inquiry, team learning and collaboration, embedded system, empowerment and system connections) on the connection between lean/agile supply chain and supply chain integration. (6) the link between independent variables and dependent variable without any moderating and mediating variables. (7) excluding operational performance, the link between all the variables and financial performance. (8) the connection between moderating variables and supply chain integration. (9) the mediating roles of supply chain integration on the connection between lean/agile supply chain and operational performance (10) the mediating roles of operational performance on the connection between supply chain integration and financial performance.

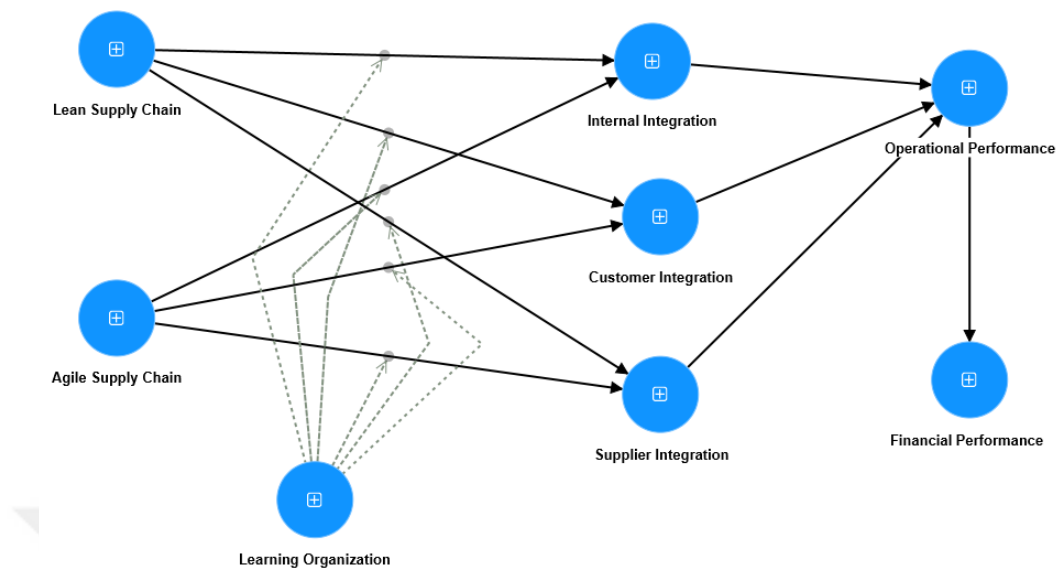


Figure 6.2: Research Model

#### 6.4. Hypothesis

The hypotheses of the study which show the relations between variables are indicated as follows:

##### Hypothesis 1;

H1a: There is a positive relationship between lean supply chain and supplier integration.

H1b: There is a positive relationship between lean supply chain and internal integration.

H1c: There is a positive relationship between lean supply chain and customer integration.

##### Hypothesis 2;

H2a: : There is a positive relationship between agile supply chain and supplier integration.

H2b: There is a positive relationship between agile supply chain and internal integration.

H2c: There is a positive relationship between agile supply chain and customer integration.

**Hypothesis 3;**

H3a: There is a positive relationship between supplier integration and operational performance.

H3b: There is a positive relationship between internal integration and operational performance.

H3c: There is a positive relationship between customer integration and operational performance.

**Hypothesis 4;**

H4: There is a positive relationship between operational performance and financial performance.

**Hypothesis 5;**

H5a: Learning organization moderates the positive relationship between lean supply chain and supplier integration.

H5b: Learning organization moderates the positive relationship between lean supply chain and internal integration.

H5c: Learning organization moderates the positive relationship between lean supply chain and customer integration.

H5d: Learning organization moderates the positive relationship between agile supply chain and supplier integration.

H5e: Learning organization moderates the positive relationship between agile supply chain and internal integration.

H5f: Learning organization moderates the positive relationship between agile supply chain and customer integration.

**Hypothesis 6;**

H6a: There is a positive relationship between lean supply chain and operational performance.

H6b: There is a positive relationship between agile supply chain and operational performance.

**Hypothesis 7;**

H7a: There is a positive relationship between lean supply chain and financial performance.

H7b: There is a positive relationship between agile supply chain and financial performance.

H7c: There is a positive relationship between supplier integration and financial performance.

H7d: There is a positive relationship between internal integration and financial performance.

H7e: There is a positive relationship between customer integration and financial performance.

**Hypothesis 8;**

H8a: There is a positive relationship between learning organization and internal integration.

H8b: There is a positive relationship between learning organization and supplier integration.

H8c: There is a positive relationship between learning organization and customer integration.

**Hypothesis 9;**

H9a: Supplier integration mediates the link between lean supply chain and operational performance.

H9b: Supplier integration mediates the link between agile supply chain and operational performance.

H9c: Internal integration mediates the link between lean supply chain and operational performance.

H9d: Internal integration mediates the link between agile supply chain and operational performance.

H9e: Customer integration mediates the link between lean supply chain and operational performance.

H9f: Customer integration mediates the link between agile supply chain and operational performance.

#### **Hypothesis 10;**

H10a: Operational performance mediates the link between supplier integration and financial performance.

H10b: Operational performance mediates the link between internal integration and financial performance.

H10c: Operational performance mediates the link between customer integration and financial performance.

### **6.5. Variables of the Research Model**

The author's best knowledge there are only a few studies that combine learning organization into a proposed research model. There are many studies and many different approaches for supply chain integration as they were briefly explained in the literature parts. Especially the Table: Selected Literature of ASCM, LSCM and Performance in chapter five indicates the selected studies related to these main variables. The Table 6.1 also summarizes the main studies.

Table 6.1: Selected Literature of Combination of the Proposed Model Variables

| Authors & Variables                                                                       | LSCM | ASCM | SCI | Performance (FP, OP) | LO |
|-------------------------------------------------------------------------------------------|------|------|-----|----------------------|----|
| Ariadi et al. (2021)                                                                      | IV   | IV   | MD  | DV                   | -  |
| Abdelilah et al. (2021)                                                                   | IV   | MD   | -   | DV                   | -  |
| Qi et al. (2017)                                                                          | IV   | IV   | MD  | DV                   | -  |
| Flumerfelt et al. (2012)                                                                  | X    | X    | -   | -                    | X  |
| Zhu et al. (2018)                                                                         | -    | -    | IV  | DV                   | MD |
| Khan & Wisner (2019)                                                                      | -    | MD   | IV  | DV                   | IV |
| Adel (2020)                                                                               | DV   | DV   | MD  | DV                   | -  |
| IV: independent variable; DV: dependent variable; MD: mediating variable X: doesn't exist |      |      |     |                      |    |

#### 6.5.1. Independent Variables

*Lean supply chain management:* Ariadi et al. (2021), Abdelilah et al. (2021) and Qi et al. (2017) have considered LSCM as an independent variable while Adel (2020) assessed it as a dependent variable.

*Agile supply chain management:* Ariadi et al. (2021) and Qi et al. (2017) have considered LSCM as an independent variable while Adel (2020) dependent variable, Qi et al. (2017) and Khan & Wisner (2019) assessed as a mediating variable.

#### 6.5.2. Dependent Variable

*Financial performance:* Since every organization's ultimate aim is to increase performance, performance is generally considered a dependent variable.

#### 6.5.3. Moderating Variable

*Learning organization:* Zhu et al., (2018) have analysed the mediating effects of supply chain learning on the relationship between SCI and customer service performance and found a positive influence. Khan & Wisner (2019) looked into the relationship between external/internal learning and business performance and how supply chain agility mediated that relationship. External learning was not shown to be significantly correlated with either company's performance in their study. Yet, supply

chain agility did not show a substantial or positive association with internal learning and company performance.

#### **6.5.4. Mediating Variable**

*Supply chain integration:* The concept of supply chain integration is a long process and it is not an output, it is a way to increase firms' benefits. These benefits are not only the financial ones, integration can be a culture, process, communication, strategy, model, etc. In summary, integration is not a choice, it is an obligation for an organization's survival. Most of the studies evaluated SCI as an independent (Zhu et al., 2018; Khan and Wisner, 2019) and mediating (Ariadi et al., 2021; Qi et al., 2017; Adel, 2020) variable.

*Operational performance:* Most of the studies which examine supply chain integration mainly concentrated on the performance as an output. Generally, this performance focus was on a company. To measure company performance either the researchers investigated financial performance (Syed et al., 2019; Yang, 2016); business performance (Tseng and Liao, 2015); supply chain performance (Abdallah et al., 2014); operational performance (Lu et al. (2018) and both operational and supply chain performance (Shaar, 2014).

### **6.6. Sampling and Data Collection**

Most studies have examined the supply chain integration concept in the manufacturing industry where production is a critical dimension. Since the independent variables of this study cover lean and agile manufacturing practices, the population of the study has to be the manufacturing industry and sampling should be precisely selected from this population.

#### **6.6.1. Manufacturing Industry in Türkiye**

The share of Turkey's manufacturing industry in the Gross Domestic Product Account increased by 19.1 % in 2020 to 22.2 % in 2021 (Turkish Statistical Institute). Six sectors and six cities in Türkiye are selected as a population. The contribution of these six sectors to the Turkish economy is shown in Table 6.2.

Table 6.2: Contribution of 6 sectors to the Turkish Economy

| Sectors          | Share in value-added |
|------------------|----------------------|
| Automotive       | 12%                  |
| White Appliances | 3%                   |
| Machinery        | 5%                   |
| Textile          | 8%                   |
| Food & Beverages | 10%                  |
| Chemicals        | 5%                   |

Source: TUSIAD (Turkish Industry and Business Association), 2016

According to Gezici (2017), the manufacturing sector's (24% of GDP) share has not grown in the past ten years, whereas the finance, construction, and transport sectors had rapid growth during the 2000s. Growth in value-added production and structural adjustment is required to address the middle-income trap problem. The most significant exports from Turkey stem from the primary metal, textile and garment, automotive, food and drinks, coke, and chemical products industries.

Given the geographic benefits of being near Europe as the primary export market, closeness to the ports, and convenience to broader (internal and external) marketplaces, three major cities —İstanbul, Ankara, and İzmir—are the most significant intensity zones for manufacturing jobs (40% of total). Nonetheless, bordering provinces of major cities have experienced increasing de-concentration, and such provinces are also among the top 10 concentration locations.

The universe of this study consists of manufacturing companies. It has been implemented in 6 provinces in Turkey: Istanbul, Bursa, Izmir, Kocaeli, Konya, and Tekirdag. The main reason for choosing these cities is that 5 provinces other than Tekirdağ are among the 10 largest industrial provinces in Turkey. The reason for the addition of Tekirdağ is because of its proximity to Istanbul and the convenience sampling method. Although integration studies in the literature are not sector-restricted, the data for this study were gathered in six sectors. The focus of this research is on the organizational level, not on individuals. It employed one representative from each company for this reason. Since it was thought that it would cause conflict in integration studies, it was deemed appropriate to do it with one

person. The production, planning, operation, and quality units—which are presumptively dominant in the production unit—were represented by middle and senior managers.

It was aimed to reach the participants through organized industrial zones, chambers of commerce, industry and trade unions and associations and a professional communication network (Linkedin). E-mails were sent to the chambers of commerce, provincial chambers of industry and associations of the specified provinces. While some associations responded positively, the majority left e-mails unanswered. Via Linkedin, private messages have been sent. After two weeks, reminding messages were sent to potential candidates.

Personal corporate visits were also conducted to promote participation. The author was asked for permission to use an onsite observation technique. To gather more information, the author went to nine factories. Because the use of the qualitative method wasn't initially anticipated, the author will share her own perspective in the discussion section. In every instance, a cover letter explaining the study's purpose, value, and confidentiality was enclosed with the questionnaire. Regarding the date they were received, all the surveys were submitted. Due to a significant number of missing data and answer inconsistencies, a final total of 177 questionnaires were gathered, with 162 usable responses; this indicates a 90% effective response rate. 59 responses were gathered online while 118 were surveyed face to face. According to the author's own belief, face-to-face survey gathering increases to get a high effective response rate.

### **6.7. Questionnaire design**

The structured questionnaire was divided into five sections and constructed on empirically validated variables using existing scales from the body of literature. The first section asks about lean supply chain practices and implementation, while the second section focuses on questions about agile supply chain. Supply chain integration is covered in the third section, while questions about financial and operational performance are covered in the fourth.

The final section included questions about the respondent's and the company's demographics, including the respondent's department, position within the organization, and tenure, as well as information about the company's markets

(domestic and international), industry, city, number of employees, and supplier count. It also asked about the company's implementation of lean practices. Also, the conceptual framework of the constructs was obtained from the existing scales that satisfy the relevant literature's criterion of reliability values greater than 0.70. The questionnaire's five-point Likert scale, which ranges from strongly disagree (1) to strongly agree (5), was used to examine each item. Table 6.4 summarizes the previously established scales that were used in the current study. There were many established scales, the main reason to choose these scales is their context appropriateness and the years that they have been created. The supply chain integration scale is adapted from Cui et al. (2022) and the questions consist of three parts: customer integration (5 items), supplier integration (5 items), and internal integration (4 items). Agile supply chain questions are taken from Abdeliah et al. (2021) and they consist of four parts: responsiveness (3 items), flexibility (4 items), speed (3 items), and competence (3 items). Financial and operational performance scales are taken from Inmal et al., (2011) and financial performance includes 4 items while operational performance contains 13 items. Lastly, lean supply chain questions are adapted from Moyano-Fuentes et al. (2019, p.28). In their studies, they examined 19 questions for scale development. After reliability and validity test two factors were created: lean supply chain operationalization consist of 5 and lean supply chain planning consist of 3 items.

Furthermore, the survey was originally created in English before being "back-translated" into Turkish. After the questionnaire was created, a pre-test was conducted utilizing a two-phase approach to make sure the participants would understand the questions' subject. Initially, six academic supply chain and organizational behavior researchers assessed the first draft of the questionnaire. The survey was piloted on five manufacturing organizations after some changes were made to enhance accuracy and simplicity of completion. The questionnaire permits accurate and thorough interpretation of the questions, according to the findings of the pilot test. Hence, throughout the initial stages of this investigation, it was assured that the content and face validity were verified.

Table 6.4: The Operationalized Scales in This Study

| Scales of Variables                   | Authors                                                                 |
|---------------------------------------|-------------------------------------------------------------------------|
| Supply Chain Integration              | Cui, L., Wu, H., Wu, L., Kumar, A., & Tan, K. H. (2022)                 |
| Lean Supply Chain                     | Moyano-Fuentes, J., Bruque-Cámara, S., & Maqueira-Marín, J. M. (2019)   |
| Agile Supply Chain                    | Abdelilah, B., El Korchi, A., & Amine Balambo, M. (2021)                |
| Learning Organizations                | Leufvén, M., Vitrakoti, R., Bergström, A., Kc, A., & Målvist, M. (2015) |
| Operational And Financial Performance | Inman, R. A., Sale, R. S., Green Jr, K. W., & Whitten, D. (2011)        |

## 6.8. Sample Characteristics

The Table 6.5 lists the key traits of the manufacturing firms that were identified during this research. Regarding the cities of the companies, Istanbul has the highest percentage with 43,2% and 70 companies out of 161 then Konya (14,2%), İzmir (12,3%), Tekirdağ (11,1%), Bursa (9,9%), Kocaeli (9,3%). In terms of industry distribution, most of the companies operating in the automotive/ vehicle equipment industry (22,2%), followed by chemical/pharmaceutical (21%), textile/clothing (14,2%), iron&steel (14,2%), packaging/paper/cleaning supplies/plastics (11,7) food and beverage (16,7%).

Companies with 1-9 employees are considered micro, companies with 10-49 employees are small, companies with 50-249 employees are considered medium companies, and companies with 250+ employees are considered large-scale companies (TOBB, 2020). Accordingly, 66,7% of the company is considered large-scale. 12,3% of the company is small-scale while 21% of the company is considered a middle-scale company. Furthermore, 87% of the companies operate both in the international and domestic market, and only a few percent operates only in Türkiye or only outside of Türkiye.

Table 6.5: Frequency of Company Characteristics

| Variables (for companies)    |                                             | Frequency | Percentage (%) |
|------------------------------|---------------------------------------------|-----------|----------------|
| Location (City)              | Istanbul                                    | 70        | 43,2           |
|                              | İzmir                                       | 20        | 12,3           |
|                              | Kocaeli                                     | 15        | 9,3            |
|                              | Tekirdağ                                    | 18        | 11,1           |
|                              | Bursa                                       | 16        | 9,9            |
|                              | Konya                                       | 23        | 14,2           |
| Industry                     | Automotive/vehicle equipment                | 36        | 22,2           |
|                              | Chemical/Pharmaceutical                     | 34        | 21,0           |
|                              | Textile/Clothing                            | 23        | 14,2           |
|                              | Iron/Steel                                  | 23        | 14,2           |
|                              | Packaging/ Paper/Cleaning supplies/Plastics | 19        | 11,7           |
|                              | Food/Beverage                               | 27        | 16,7           |
| The Number of Total Employee | 0-50                                        | 20        | 12,3           |
|                              | 51-250                                      | 34        | 21,0           |
|                              | 251-500                                     | 13        | 8,0            |
|                              | 501-2000                                    | 51        | 31,5           |
|                              | More than 2001                              | 44        | 27,2           |
| The Number of Total Supplier | 0-50                                        | 32        | 19,8           |
|                              | 51-250                                      | 55        | 34,0           |
|                              | 251-500                                     | 27        | 16,7           |
|                              | 501-2000                                    | 30        | 18,5           |
|                              | More than 2001                              | 18        | 11,1           |
| Market                       | Only Domestic                               | 10        | 6,2            |
|                              | Only Foreign Trade                          | 10        | 6,2            |
|                              | Both International and domestic             | 142       | 87,7           |

After examining company traits, the key characteristics of the respondent were listed in Table 6.6. Regarding the gender of the respondents, 65,4% of the respondents are men and 34,6% of the respondents are women. Of the 162 respondents, 21.6% is top manager such as CEO, president and general manager; 17,9 % is production manager; 19,1% is planning manager, 22,8%; 11,5% works as operation and supply chain manager and lastly, 7,45% work as a specialist in different departments. In the beginning, the target of this study was only middle and top managers. However, due to a lack of responses and an increased sample, the author

has contacted more respondents who work as specialists and 12 more people accepted to fill up the questionnaires. The age of respondents changes between 25 to 55. Most of the respondents' age range is between 25 to 35 with 56,8%. The second biggest age range is between 36 to 45 years old with 27,2%. The highest rate for respondents' tenure is between 1 to 5 years with 53,1%. 28,4% of the respondents' tenure is changing between 6 to 10 years while 9,3% of the respondents range is between 16-20 years and 5,6% of the respondents have more than 20 years of experience.

Table 6.6: Frequency of Respondent Characteristics

| Variables (for respondents) |                                                       | Frequency | Percentage (%) |
|-----------------------------|-------------------------------------------------------|-----------|----------------|
| Gender                      | Women                                                 | 56        | 34,6           |
|                             | Men                                                   | 106       | 65,4           |
| Position of the respondent  | General Manager/CEO/President                         | 35        | 21,6           |
|                             | Production Manager                                    | 29        | 17,9           |
|                             | Planning Manager                                      | 31        | 19,1           |
|                             | Quality/R&D Manager                                   | 37        | 22,8           |
|                             | Operation and Supply Chain Manager                    | 18        | 11,05          |
|                             | Specialist (Production, quality, planning, operation) | 12        | 7,45           |
|                             |                                                       |           |                |
| Age of the respondent       | Between 25-35 years                                   | 92        | 56,8           |
|                             | Between 36-45 years                                   | 44        | 27,2           |
|                             | Between 46-55 years                                   | 26        | 16,0           |
|                             | More than 55 years                                    |           |                |
| Tenure of the respondent    | Between 1-5 years                                     | 86        | 53,1           |
|                             | Between 6-10 years                                    | 46        | 28,4           |
|                             | Between 16-20 years                                   | 15        | 9,3            |
|                             | More than 20 years                                    | 9         | 5,6            |

## 6.9. Descriptive Statistics

The respondents were also questioned regarding their lean implementation such as; Kaizen, 5S, Kanban, Pull System, Value Flow Mapping, Value Chain Analysis, and A3 Report (PDCA). Giving a summary of these seven tools will be beneficial for the result evaluation.

- a) 5S technique: Covers five steps, each word starting with “S”. These are; sort, set in order, shine, standardize and sustain. This technique is about efficient workplace organization.
- b) Kanban system: It is a useful tool for boosting productivity, cutting waste, and raising client happiness. A pull-based method called Kanban is used to manage and regulate how work flows through a process. It conveys information about the task being done and the resources required to do it visually.
- c) Pull system: The goal of the pull system is to create only what is needed, It is driven by client demand. The pull method is frequently employed in Just-In-Time (JIT) manufacturing, where the production and delivery of goods must be done as effectively and efficiently.
- d) Value Flow Mapping: This technique is used to evaluate and enhance the movement of resources, knowledge, and activities necessary to provide a good or service to the client. VFM, a visual representation of the work process, is employed to find and get rid of process waste.
- e) Value Chain Analysis: It seeks to find opportunities for an organization to produce value and gain a competitive edge. A company can discover its strengths and weaknesses by studying the value chain, and then decide where to focus its resources in order to increase productivity, cut costs, and boost customer value.
- f) A3 Report (PDCA): These two tools are not the same but their common feature is both of them are problem-solving techniques. An A3 report often comprises a visual representation of the issue, an assessment of the present situation, a goal for the future, and a strategy for applying and assessing a remedy. The PDCA (plan-do-check-act) cycle is a structured approach to continuous development that entails planning, carrying it out, checking the outcomes, and then taking appropriate action. It is a four-step procedure that is frequently used to pinpoint issues, find solutions, and continuously enhance workflows.
- g) Kaizen: The foundation of Kaizen is the notion that gradual, incremental improvements are more beneficial and long-lasting than abrupt, drastic ones.

The objective is to establish a continuous improvement culture where everyone in the company participates in finding and executing incremental changes.

The results of these descriptive results were summarized in Figure 6.3, which demonstrates that 5S and Kazien are implemented at most with 55 % and 90 companies out of 161. Value flow is the lowest percentage at 25 %. While 30% of the companies participating in the survey applied the Kanban technique, 28% of the companies reported that they applied the Pull technique, 35% of the companies with the Value Chain approach, and 27% of the companies using PDCA method.



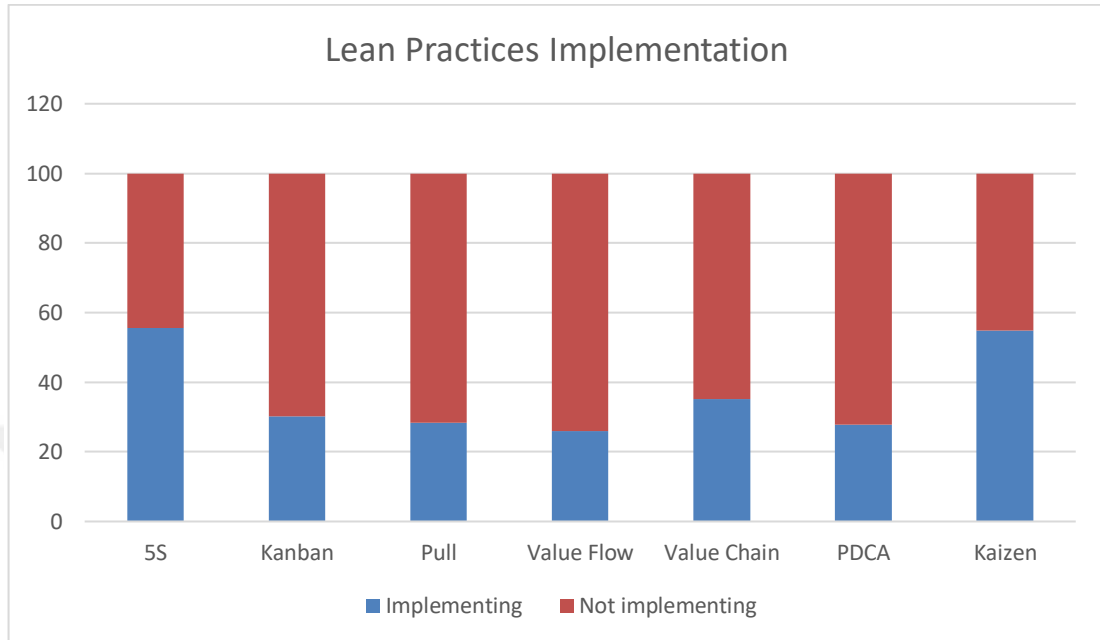


Figure 6.3: Lean Practices Implementation Result

#### 6.9.1. Lean Supply Chain Scale

Lean supply chain scale consist of 8 items. The first two items represent “lean supply chain tooling”; LSC3, LSC4 and LSC5 are representing “lean supply chain operationalization” and the last three items (LSC6, LSC7, LSC8) are representing “lean supply chain planning” factor. According to Table 6.7 the average mean of lean supply chain is 3,56. In comparison to other variables, LSC has the lowest average mean value. This result is also compatible with the lean practices implementation result (see Table 6.7) where the lean implementation is not that common. When it comes to specific scale items, It is seen that 4 out of 8 expressions are below the general average of the scale. These are “*LSC4: Process and product standardization is a common practice in our supply chain*”, “*LSC5: Our supply chain delivers in small lot sizes*”, “*LSC6: Our supply chain does long term forecasting of customer demands serving only the current market segments*” and “*LSC8: Our supply chain structure seldom change*”.

Table 6.7: The Mean and Sd Values of LSCM

| Items                     | Mean        | Sd    | Skewness | Kurtosis |
|---------------------------|-------------|-------|----------|----------|
| LSC1                      | 3,67        | 0,869 | -0,516   | 0,200    |
| LSC2                      | 3,83        | 0,934 | -0,633   | 0,048    |
| <b>Average Mean</b>       | 3, 75       |       |          |          |
| LSC3                      | 3,84        | 0,739 | -0,765   | 1,858    |
| <b>LSC4</b>               | <b>3,38</b> | 0,764 | -0,083   | 0,470    |
| <b>LSC5</b>               | <b>3,12</b> | 1,002 | 0,199    | -0,511   |
| <b>Average Mean</b>       | 3,44        |       |          |          |
| <b>LSC6</b>               | <b>3,46</b> | 0,842 | -0,273   | -0,015   |
| LSC7                      | 3,69        | 0,973 | -0,941   | 1,028    |
| <b>LSC8</b>               | <b>3,51</b> | 0,790 | -0,347   | 0,409    |
| <b>Average Mean</b>       | 3,55        |       |          |          |
| <b>Total Average Mean</b> | <b>3,56</b> |       |          |          |

### 6.9.2. Agile Supply Chain Scale

The arithmetic means and standard deviation values were obtained in line with the statements regarding the agile supply chain scale consisting of 13 statements. First four items represents “flexibility” factor, ASC5, ASC6, ASC7 belongs to “responsiveness” factor; ASC8, ASC9, ASC10 items represent “speed” factor and ASC11, ASC12, ASC13 items reflect “competence” factor. The answers of the participants are shown in the Table 6.8. According to the table, the general average of the scale is 3.9. When we look at the expressions, it is seen that 4 out of 13 expressions are below the general average of the scale and the first 4 expressions are the items of the flexibility factor. These are “*This organisation is flexible in terms of product volume*”, “*The production processes of this organisation are flexible in terms of product models and configurations*”, “*This organisation exhibits flexibility in both organisation and organisational issues*”, “*This organisation has flexible workforce*”. In addition, the statement with the highest average is “*Environmentally friendly products should be purchased regularly in daily life*”. The fact that the average mean of the scale is 3.90 indicates that the companies participating in the research can have an agile supply structure.

Table 6.8: The Mean and Sd Values of ASCM

| Items              | Mean     | Sd    | Skewness | Kurtosis |
|--------------------|----------|-------|----------|----------|
| ASC1               | 3,72     | 0,960 | -0,822   | 0,752    |
| ASC2               | 3,68     | 0,875 | -0,956   | 1,067    |
| ASC3               | 3,63     | 0,905 | -0,776   | 0,785    |
| ASC4               | 3,72     | 0,867 | -0,804   | 0,826    |
| Average Mean       | 3,64     |       |          |          |
| ASC5               | 4,04     | 0,945 | -1,013   | 0,686    |
| ASC6               | 3,92     | 0,898 | -0,829   | 0,617    |
| ASC7               | 3,96     | 0,884 | -0,966   | 1,013    |
| Average Mean       | 3,983333 |       |          |          |
| ASC8               | 3,96     | 1,030 | -0,846   | 0,176    |
| ASC9               | 4,11     | 0,905 | -1,188   | 1,609    |
| ASC10              | 4,02     | 0,895 | -0,879   | 0,483    |
| Average Mean       | 4,033333 |       |          |          |
| ASC11              | 4,04     | 0,928 | -1,219   | 1,497    |
| ASC12              | 4,01     | 0,881 | -0,839   | 0,743    |
| ASC13              | 4,02     | 0,874 | -0,884   | 0,898    |
| Average Mean       | 4,033333 |       |          |          |
| Total Average Mean | 3,900769 |       |          |          |

### 6.9.3. Supply Chain Integration Scale

The SCI scale consists of 14 statements. The first 5 of them represent customer integration, the next 5 statements (SCSI1, SCSI2, SCSI3, SCSI4, SCSI5) represent supplier integration, the last 4 statements (SCII1, SCII2, SCII3, SCII4) represent internal integration. The answers of the participants are shown in the Table 6.9. According to the table, the general average of the SCI scale is 3.80. However, it is more appropriate to evaluate each sub-factor separately. The average mean of customer integration is 3,77. SCSI5 -“Our customers are involved in our product development processes” - has the lowest mean value. When it comes to supplier integration it has the lowest average mean value (3,62) out of three sub-factors. SCSI5 – “Our suppliers are involved in our product development processes”- is the

lowest value with a 3,38. Internal integration has the highest average mean value (4,13). It can be clearly concluded that internal integration is higher than both customer and supplier integration. The company's supplier integration is the lower than other two integration.

Table 6.9: The Mean and Sd Values of SCI

| Items                     | Mean        | Sd    | Skewness | Kurtosis |
|---------------------------|-------------|-------|----------|----------|
| SCCI1                     | 3,82        | 0,833 | -0,370   | -0,023   |
| SCCI2                     | 3,76        | 0,818 | -0,426   | 0,167    |
| SCCI3                     | 3,84        | 0,884 | -0,498   | -0,109   |
| SCCI4                     | 3,77        | 0,785 | -0,419   | 0,358    |
| <b>SSCI5</b>              | <b>3,67</b> | 0,885 | -0,382   | -0,257   |
| <b>Average Mean</b>       | <b>3,77</b> |       |          |          |
| SCSI1                     | 3,69        | 0,894 | -0,566   | 0,358    |
| <b>SCSI2</b>              | <b>3,56</b> | 0,891 | -0,082   | -0,221   |
| SCSI3                     | 3,67        | 0,827 | -0,512   | 0,801    |
| SCSI4                     | 3,71        | 0,846 | -0,587   | 0,759    |
| <b>SCSI5</b>              | <b>3,49</b> | 0,907 | -0,013   | -0,544   |
| <b>Average Mean</b>       | <b>3,62</b> |       |          |          |
| <b>SCII1</b>              | <b>4,03</b> | 0,768 | -0,887   | 1,519    |
| <b>SCII2</b>              | <b>4,06</b> | 0,872 | -0,734   | 0,217    |
| SCII3                     | 4,19        | 0,768 | -1,008   | 1,668    |
| SCII4                     | 4,23        | 0,766 | -1,086   | 1,878    |
| <b>Average Mean</b>       | <b>4,13</b> |       |          |          |
| <b>Total Average Mean</b> | <b>3,80</b> |       |          |          |

#### 6.9.4. Performance Scale

The performance scale is slightly different than the other four scales. Instead of rating “strongly agree/strongly disagree”, this scale wants respondents to compare themselves with the industry average where they operate. This is also five points Likert scale (1 = well below industry average; 5= well above industry average). The performance scale consists of two parts. Financial performance includes 4 items (FP1, FP2, FP3, FP4) and operational performance has 12 items (from OP1 to OP12). The average mean of FP is 3.65. FP1- “Average ROI over the past 3 years” has the

lowest value (3.60). The operational performance average is 3.74. Four items are lower than the average. OP4 (logistics cost), OP10 (advance ship notification), OP11 (inventory turn), OP12 (return on asset). According to these results, it can be concluded that participant companies rate themselves above the average.

Table 6.10: The Mean and Sd Values of Firm Performance

| Items               | Mean        | Sd    | Skewness | Kurtosis |
|---------------------|-------------|-------|----------|----------|
| <b>FP1</b>          | <b>3,60</b> | 0,776 | -0,779   | 1,716    |
| FP2                 | 3,66        | 0,724 | -0,378   | 0,600    |
| <b>FP3</b>          | <b>3,62</b> | 0,739 | -0,481   | 1,047    |
| FP4                 | 3,72        | 0,700 | -0,422   | 0,874    |
| <b>Average Mean</b> | <b>3,65</b> |       |          |          |
| OP1                 | 3,93        | 0,816 | -0,558   | 0,355    |
| OP2                 | 3,83        | 0,800 | -0,486   | 0,366    |
| OP3                 | 3,86        | 0,862 | -0,250   | -0,423   |
| <b>OP4</b>          | <b>3,28</b> | 0,689 | 0,841    | 0,826    |
| OP5                 | 3,93        | 0,842 | -0,438   | -0,080   |
| OP6                 | 3,90        | 0,736 | -0,116   | -0,505   |
| OP7                 | 3,85        | 0,798 | -0,098   | -0,704   |
| OP8                 | 3,76        | 0,794 | -0,067   | -0,565   |
| OP9                 | 3,80        | 0,729 | -0,356   | 0,639    |
| <b>OP10</b>         | <b>3,62</b> | 0,812 | 0,177    | -0,271   |
| <b>OP11</b>         | <b>3,56</b> | 0,772 | -0,024   | 0,076    |
| <b>OP12</b>         | <b>3,62</b> | 0,722 | -0,291   | 0,493    |
| <b>Average Mean</b> | <b>3,74</b> |       |          |          |

#### 6.9.5. Learning Organization Scale

The learning organization scale includes 21 items in total and has seven factors in it. Each factor has three items. These items are: continuous learning (LO1, LO2, LO3), dialogue and inquiry (LO4, LO5, LO6), team learnig and collaboration (LO7, LO8, LO9), embedded system (LO10, LO11, LO12), empowerment (LO13, LO14, LO15), system connection (LO16, LO17, LO18), strategic leadership (LO19, LO20, LO21). The average mean of 21 items value is 3.80. The average mean of seven factors is quite close to each other that's why the interpretation of 21 items

together will be appropriate. LO3 (In my organization, people are rewarded for learning) has the lowest value (3,44).

Table 6.11: The Mean and Sd Values of Learning Organization

| Items                     | Mean        | Sd    | Skewness | Kurtosis |
|---------------------------|-------------|-------|----------|----------|
| LO1                       | 4,04        | 0,870 | -1,219   | 2,306    |
| LO2                       | 3,78        | 1,057 | -0,916   | 0,374    |
| <b>LO3</b>                | <b>3,44</b> | 1,174 | -0,482   | -0,692   |
| LO4                       | 3,77        | 0,969 | -0,634   | 0,016    |
| LO5                       | 3,85        | 0,936 | -1,019   | 1,227    |
| LO6                       | 3,80        | 0,855 | -0,755   | 0,720    |
| LO7                       | 3,70        | 1,028 | -0,753   | 0,295    |
| LO8                       | 3,91        | 0,783 | -0,867   | 1,680    |
| LO9                       | 3,87        | 0,871 | -0,942   | 1,249    |
| LO10                      | 3,80        | 0,945 | -0,937   | 0,966    |
| LO11                      | 3,86        | 0,918 | -0,737   | 0,308    |
| LO12                      | 3,76        | 0,918 | -0,771   | 0,487    |
| LO13                      | 3,78        | 0,959 | -0,825   | 0,674    |
| LO14                      | 3,87        | 0,797 | -0,806   | 1,369    |
| LO15                      | 3,86        | 0,909 | -0,983   | 1,453    |
| LO16                      | 3,83        | 0,875 | -0,783   | 0,647    |
| LO17                      | 3,81        | 0,886 | -0,874   | 0,938    |
| LO18                      | 3,85        | 0,865 | -0,758   | 0,421    |
| LO19                      | 3,72        | 1,066 | -0,968   | 0,612    |
| LO20                      | 3,73        | 1,009 | -0,936   | 0,794    |
| LO21                      | 3,90        | 0,900 | -1,097   | 1,562    |
| <b>Total Average Mean</b> | <b>3,81</b> |       |          |          |

## 6.10. Structural Equation Modelling (SEM)

The technique of structural equation modeling is used to identify the causes of the correlations between latent and observable variables. Implicit variables are typically abstract ideas that are understood based on observable variables, whereas observable variables are variables that may be assessed numerically by data gathering methods. According to structural equation modeling, there is causality

between latent variables, and observable variables can be used to statistically measure the relationships between these variables (Öztürk, 2020).

Techniques for structural equation modeling in general let researchers model the connections between several variables, produce latent variables, model errors in the measurement of observed variables, and carry out confirmatory analyses (Chin, 1998: 297). Structural equation modeling can be used to examine conventional models even though it is an extension of classical regression analysis that combines numerous regression analyses. Also, it is a technique that can be quite helpful in situations involving more complicated relationships (Öztürk, 2020).

SFSU (2004) cited by Ayyıldız and Cengiz (2006) listed some features of SEM:

- It allows the calculation of the regression coefficients in the theoretical model by controlling the effects of measurement errors in the relationships specified with the hypotheses.
- The suitability of the theoretical model with the data obtained as a result of the measurement can be tested as a whole.
- Allows testing of different estimates of measurement errors.
- By testing different factor structures, comparisons with different groups can be made. Thus, by testing different models, it can be revealed which of these models is more suitable for the collected data.
- It can perform simultaneous multiple regression analyzes that first generation analyzes cannot.
- It allows us to measure the relationships between latent variables.
- It allows the determination of direct and indirect relationships between variables.
- It helps to keep measurement errors to a minimum by assigning observed variables to each latent variable and analyzing whether these variables are reliable.
- It has a graphical interface for better visual understanding of the models.
- Not only can analyze the model by means of coefficients, but also analyze it as a whole.
- Can explain the intermediary and regulatory variables by including them in the model.

SEM can be done in a variety of ways: The first strategy makes use of the widely used Covariance-based SEM (CB-SEM) which runs on programs like AMOS, EQS, LISREL, and MPlus. The second strategy is partial least squares (PLS), which may be applied using PLS-Graph, VisualPLS, SmartPLS, and WarpPLS. (Wong, 2013) Herman O. A. Wold created the Partial least squares path modeling statistical technique in 1975 (Hair et al., 2011). PLS-SEM integrates principle components analysis with ordinary least squares (OLS) regressions to construct partial model architectures (Mateos-Aparcio, 2011). A popular regression-based method used in social sciences called PLS-SEM analyzes correlations in path models with latent and manifest variables (Hair et al., 2017). PLS-SEM is a causal modeling approach to increase the explained variance of the dependent latent components (Hair et al., 2011).

#### **6.10.1. CB-SEM vs. PLS-SEM**

CB-SEM (Covariance-based Structural Equation Modelling) is the best method to use if the goal of the study is to verify and validate theories. On the other hand, PLS-SEM (Partial Least Square Structural Equation Modelling) is the right approach if the goal of the study is theory creation and forecasting. PLS-SEM is theoretically and practically equivalent to performing multiple regression analysis. The main goal is to increase explained variance in the dependent constructs, but we also want to assess the quality of the data using the properties of the measurement model. In 2017a, Hair Jr. et al. Amos has stricter rules than Smart PLS (SPLS). Although SPLS can be effective in the absence of formal theory and the necessary sample size, Amos does not provide a good model fit. Hair (2017a) stated that "both strategies are supportive, not conflicting." The research's objective informs the method chosen. CB-SEM is the method of choice when the preexisting hypothesis requires to be validated and verified. Nonetheless, PLS-SEM is superior for both theory building and prediction needs (Dash, 2021).

It is necessary to explain the differences between PLS-SEM and CB-SEM. Both of them have their pros and cons. However, employing PLS-SEM is more appropriate for this current study. The goal of CB-SEM is to replicate the conceptual covariance matrix without requiring an explanation of the variance. There are a number of assumptions that must be fulfilled for CB-SEM, such as the multivariate normality of the data, the minimum required sample size, and many others

(Diamantopoulos and Siguaw, 2000). Variance-based PLS-SEM is an appropriate method, but, if CB-SEM standards cannot be met if the research goal is prediction rather than confirmation of structural correlations. The accuracy of CB-SEM results decreases when assumptions are broken. PLS-SEM provides more accurate structural model estimations (Ringle et al., 2009). Since prediction is the main goal of this study, SMART-PLS is an appropriate statistical analytic technique. There is a fairly small sample (N=162) for this thesis. Additionally, it seeks to maximize the explained variance of the dependent latent components (Shmueli et al., 2019). Widespread use of PLS-SEM, which permits sophisticated model designs of higher-order constructs (Ringle et al., 2019). Researchers can model a construct with an abstract dimension (known as a higher-order component) and its objective subdimensions using hierarchical component models in PLS-SEM (Lohmöller, 1989).

PLS-SEM has the major benefit of simultaneously calculating the direct and indirect effects of the latent variables on one another and on their associated measures. PLS-SEM does not rely on the data having a normal distribution. It employs a technique called bootstrapping, where the original set of observations is repeatedly sampled (using only a portion of the observations), creating a model each time, to produce metrics of statistical significance. The variance of these values is used to determine the t-values of the coefficients in the final model. The coefficients in the final model are the means of the values collected in the multiple iterations. Similar to linear regression, PLS's statistical objective is to maximize R<sup>2</sup> values, identify significant t values, and reject the null hypothesis. By demonstrating that all paths described in the examined model are logical, covariance-based structural equation modeling aims to demonstrate that the null hypothesis is meaningless in all paths in the model (Gefen et al., 2000: 24).

PLS-SEM is a sampling technique that is particularly appropriate for exploratory research. When the size of the data is relatively small, there is no normal distribution, or the results of covariance-based structural equation modeling are uncertain, this method is thought to be effective (Hair, 2012).

The PLS-SEM approach does not have a universally recognized goodness of fit value. PLS-SEM lacks global goodness-of-fit values, in contrast to covariance-based structural equation modeling, which is thought by some academics to be a

significant drawback of PLS-SEM. It uses the prediction capabilities of the model to evaluate the quality of the model (Hair et al., 2017, p.33).

The PLS-SEM technique is highly beneficial, however, it is important to note that not all statistical studies are appropriate for it. Like every method of analysis, PLS-SEM has various drawbacks (Wong, 2013: 3):

- When the sample size is very small, high structural path coefficients are necessary.
- There could be a multicollinearity issue.
- Arrows are always unidirectional, hence it is impossible to represent non-directional relationships.
- A potential inconsistency with the implicit variable values could lead to biased component estimates and path coefficients.
- The path coefficients' loads can be estimated with significant mean square errors.

Wong (2013) proposed some suggestions for the application of PLS-SEM.

- For the inner model evaluation, goodness of fit values should not be considered.
- For the reflective model, Cronbach alfa should not be considered as a reliability measurement.
- For formative model evaluation, path coefficients should be reported. For the outer model appropriateness; t value, p value and standard errors should be evaluated.

The development of path models is theory-based. The research paradigm is utilized to construct a theory, which is a collection of logically connected hypotheses that can be used to explain and forecast outcomes. To create path models, measurement theory and structural theory are both necessary. Measurement theory describes how each construct is evaluated, whereas the latter describes how the constructs are linked to one another in the structural model (Hair et al., 2017, p.28).

#### 6.10.1.1. The Measurement Model

PLS-SEM has two main phases: measurement model and structural model. Measurement of the latent variables (constructs) is described by measurement theory. There are two alternative approaches to quantifying unobservable factors. The first method is known as reflecting measurement, and the second is known as formative measurement (Hair et al., 2017,p.28). It is very crucial to determine the model type for the evaluation of the measurement model because the reliability and validity assessment of these two modes is different. Hair et al. (2017) have suggested some criteria for the decision of reflective and formative models. In this study all the variables are reflective. Table 6.12 summarizes these criteria.

**Table 6.12:** Decision model mode of Reflective vs. Formative

| <b>Criteria</b>                      | <b>Reflective</b>                                                 | <b>Formative</b>                                                                          |
|--------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>Causality of construct</b>        | When causality is from the latent variable to the items           | When causal factors (items; each rectangulars) constitute the latent variable (construct) |
| <b>Structure of construct</b>        | the indicators have a trait that the concept claims to explain.   | The indications are combined to create the construct.                                     |
| <b>Cause Effect relationship</b>     | The indicators signify outcomes.                                  | The causes of the construct are indicated by the indicators.                              |
| <b>Assesment of trait alteration</b> | All items will alter similarly as the trait's evaluation changes. | All items are not necessarily altered in a similar way as the trait's evaluation changes. |
| <b>Interchangeability</b>            | The items are mutually interchangeable.                           | The items aren't mutually interchangeable.                                                |

Source: Adapted from Hair et al. (2017, p. 67)

After the determination of whether the model is reflective or formative, the evaluation of the measurement model should be examined. In this phase, all the

reliability and validity assessments have to be calculated before assessing the structural model.

### 1.1 Reliability

#### Internal consistency

- **Cronbach's alpha:** This statistic presumes that every indicator is equally credible. Nevertheless, PLS-SEM ranks the indicators in order of individual reliability. Moreover, Cronbach's alpha tends to underestimate the internal consistency dependability due to its sensitivity to the scale's element amount. So, it could be utilized as a more cautious internal consistency reliability measure (Hair et al., 2017, p.126).
- **Composite reliability:** Owing to Cronbach's alpha's restrictions, a new internal consistency reliability metric—known as composite reliability—is theoretically more acceptable to use. The various outside loadings of the indicator variables are taken into consideration by this reliability measurement (Hair et al., 2017, p.126). When  $CR > 0.7$ , good consistency is attained (Gefen, 2000).

### 2.1 Validity

**Convergent validity:** The degree to which a measure correlates favorably with different indicators related to the same construct. Scholars take into account the outer loadings of the indicators and the average variance extracted when assessing the convergent validity of reflective constructs (AVE). AVE value should be greater than 0.5.

Scholars need to carefully assess how item deletion affects the construct's content validity and the composite reliability. In principle, items with outer loadings between 0.40 and 0.70 should only be removed from the scale if doing so causes a rise in composite reliability (or AVE) above the recommended threshold value. The outer loading below 0.4 has to be eliminated from the model (Hair et al., 2017, p. 128).

**Discriminant Validity:** The degree to which a construct is objectively distinguishable from other constructs (when indicators are substantially correlated with one latent variable in comparison to other latent variables).

- **The cross-loadings:** The initial method used to evaluate the indicators' discriminant validity.
- **The Fornell-Larcker criterion:** It contrasts the correlations between the latent variable and the square root of the AVE values.
- **HTMT Approach:** For all possible build combinations, the confidence interval of the HTMT statistic must not contain the number 1.

#### 6.10.1.2. Structural Model

The structure and the order of the variables are determined according to theory, literature, or the knowledge of the researchers. When the variable is only Independent, it is called exogenous while the variable has a dependent or both dependent and independent roles it is called an endogenous variable (Hair et al., 2017, p.29).

The connections between the latent variables are represented by the structural model. How strongly one latent variable influences another latent variable is indicated by the path coefficient. A high path coefficient indicates that one exogenous latent variable has a strong impact on the other exogenous latent variable (endogenous). It is possible to rate the relative statistical importance of the path coefficients based on their size. A route coefficient that is appropriate is greater than 0.1. Path coefficients should also have t-values of more than 1.96 and statistical significance. P-values for the path coefficients should be small ( $<0.05$ ). The (endogenous) latent variables' R<sup>2</sup> values should be above 0.1 to be significant. Indicators will be considered significant if their loading value is more than 0.7. Significant coefficients have values more than 0.1, t values greater than 1.96, and p values less than 0.05. The steps of the structural model assessment are shown in Figure 6.4.

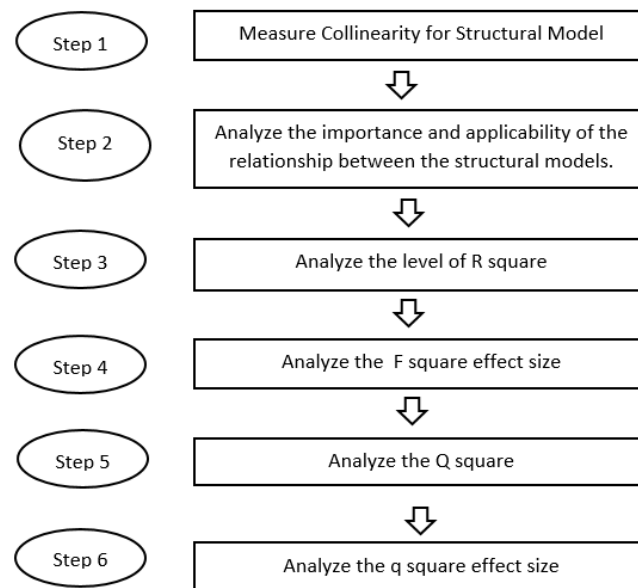


Figure 6.4: The Structural Model Assessment

Since this model contains both mediating and moderating variables after assessing the relationship between variables, mediation and moderation tests are also needed.

### Mediation Testing

To test the mediation relationships of supply chain integration between lean supply chain and organizational performance (financial and operational), agile supply chain, and organization performance, comparing the path coefficient of the direct and indirect relationships is required. There must be a meaningful mediating link if the indirect coefficients are significant. The mediation test won't hold up in that case.

### Moderation Testing

In contrast to CB-SEM (Amos), PLS-SEM can offer an apparent moderation (interaction effect) with decent presentation. CB-SEM requires more work from scientists. To estimate the interaction impact, a normalization or standardization method is required (Dash, 2021). Moderating variables of learning organization will be assessed in the results part.

The moderation effect can be evaluated by path coefficient values which clearly demonstrate the effect sizes. In addition, simple slope analysis presents each moderating effect on a graph.

## **CHAPTER SEVEN**

### **DATA ANALYSIS AND RESULTS**

The model was tested with 177 companies. 15 company responses were eliminated because of missing values. The model was tested with 162 companies' responses in total. In the previous chapter, all the steps have been explained. In this chapter, the results of the original model and the improved model will be explained briefly.

The coded data were obtained from SPSS 25, then transferred to the SMART PLS 4 program. The indicators were interchangeable, therefore the items were reflective; removing any indicator did not alter the essence of the build. PLS-SEM assessment is typically suggested in two areas that call for independent evaluations of the measurement models and the structural model (Joseph F Hair Jr et al., 2016). First, reliability and validity were assessed using the provided criteria, particularly those of a higher-order reflective measurement model (Hair, Ringle, & Sarstedt, 2011). Then, for the structural model assessment; collinearity, bootstrapping, path coefficients, quality criteria, blindfolding, mediation, moderation and lastly hypothesis testing were interpreted.

#### **7.1. The Original Model**

The application of the following analyses is ensured by the measurement model's quality (Hulland, 1999: 200; Schotter and Beamish, 2014: 183).

In this way, construct reliability, convergent validity, and discriminant validity serve as the foundation for evaluating the measurement model for reflective indicators (HTMT, Fornell-locker, Cross-loading). The model of the current study is not based on a structured, well-known theory. There are many different approaches from different scholars. Since the author is willing to explore the relationship between the construct, the model variables have been tested in various ways until the optimum result is gathered. After all these trials, the proposed research model was found logical and appropriate.

The original model of the study is demonstrated in Figure 7.1. After evaluation of the model measurement and the structural model, sufficient values could not be

gathered. For this reason, the model has been revised many times until the best results are obtained. As briefly discussed in the previous chapter, PLS-SEM is very flexible and exploratory instead of confirmatory. The research model of the current study is not based on a theory. The structure model has been designed according to previous studies.



### 7.1.1. The Measurement of Original Model Evaluation

The item loadings are shown in both figure and table. Even though, 16 items loadings are lower than 0.70. There are only three items that are lower than 0.516. The rest 13 items range between 0.60 to 0.70. As suggested by Hair et al., (2017, p.128) items with outer loadings between 0.40 and 0.70 should only be removed from the scale if it causes a rise in the composite reliability (or AVE).

For the assessment of reflective models, the outer loadings value should be considered. Table 7.1 indicates the factor loadings values. This is an initial step to evaluate the measurement of the original model. As can be seen, three items (LSC5, LSC7, and OP4) loadings are lower than 0.60 and the other 13 items' loadings are between 0.60-0.70. In addition, the AVE values of the original model are also shown in Table 7.2, AVE is a critical element for elimination decision.

Table 7.1: Scale Items, Reliabilities and Factor Loadings

| Variables          | Factors       | Items | Outer loadings |
|--------------------|---------------|-------|----------------|
| Agile Supply Chain | Flexibility   | ASC1  | 0.658*         |
|                    |               | ASC2  | 0.670*         |
|                    |               | ASC3  | 0.731          |
|                    |               | ASC4  | 0.653*         |
|                    | Responsivness | ASC5  | 0.822          |
|                    |               | ASC6  | 0.859          |
|                    |               | ASC7  | 0.882          |
|                    | Speed         | ASC8  | 0.828          |
|                    |               | ASC9  | 0.816          |
|                    |               | ASC10 | 0.831          |
|                    | Competence    | ASC11 | 0.816          |
|                    |               | ASC12 | 0.806          |
|                    |               | ASC13 | 0.745          |
| Lean Supply Chain  |               | LSC1  | 0.655*         |
|                    |               | LSC2  | 0.694*         |
|                    |               | LSC3  | 0.765          |
|                    |               | LSC4  | 0.812          |
|                    |               | LSC5  | 0.437**        |
|                    |               | LSC6  | 0.698*         |
|                    |               | LSC7  | 0.287**        |
|                    |               | LSC8  | 0.701          |

|                          |                                |       |        |
|--------------------------|--------------------------------|-------|--------|
| Supply Chain Integration | Customer Integration           | SCCI1 | 0.744  |
|                          |                                | SCCI2 | 0.861  |
|                          |                                | SCCI3 | 0.835  |
|                          |                                | SCCI4 | 0.646* |
|                          |                                | SCCI5 | 0.780  |
|                          | Supplier Integration           | SCSI1 | 0.748  |
|                          |                                | SCSI2 | 0.867  |
|                          |                                | SCSI3 | 0.900  |
|                          |                                | SCSI4 | 0.750  |
|                          |                                | SCSI5 | 0.801  |
|                          | Internal Integration           | SCII1 | 0.867  |
|                          |                                | SCII2 | 0.907  |
|                          |                                | SCII3 | 0.900  |
|                          |                                | SCII4 | 0.870  |
| Learning Organization    | continuous learning            | LO1   | 0.682* |
|                          |                                | LO2   | 0.751  |
|                          |                                | LO3   | 0.726  |
|                          | dialogue and inquiry           | LO4   | 0.749  |
|                          |                                | LO5   | 0.725  |
|                          |                                | LO6   | 0.747  |
|                          | team learnig and collaboration | LO7   | 0.712  |
|                          |                                | LO8   | 0.796  |
|                          |                                | LO9   | 0.816  |
|                          | embedded system                | LO10  | 0.801  |
|                          |                                | LO11  | 0.718  |
|                          |                                | LO12  | 0.844  |
|                          | empowerment                    | LO13  | 0.678* |
|                          |                                | LO14  | 0.758  |
|                          |                                | LO15  | 0.664* |
|                          | system connection              | LO16  | 0.767  |
|                          |                                | LO17  | 0.715  |
|                          |                                | LO18  | 0.755  |
|                          | strategic leadership           | LO19  | 0.770  |
|                          |                                | LO20  | 0.778  |
|                          |                                | LO21  | 0.802  |
| Firm Performance         | Financial Performance          | FP1   | 0.856  |
|                          |                                | FP2   | 0.854  |
|                          |                                | FP3   | 0.876  |
|                          |                                | FP4   | 0.833  |
|                          | Operational Performance        | OP1   | 0.771  |

|  |      |         |
|--|------|---------|
|  | OP2  | 0.742   |
|  | OP3  | 0.724   |
|  | OP4  | 0.516** |
|  | OP5  | 0.782   |
|  | OP6  | 0.766   |
|  | OP7  | 0.648*  |
|  | OP8  | 0.684*  |
|  | OP9  | 0.711   |
|  | OP10 | 0.730   |
|  | OP11 | 0.669*  |
|  | OP12 | 0.652*  |

The Cronbach's alpha, composite reliability and AVE values are shown in Table 7.2. The required values of Cronbach's alpha and composite reliability are obtained, all of which are higher than 0.70 (Bagozzi and Yi, 1988: 76). AVE values of lean supply chain and operational performance are below the required value (0.50). To increase the values, items are needed to eliminate.

Table 7.2: Reliability and Validity of Original Model

|                         | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|-------------------------|------------------|-------------------------------|-------------------------------|----------------------------------|
| Agile Supply Chain      | 0.946            | 0.951                         | 0.953                         | 0.611                            |
| Customer Integration    | 0.833            | 0.853                         | 0.883                         | 0.604                            |
| Financial Performance   | 0.877            | 0.878                         | 0.916                         | 0.731                            |
| Internal Integration    | 0.909            | 0.914                         | 0.936                         | 0.785                            |
| Learning Organization   | 0.961            | 0.964                         | 0.965                         | 0.565                            |
| Lean Supply Chain       | 0.793            | 0.833                         | 0.847                         | 0.426**                          |
| Operational Performance | 0.906            | 0.911                         | 0.921                         | 0.494**                          |
| Supplier Integration    | 0.874            | 0.896                         | 0.908                         | 0.665                            |

## 7.2. The Improved Original Model Evaluation

The original model results which are indicated above were not satisfactory for further analysis. That's why, the initial step should be provided which are reliability and validity requirements. Several improvements have been done more model measurements that will be explained below.

The association between the observable data is looked at by the measurement model as a reliable indicator of the latent variables. To enhance the model, indicators with a loading of less than 0.50 were eliminated. After eliminating three items (LSC5, LSC7 and OP4), the AVE values of two variables that are lower than 0.50 have increased the threshold. That's why there was no need to delete more items. The improved model's reliability indicators such as Cronbach's alpha and composite reliability values are above the threshold and the convergent validity indicator (AVE) is higher than 0.50 showing the minimum requirement has been achieved.

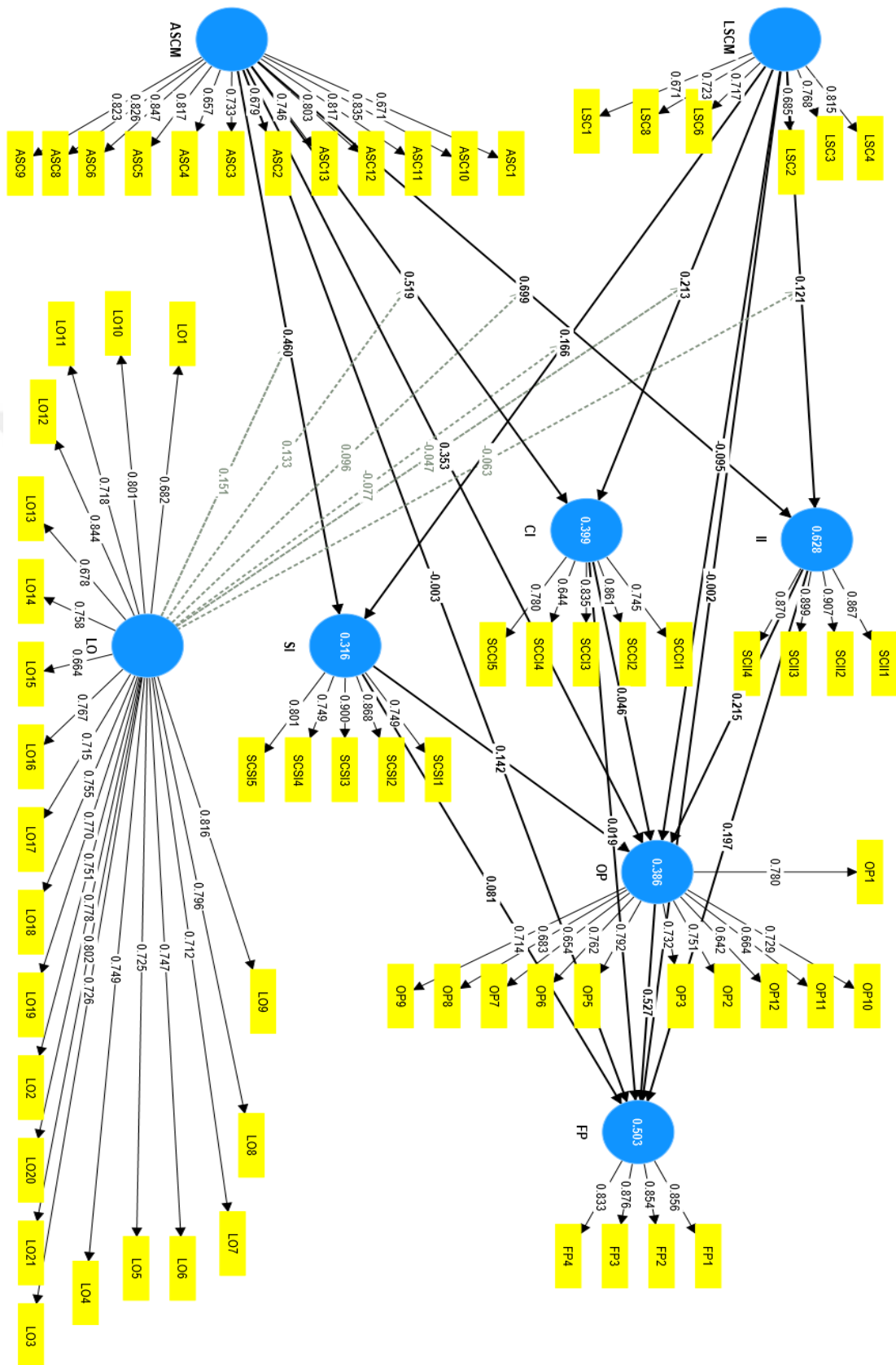


Figure 7.2: The Improved Structural Model

### 7.2.1. Reliability and Validity Results

Individual factor item loadings provide satisfying results because all of the items were loaded highly on the given constructs, with the lowest value being 0.652. Even though 13 individual factor values are less than 0.70 and the majority is above 0.70, the results can still be deemed good and significant ( $p < 0.05$ ).

All of the constructs' AVE values were within the acceptable range of 0.50 and higher, providing evidence of convergent validity (Fornell and Larcker, 1981: 385; Hair et al., 2012: 416). To examine construct reliability for each construct, Cronbach's alpha values and composite reliability were also assigned. Indeed, all Cronbach's alpha values and composite reliability values were higher than the threshold of 0.70, demonstrating that each construct was measured with a high degree of reliability (Bagozzi and Yi, 1988: 76).

Table 7.3: Reliability and Validity of Improved Model

|                                | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|--------------------------------|------------------|-------------------------------|-------------------------------|----------------------------------|
| <b>Agile Supply Chain</b>      | 0.939            | 0.944                         | 0.947                         | 0.599                            |
| <b>Customer Integration</b>    | 0.833            | 0.854                         | 0.883                         | 0.604                            |
| <b>Financial Performance</b>   | 0.877            | 0.878                         | 0.916                         | 0.731                            |
| <b>Internal Integration</b>    | 0.909            | 0.914                         | 0.936                         | 0.785                            |
| <b>Learning Organization</b>   | 0.961            | 0.964                         | 0.965                         | 0.565                            |
| <b>Lean Supply Chain</b>       | 0.829            | 0.832                         | 0.873                         | 0.535                            |
| <b>Operational Performance</b> | 0.907            | 0.911                         | 0.922                         | 0.518                            |
| <b>Supplier Integration</b>    | 0.874            | 0.897                         | 0.908                         | 0.665                            |

#### 7.2.1.1. Discriminant validity

The discriminant validity indicates how much latent variables vary from other constructs. According to Hair et al. (2017) suggestion, for discriminant validity, all three analyses which are HT-MT, Fornell and Larcker and cross-loading approaches should be provided and evaluated carefully.

The Heterotrait-Monotrait (HT-MT) values are lower than the optimum cutoff point of 0.90, with the highest value being 0.853. These values correspond to the

mean of each correlation of the items among the variables evaluating different constructs (Henseler, Ringle, and Sarstedt, 2015: 118) (see Table 7.4) For all possible build combinations, the HTMT statistic's confidence interval shouldn't contain the value 1. Analysis should be carried out to identify confidence interval values using bootstrapping with bias-corrected and accelerated bootstrap (BCa). Table shows that no value includes 1 as can be observed (Hair et al., 2017: 137). (see Table 7.5)

The second method for evaluating discriminant validity is the Fornell-Larcker criterion. It contrasts the correlations between the latent variable and the square root of the AVE values. In particular, the square root of each construct's AVE should be higher than the construct's highest correlation (Hair et al., 2017:131). (see Table 7.6)

The cross-loading approach was evaluated and found to be superior to any of its cross-loadings for each item loaded on its associated construct (see Table 7.7). Each of these requirements guarantees the discriminant validity of the current study.

Table 7.4: Analysis of Discriminant Validity Regarding to HT-MT Approach

|                  | <b>ASCM</b> | <b>CI</b> | <b>FP</b> | <b>II</b> | <b>LO</b> | <b>LSCM</b> | <b>OP</b> | <b>SI</b> | <b>LO x<br/>ASCM</b> | <b>LO x<br/>LSCM</b> |
|------------------|-------------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|----------------------|----------------------|
| <b>ASCM</b>      |             |           |           |           |           |             |           |           |                      |                      |
| <b>CI</b>        | 0.630       |           |           |           |           |             |           |           |                      |                      |
| <b>FP</b>        | 0.550       | 0.489     |           |           |           |             |           |           |                      |                      |
| <b>II</b>        | 0.810       | 0.680     | 0.596     |           |           |             |           |           |                      |                      |
| <b>LO</b>        | 0.454       | 0.311     | 0.372     | 0.461     |           |             |           |           |                      |                      |
| <b>LSCM</b>      | 0.384       | 0.463     | 0.247     | 0.443     | 0.294     |             |           |           |                      |                      |
| <b>OP</b>        | 0.617       | 0.492     | 0.750     | 0.597     | 0.484     | 0.246       |           |           |                      |                      |
| <b>SI</b>        | 0.534       | 0.853     | 0.467     | 0.575     | 0.276     | 0.386       | 0.477     |           |                      |                      |
| <b>LO x ASCM</b> | 0.299       | 0.019     | 0.221     | 0.149     | 0.299     | 0.082       | 0.222     | 0.032     |                      |                      |
| <b>LO x LSCM</b> | 0.099       | 0.033     | 0.112     | 0.092     | 0.112     | 0.162       | 0.081     | 0.044     | 0.554                |                      |

Table 7.5: Analysis of Discriminant Validity Regarding to HT-MT BCa Approach

|                  | Original sample<br>(O) | Sample mean<br>(M) | Bias   | 2.5%  | 97.5% |
|------------------|------------------------|--------------------|--------|-------|-------|
| CI <-> ASCM      | 0.630                  | 0.627              | -0.003 | 0.439 | 0.768 |
| FP <-> ASCM      | 0.550                  | 0.551              | 0.001  | 0.365 | 0.693 |
| FP <-> CI        | 0.489                  | 0.489              | 0.000  | 0.328 | 0.629 |
| II <-> ASCM      | 0.810                  | 0.809              | -0.001 | 0.717 | 0.884 |
| II <-> CI        | 0.680                  | 0.676              | -0.005 | 0.535 | 0.796 |
| II <-> FP        | 0.596                  | 0.598              | 0.002  | 0.421 | 0.734 |
| LO <-> ASCM      | 0.454                  | 0.466              | 0.012  | 0.223 | 0.677 |
| LO <-> CI        | 0.311                  | 0.333              | 0.021  | 0.134 | 0.515 |
| LO <-> FP        | 0.372                  | 0.377              | 0.005  | 0.217 | 0.534 |
| LO <-> II        | 0.461                  | 0.467              | 0.006  | 0.225 | 0.664 |
| LSCM <-><br>ASCM | 0.384                  | 0.390              | 0.006  | 0.215 | 0.578 |
| LSCM <-> CI      | 0.463                  | 0.464              | 0.001  | 0.292 | 0.644 |
| LSCM <-> FP      | 0.247                  | 0.269              | 0.021  | 0.139 | 0.366 |
| LSCM <-> II      | 0.443                  | 0.438              | -0.005 | 0.248 | 0.639 |
| LSCM <-> LO      | 0.294                  | 0.327              | 0.033  | 0.145 | 0.477 |
| OP <-> ASCM      | 0.617                  | 0.618              | 0.001  | 0.472 | 0.736 |
| OP <-> CI        | 0.492                  | 0.496              | 0.005  | 0.336 | 0.627 |
| OP <-> FP        | 0.750                  | 0.748              | -0.002 | 0.624 | 0.843 |
| OP <-> II        | 0.597                  | 0.597              | 0.001  | 0.433 | 0.731 |
| OP <-> LO        | 0.484                  | 0.487              | 0.003  | 0.341 | 0.605 |
| OP <-> LSCM      | 0.246                  | 0.275              | 0.029  | 0.151 | 0.340 |
| SI <-> ASCM      | 0.534                  | 0.531              | -0.002 | 0.361 | 0.681 |
| SI <-> CI        | 0.853                  | 0.854              | 0.001  | 0.701 | 0.953 |
| SI <-> FP        | 0.467                  | 0.466              | -0.001 | 0.308 | 0.605 |
| SI <-> II        | 0.575                  | 0.571              | -0.005 | 0.412 | 0.706 |
| SI <-> LO        | 0.276                  | 0.298              | 0.022  | 0.120 | 0.458 |
| SI <-> LSCM      | 0.386                  | 0.389              | 0.003  | 0.202 | 0.582 |
| SI <-> OP        | 0.477                  | 0.478              | 0.001  | 0.336 | 0.597 |

Table 7.6: Analysis of Discriminant Validity Regarding to Fornell and Larcker (1981)

|                                | ASCM         | CI           | FP           | II           | LO           | LSCM         | OP           | SI    |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------|
| <b>Agile Supply Chain</b>      | <b>0.774</b> |              |              |              |              |              |              |       |
| <b>Customer Integration</b>    | 0.565        | <b>0.777</b> |              |              |              |              |              |       |
| <b>Financial Performance</b>   | 0.503        | 0.423        | <b>0.855</b> |              |              |              |              |       |
| <b>Internal Integration</b>    | 0.764        | 0.595        | 0.537        | <b>0.886</b> |              |              |              |       |
| <b>Learning Organization</b>   | 0.450        | 0.292        | 0.349        | 0.443        | <b>0.752</b> |              |              |       |
| <b>Lean Supply Chain</b>       | 0.364        | 0.412        | 0.215        | 0.413        | 0.275        | <b>0.732</b> |              |       |
| <b>Operational Performance</b> | 0.579        | 0.438        | 0.676        | 0.549        | 0.467        | 0.192        | <b>0.720</b> |       |
| <b>Supplier Integration</b>    | 0.493        | 0.728        | 0.423        | 0.528        | 0.270        | 0.352        | 0.430        | 0.816 |

Table 7.7: Analysis of Discriminant Validity Regarding to Cross Loadings Approach

|              | ASCM         | CI    | FP           | II    | LO           | LSCM  | OP    | SI    |
|--------------|--------------|-------|--------------|-------|--------------|-------|-------|-------|
| <b>ASC1</b>  | <b>0.671</b> | 0.318 | 0.347        | 0.461 | 0.235        | 0.140 | 0.353 | 0.397 |
| <b>ASC10</b> | <b>0.835</b> | 0.451 | 0.334        | 0.665 | 0.372        | 0.302 | 0.459 | 0.293 |
| <b>ASC11</b> | <b>0.817</b> | 0.409 | 0.441        | 0.658 | 0.445        | 0.306 | 0.485 | 0.330 |
| <b>ASC12</b> | <b>0.803</b> | 0.505 | 0.441        | 0.689 | 0.420        | 0.359 | 0.549 | 0.445 |
| <b>ASC13</b> | <b>0.746</b> | 0.490 | 0.402        | 0.680 | 0.420        | 0.276 | 0.490 | 0.398 |
| <b>ASC2</b>  | <b>0.679</b> | 0.333 | 0.379        | 0.409 | 0.227        | 0.161 | 0.346 | 0.326 |
| <b>ASC3</b>  | <b>0.733</b> | 0.536 | 0.380        | 0.476 | 0.293        | 0.271 | 0.395 | 0.450 |
| <b>ASC4</b>  | <b>0.657</b> | 0.383 | 0.207        | 0.380 | 0.152        | 0.250 | 0.297 | 0.381 |
| <b>ASC5</b>  | <b>0.817</b> | 0.449 | 0.453        | 0.624 | 0.381        | 0.358 | 0.452 | 0.397 |
| <b>ASC6</b>  | <b>0.847</b> | 0.467 | 0.450        | 0.645 | 0.371        | 0.296 | 0.451 | 0.428 |
| <b>ASC8</b>  | <b>0.826</b> | 0.403 | 0.415        | 0.598 | 0.328        | 0.274 | 0.501 | 0.366 |
| <b>ASC9</b>  | <b>0.823</b> | 0.456 | 0.369        | 0.690 | 0.428        | 0.325 | 0.523 | 0.373 |
| <b>FP1</b>   | 0.414        | 0.380 | <b>0.856</b> | 0.440 | 0.320        | 0.270 | 0.624 | 0.372 |
| <b>FP2</b>   | 0.456        | 0.355 | <b>0.854</b> | 0.504 | 0.309        | 0.150 | 0.527 | 0.355 |
| <b>FP3</b>   | 0.448        | 0.373 | <b>0.876</b> | 0.457 | 0.271        | 0.229 | 0.598 | 0.352 |
| <b>FP4</b>   | 0.402        | 0.338 | <b>0.833</b> | 0.438 | 0.295        | 0.077 | 0.558 | 0.367 |
| <b>LO1</b>   | 0.374        | 0.285 | 0.283        | 0.343 | <b>0.682</b> | 0.045 | 0.446 | 0.313 |
| <b>LO10</b>  | 0.352        | 0.175 | 0.243        | 0.352 | <b>0.801</b> | 0.252 | 0.384 | 0.090 |
| <b>LO11</b>  | 0.283        | 0.273 | 0.277        | 0.358 | <b>0.718</b> | 0.200 | 0.322 | 0.180 |
| <b>LO12</b>  | 0.381        | 0.277 | 0.308        | 0.429 | <b>0.844</b> | 0.344 | 0.409 | 0.227 |
| <b>LO13</b>  | 0.251        | 0.165 | 0.267        | 0.327 | <b>0.678</b> | 0.250 | 0.293 | 0.136 |
| <b>LO14</b>  | 0.267        | 0.185 | 0.255        | 0.308 | <b>0.758</b> | 0.280 | 0.277 | 0.151 |
| <b>LO15</b>  | 0.199        | 0.098 | 0.131        | 0.253 | <b>0.664</b> | 0.175 | 0.210 | 0.071 |
| <b>LO16</b>  | 0.369        | 0.145 | 0.279        | 0.386 | <b>0.767</b> | 0.273 | 0.299 | 0.159 |
| <b>LO17</b>  | 0.283        | 0.256 | 0.220        | 0.342 | <b>0.715</b> | 0.221 | 0.307 | 0.292 |
| <b>LO18</b>  | 0.302        | 0.241 | 0.212        | 0.400 | <b>0.755</b> | 0.297 | 0.290 | 0.171 |
| <b>LO19</b>  | 0.420        | 0.209 | 0.298        | 0.349 | <b>0.770</b> | 0.141 | 0.383 | 0.230 |

|       |       |              |       |              |              |              |              |              |
|-------|-------|--------------|-------|--------------|--------------|--------------|--------------|--------------|
| LO2   | 0.297 | 0.283        | 0.244 | 0.309        | <b>0.751</b> | 0.209        | 0.373        | 0.199        |
| LO20  | 0.398 | 0.150        | 0.290 | 0.354        | <b>0.778</b> | 0.229        | 0.319        | 0.151        |
| LO21  | 0.466 | 0.185        | 0.312 | 0.376        | <b>0.802</b> | 0.227        | 0.398        | 0.184        |
| LO3   | 0.385 | 0.374        | 0.282 | 0.350        | <b>0.726</b> | 0.174        | 0.388        | 0.250        |
| LO4   | 0.403 | 0.218        | 0.336 | 0.342        | <b>0.749</b> | 0.111        | 0.451        | 0.275        |
| LO5   | 0.371 | 0.202        | 0.266 | 0.292        | <b>0.725</b> | 0.141        | 0.385        | 0.195        |
| LO6   | 0.240 | 0.125        | 0.193 | 0.221        | <b>0.747</b> | 0.118        | 0.271        | 0.244        |
| LO7   | 0.305 | 0.258        | 0.279 | 0.252        | <b>0.712</b> | 0.222        | 0.361        | 0.249        |
| LO8   | 0.267 | 0.163        | 0.190 | 0.233        | <b>0.796</b> | 0.203        | 0.298        | 0.169        |
| LO9   | 0.358 | 0.110        | 0.223 | 0.248        | <b>0.816</b> | 0.209        | 0.355        | 0.171        |
| LSC4  | 0.303 | 0.251        | 0.186 | 0.275        | 0.243        | <b>0.815</b> | 0.146        | 0.262        |
| LSC2  | 0.325 | 0.394        | 0.170 | 0.382        | 0.265        | <b>0.685</b> | 0.106        | 0.321        |
| LSC3  | 0.208 | 0.245        | 0.134 | 0.246        | 0.214        | <b>0.768</b> | 0.138        | 0.229        |
| LSC6  | 0.173 | 0.219        | 0.067 | 0.206        | 0.069        | <b>0.717</b> | 0.151        | 0.191        |
| LSC8  | 0.202 | 0.222        | 0.091 | 0.234        | 0.140        | <b>0.723</b> | 0.170        | 0.186        |
| LSC1  | 0.304 | 0.372        | 0.229 | 0.368        | 0.202        | <b>0.671</b> | 0.141        | 0.284        |
| OP1   | 0.527 | 0.254        | 0.582 | 0.501        | 0.473        | 0.139        | <b>0.780</b> | 0.265        |
| OP10  | 0.421 | 0.374        | 0.436 | 0.415        | 0.281        | 0.205        | <b>0.729</b> | 0.404        |
| OP11  | 0.328 | 0.326        | 0.424 | 0.338        | 0.326        | 0.206        | <b>0.664</b> | 0.328        |
| OP12  | 0.246 | 0.345        | 0.581 | 0.285        | 0.282        | 0.192        | <b>0.642</b> | 0.345        |
| OP2   | 0.463 | 0.290        | 0.546 | 0.375        | 0.325        | 0.083        | <b>0.751</b> | 0.272        |
| OP3   | 0.530 | 0.358        | 0.480 | 0.464        | 0.319        | 0.167        | <b>0.732</b> | 0.319        |
| OP5   | 0.480 | 0.356        | 0.510 | 0.429        | 0.441        | 0.149        | <b>0.792</b> | 0.311        |
| OP6   | 0.391 | 0.298        | 0.478 | 0.388        | 0.418        | 0.061        | <b>0.762</b> | 0.276        |
| OP7   | 0.356 | 0.209        | 0.385 | 0.294        | 0.192        | -0.091       | <b>0.654</b> | 0.224        |
| OP8   | 0.467 | 0.265        | 0.334 | 0.391        | 0.261        | 0.128        | <b>0.683</b> | 0.261        |
| OP9   | 0.339 | 0.387        | 0.543 | 0.422        | 0.324        | 0.249        | <b>0.714</b> | 0.403        |
| SCCI3 | 0.482 | <b>0.835</b> | 0.343 | 0.543        | 0.280        | 0.410        | 0.400        | 0.552        |
| SCCI1 | 0.386 | <b>0.745</b> | 0.310 | 0.450        | 0.147        | 0.220        | 0.325        | 0.483        |
| SCCI4 | 0.354 | <b>0.644</b> | 0.226 | 0.433        | 0.264        | 0.320        | 0.181        | 0.558        |
| SCCI5 | 0.445 | <b>0.780</b> | 0.361 | 0.391        | 0.182        | 0.289        | 0.340        | 0.651        |
| SCCI2 | 0.505 | <b>0.861</b> | 0.382 | 0.494        | 0.261        | 0.350        | 0.409        | 0.599        |
| SCII1 | 0.743 | 0.598        | 0.524 | <b>0.867</b> | 0.392        | 0.403        | 0.514        | 0.510        |
| SCII2 | 0.657 | 0.520        | 0.528 | <b>0.907</b> | 0.412        | 0.408        | 0.520        | 0.486        |
| SCII3 | 0.694 | 0.517        | 0.458 | <b>0.899</b> | 0.409        | 0.344        | 0.451        | 0.484        |
| SCII4 | 0.600 | 0.458        | 0.373 | <b>0.870</b> | 0.352        | 0.292        | 0.449        | 0.374        |
| SCSI1 | 0.362 | 0.616        | 0.288 | 0.400        | 0.267        | 0.334        | 0.379        | <b>0.749</b> |
| SCSI2 | 0.464 | 0.637        | 0.409 | 0.471        | 0.242        | 0.291        | 0.387        | <b>0.868</b> |
| SCSI3 | 0.497 | 0.659        | 0.446 | 0.542        | 0.273        | 0.354        | 0.388        | <b>0.900</b> |
| SCSI4 | 0.328 | 0.479        | 0.214 | 0.356        | 0.117        | 0.223        | 0.247        | <b>0.749</b> |
| SCSI5 | 0.313 | 0.549        | 0.310 | 0.338        | 0.162        | 0.204        | 0.322        | <b>0.801</b> |

### 7.3. The Improved Structural Model Evaluation

Hair et al. (2017) have suggested a collinearity test before evaluating the structural model. A potential collinearity issue is indicated in the context of PLS-SEM by a variance inflation factor (VIF) score of 5 or higher (Hair et al., 2011). The collinearity test of both inner and outer model results are indicated in Table 7.8 and there is no value equal to or higher than 5.

Table 7.8: Collinearity outer model

| Items | VIF   | Items | VIF   |
|-------|-------|-------|-------|
| ASC1  | 2.622 | LO1   | 2.869 |
| ASC2  | 2.925 | LO2   | 2.788 |
| ASC3  | 2.634 | LO3   | 2.242 |
| ASC4  | 2.390 | LO4   | 3.660 |
| ASC5  | 3.283 | LO5   | 4.158 |
| ASC6  | 3.497 | LO6   | 3.404 |
| ASC8  | 3.138 | LO7   | 2.797 |
| ASC9  | 2.886 | LO8   | 4.094 |
| ASC10 | 3.461 | LO9   | 4.447 |
| ASC11 | 3.056 | LO10  | 3.642 |
| ASC12 | 3.191 | LO11  | 2.599 |
| ASC13 | 2.986 | LO12  | 4.160 |
| LSC1  | 1.299 | LO13  | 3.196 |
| LSC2  | 1.317 | LO14  | 3.468 |
| LSC3  | 1.880 | LO15  | 2.930 |
| LSC4  | 2.218 | LO16  | 3.569 |
| LSC6  | 1.984 | LO17  | 2.663 |
| LSC8  | 1.790 | LO18  | 3.237 |
| SCCI1 | 1.692 | LO19  | 3.888 |
| SCCI2 | 2.226 | LO20  | 4.325 |
| SCCI3 | 2.005 | LO21  | 4.759 |
| SCCI4 | 1.393 | OP1   | 2.327 |
| SCCI5 | 1.714 | OP2   | 1.961 |
| SCII1 | 2.269 | OP3   | 1.800 |
| SCII2 | 3.173 | OP5   | 2.456 |
| SCII3 | 3.098 | OP6   | 2.135 |
| SCII4 | 2.659 | OP7   | 2.280 |
| SCSI1 | 1.612 | OP8   | 2.499 |
| SCSI2 | 2.580 | OP9   | 1.854 |
| SCSI3 | 2.953 | OP10  | 1.878 |
| SCSI4 | 1.765 | OP11  | 1.887 |
| SCSI5 | 2.021 | OP12  | 1.875 |
| FP1   | 2.244 |       |       |

|            |       |  |  |
|------------|-------|--|--|
| <b>FP2</b> | 2.262 |  |  |
| <b>FP3</b> | 2.490 |  |  |
| <b>FP4</b> | 2.056 |  |  |

Table 7.9: Collinerity Inner Model

|                      | ASCM | CI    | FP    | II    | LO | LSCM | OP    | SI    | LO x<br>ASCM | LO x<br>LSCM |
|----------------------|------|-------|-------|-------|----|------|-------|-------|--------------|--------------|
| <b>ASCM</b>          |      | 1.435 | 2.729 | 1.435 |    |      | 2.525 | 1.435 |              |              |
| <b>CI</b>            |      |       | 2.562 |       |    |      | 2.559 |       |              |              |
| <b>FP</b>            |      |       |       |       |    |      |       |       |              |              |
| <b>II</b>            |      |       | 2.819 |       |    |      | 2.743 |       |              |              |
| <b>LO</b>            |      | 1.338 |       | 1.338 |    |      |       | 1.338 |              |              |
| <b>LSCM</b>          |      | 1.216 | 1.290 | 1.216 |    |      | 1.275 | 1.216 |              |              |
| <b>OP</b>            |      |       | 1.628 |       |    |      |       |       |              |              |
| <b>SI</b>            |      |       | 2.237 |       |    |      | 2.204 |       |              |              |
| <b>LO x<br/>ASCM</b> |      | 1.677 |       | 1.677 |    |      |       | 1.677 |              |              |
| <b>LO x<br/>LSCM</b> |      | 1.504 |       | 1.504 |    |      |       | 1.504 |              |              |

### 7.3.1. Main Hypothesis Results

The evaluation and processes of the structural model were made in line with the recommendation of Hair et al. (2017:224: exhibit 6.1). The structural model assessment was measured The structural model was evaluated in this study using a multiple processes: (1) coefficient of determination ( $R^2$ ) for endogenous latent constructs; (2)  $F^2$  effect size; (3) predictive relevance ( $Q^2$ ) for each dependent variable using the blindfolding technique; (4) significance of the standardized path coefficients and effect size using bootstrapping and (5) model fit indices. In this context, a structural model using the bootstrapping approach with 5000 sub-samples was carried out to examine the importance of the key presented hypotheses (Hair et al., 2017: ). Using the direction and size of the route coefficients, the current study investigates the causal relationships among latent variables contained inside the conceptual model. Table 7.10 displays the  $R^2$  and  $Q^2$  values.

In this condition, 42% of the hypothesized associations were found to be significant within the model, and the model explained about 39% of the variance for customer integration, 62% of the variance for internal integration, 31% of the variance

for supplier integration, 50% of the variance for financial performance, and 38% of the variance for financial performance, indicating satisfactory results that were greater than the minimum threshold of 10% and higher than 20% are considered high (in consumer behavior field, higher the  $R^2$  values better the result) for the  $R^2$  of the endogenous constructs (Hair et al., 2017:214) (see Table 7.10).

When the predictive power of the model was calculated for each endogenous variable using the blindfolding procedure (i.e.,  $Q^2$ ), the model produced values greater than zero which is satisfactory for the following endogenous variables: customer integration (i.e.,  $Q^2=.23$ ), internal integration (i.e.,  $Q^2=.46$ ), supplier integration (i.e.,  $Q^2 = 0.19$ ), financial performance (i.e.,  $Q^2=.34$ ), and operational performance (see Table 7.10).

Also, in the current investigation, effect sizes (i.e. Cohen's  $f^2$ ) were used to determine predictive validity. These results show that some endogenous variables had effect sizes that were higher than the acceptable threshold of 0.02 for predictive validity. The acceptable values were written in bold version. These values are compatible with bootstrapping table. (see Table 7.11)

In addition, the standardized root mean square residual (SRMR), which indicates the quality of the model, showed a decent fit being below the threshold of 0.08 (SRMR = 0.075) (Hair et al., 2017:224) (see Table 7.12).

Table 7.10: Variance Explained ( $R^2$ ) and Predictive Ability ( $Q^2$ ) for the Endogenous Constructs

|                                | $R^2$ | $R^2$ adjusted | $Q^2$        |
|--------------------------------|-------|----------------|--------------|
| <b>Customer Integration</b>    | 0.399 | 0.380          | <b>0.230</b> |
| <b>Financial Performance</b>   | 0.503 | 0.483          | <b>0.343</b> |
| <b>Internal Integration</b>    | 0.628 | 0.616          | <b>0.465</b> |
| <b>Operational Performance</b> | 0.386 | 0.366          | <b>0.187</b> |
| <b>Supplier Integration</b>    | 0.316 | 0.294          | <b>0.191</b> |

Table 7.11:  $f^2$  effect size

|              | ASCM | CI            | FP            | II            | LO | LSCM | OP            | SI            | LO x<br>ASCM | LO x<br>LSCM |
|--------------|------|---------------|---------------|---------------|----|------|---------------|---------------|--------------|--------------|
| ASCM         |      | <b>0.313*</b> | 0.000         | <b>0.915*</b> |    |      | <b>0.080*</b> | <b>0.215*</b> |              |              |
| CI           |      |               | 0.000         |               |    |      | 0.001         |               |              |              |
| FP           |      |               |               |               |    |      |               |               |              |              |
| II           |      |               | <b>0.028*</b> |               |    |      | <b>0.028*</b> |               |              |              |
| LO           |      | 0.004         |               | <b>0.036*</b> |    |      |               | 0.007         |              |              |
| LSCM         |      | <b>0.062*</b> | 0.000         | <b>0.032*</b> |    |      | 0.011         | <b>0.033*</b> |              |              |
| OP           |      |               | <b>0.343*</b> |               |    |      |               |               |              |              |
| SI           |      |               | 0.006         |               |    |      | 0.015         |               |              |              |
| LO x<br>ASCM |      | <b>0.047*</b> |               | <b>0.040*</b> |    |      |               | <b>0.053*</b> |              |              |
| LO x<br>LSCM |      | 0.004         |               | 0.012         |    |      |               | 0.010         |              |              |

Table 7.12: Model fit results

|                   | <b>Saturated model</b> |
|-------------------|------------------------|
| <b>SRMR</b>       | 0.075                  |
| <b>d_ULS</b>      | 13.102                 |
| <b>d_G</b>        | 6.487                  |
| <b>Chi-square</b> | 4.502.574              |

Finally, using a bootstrapping approach, the relevance of the structural model's route coefficients was estimated (Hair et al., 2017: 80). The results for the key hypotheses (i.e., direct correlations) are shown in Table 7.13, together with the significance level, path coefficients, and t-values for two-tailed tests.

With regard to research hypotheses, the findings supported H1a, H1b and H1c, linking supplier integration ( $\beta = 0.166$ ,  $p < .05$ ), customer integration ( $\beta = 0.213$ ,  $p < .05$ ) and internal integration ( $\beta = 0.121$ ,  $p < .05$ ) with lean supply chain. Furthermore, H2a, H2b, H2c were also confirmed relating the agile supply chain with supplier integration ( $\beta = 0.460$ ,  $p < .05$ ), customer integration ( $\beta = 0.519$ ,  $p < .05$ ) and internal integration ( $\beta = 0.699$ ,  $p < .05$ ).

When it comes to the integration effects on operational performance, H3c (customer integration effect on operational performance) wasn't found significant regard to p and t values. However, the positive effect of supplier integration on

operational performance ( $\beta = 0.142$ ,  $p < .05$ ) and internal integration on operational performance ( $\beta = 0.215$ ,  $p < .05$ ) were found significant.

In line with hypothesis 4 and 7, which contains 6 hypotheses in total, investigates the effects of all main variables on a dependent variable. The results demonstrate only two significant effects. While the effect of operational performance on financial performance ( $\beta = 0.527$ ,  $p < .05$ ) and internal integration effect on financial performance ( $\beta = 0.215$ ,  $p < .05$ ) were found positive and significant, the rest of the four hypotheses (H7a, H7b, H7c, H7e) were not found significant.

Lastly, the effects of moderating variables on mediating variables results were shown under hypothesis 8. While the effect of learning organization on internal integration ( $\beta = 0.134$ ,  $p < .05$ ) was found positive and significant, H8b and H8c were rejected.

Table 7.13: Main hypothesis results

| Hypothesis | Direct Relationship | Path Coefficients ( $\beta$ ) | T statistics | P values     | Hypothesis testing results |
|------------|---------------------|-------------------------------|--------------|--------------|----------------------------|
| H1a        | LSCM -> SI          | 0.166                         | 2.011        | <b>0.045</b> | Accepted                   |
| H1b        | LSCM -> II          | 0.121                         | 2.228        | <b>0.026</b> | Accepted                   |
| H1c        | LSCM -> CI          | 0.213                         | 3.140        | <b>0.002</b> | Accepted                   |
| H2a        | ASCM -> CI          | 0.519                         | 5.982        | <b>0.000</b> | Accepted                   |
| H2b        | ASCM -> II          | 0.699                         | 11.608       | <b>0.000</b> | Accepted                   |
| H2c        | ASCM -> SI          | 0.460                         | 4.518        | <b>0.000</b> | Accepted                   |
| H3a        | SI -> OP            | 0.142                         | 1.971        | <b>0.049</b> | Accepted                   |
| H3b        | II -> OP            | 0.215                         | 2.001        | <b>0.046</b> | Accepted                   |
| H3c        | CI -> OP            | 0.046                         | 0.444        | 0.657        | Rejected                   |
| H4a        | OP -> FP            | 0.527                         | 6.576        | <b>0.000</b> | Accepted                   |
| H6a        | LSCM -> OP          | -0.095                        | 1.065        | 0.287        | Rejected                   |
| H6b        | ASCM -> OP          | 0.353                         | 3.330        | <b>0.001</b> | Accepted                   |
| H7a        | LSCM -> FP          | -0.002                        | 0.031        | 0.975        | Rejected                   |
| H7b        | ASCM -> FP          | -0.003                        | 0.024        | 0.981        | Rejected                   |
| H7c        | SI -> FP            | 0.081                         | 1.207        | 0.227        | Rejected                   |
| H7d        | II -> FP            | 0.197                         | 2.111        | <b>0.035</b> | Accepted                   |
| H7e        | CI -> FP            | 0.019                         | 0.246        | 0.806        | Rejected                   |
| H8a        | LO -> II            | 0.134                         | 2.101        | <b>0.036</b> | Accepted                   |
| H8b        | LO -> SI            | 0.081                         | 0.713        | 0.476        | Rejected                   |
| H8c        | LO -> CI            | 0.058                         | 0.580        | 0.562        | Rejected                   |

### 7.3.2. Moderation Analysis

To the moderation effect bootstrapping approach, the relevance of the structural model's route coefficients was estimated (Hair et al., 2017: 80). In addition, Smart-PLS enables a visual representation of the moderation effect with a simple slope analysis. According to Table 7.14, learning organization moderates the relationship between agile supply chain on all three integration, while did not moderate the relationship between lean supply chain on any integration types. H5d, H5e and H5f were approved and H5a, H5b and H5c were rejected. H5d: Learning organization moderates the relationship between agile supply chain and supplier integration ( $\beta = 0.151$ ,  $p < .05$ ). H5e: Learning organization moderates the relationship between agile supply chain and internal integration ( $\beta = 0.103$ ,  $p < .05$ ) and H5f: Learning organization moderates the relationship between agile supply chain and supplier integration ( $\beta = 0.133$ ,  $p < .05$ )

Table 7.14: Moderation Hypothesis

| Hypothesis | Direct Relationship | Path Coefficients ( $\beta$ ) | T statistics | P values     | Hypothesis testing results |
|------------|---------------------|-------------------------------|--------------|--------------|----------------------------|
| H5a        | LO x LSCM -> SI     | -0.077                        | 0.727        | 0.467        | Rejected                   |
| H5b        | LO x LSCM -> II     | -0.063                        | 1.029        | 0.304        | Rejected                   |
| H5c        | LO x LSCM -> CI     | -0.047                        | 0.527        | 0.598        | Rejected                   |
| H5d        | LO x ASCM -> SI     | 0.151                         | 2.494        | <b>0.013</b> | <b>Accepted</b>            |
| H5e        | LO x ASCM -> II     | 0.103                         | 1.991        | <b>0.047</b> | <b>Accepted</b>            |
| H5f        | LO x ASCM -> CI     | 0.133                         | 2.311        | <b>0.021</b> | <b>Accepted</b>            |

A simple slope analysis of all three accepted hypotheses is shown in the Figure 7.3. The figure represents the relationship between Agile supply chain (x-axis) and Customer integration using three lines (y-axis). The association for the moderator variable LO's average level is shown by the center line. The remaining two lines show the correlation between ASC and CI for the moderator variable LO at higher (mean value of LO plus one standard deviation unit) and lower (mean value of LO minus one standard deviation unit) levels. As can be observed, the positive slope of all three

lines indicates a favorable correlation between ASC and CI. Higher LO levels entail a stronger relationship between ASC and CI, while lower levels of LO lead to a weaker relationship between ASC and CI.

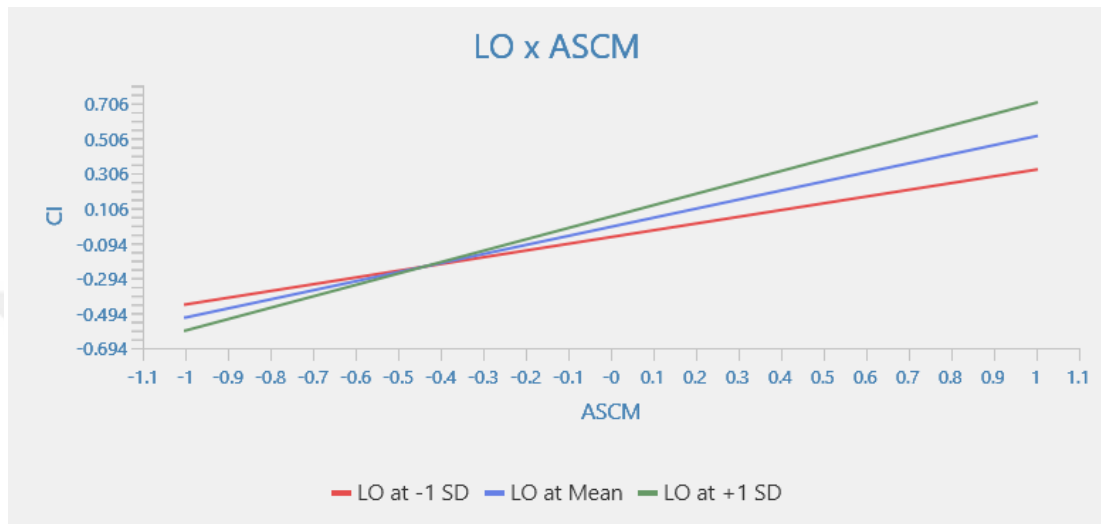


Figure 7.3: Simple Slope Analysis (LO x ASCM -> CI)

A similar interpretation can be made for moderating the effects of learning organization on the relationship between supplier integration and agile supply chain. Higher LO levels entail a stronger relationship between agile supply chain and supplier integration, while lower levels of LO lead to a weaker relationship between ASC and SI (see Figure 7.4)

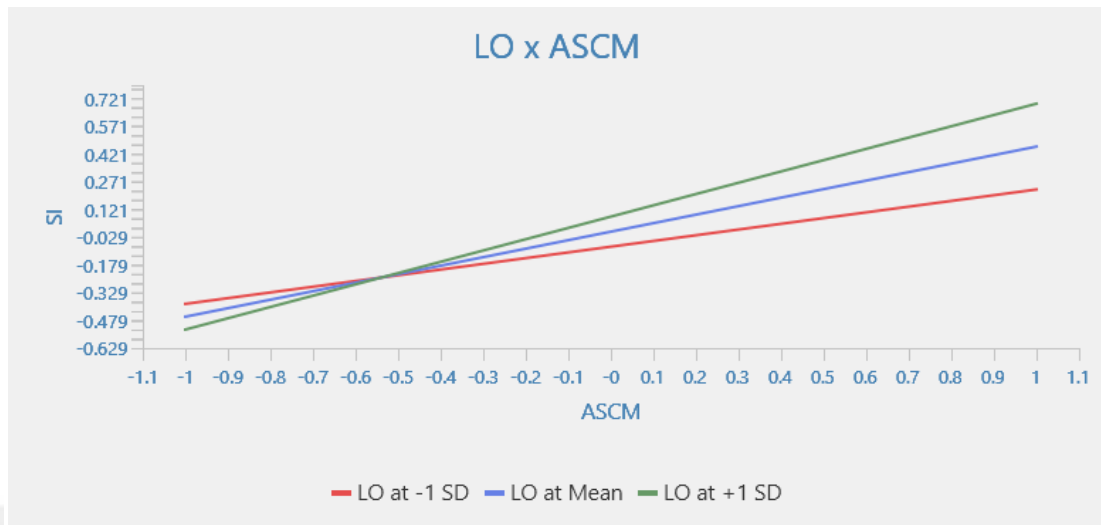


Figure 7.4: Simple Slope Analysis (LO x ASCM -> SI)

Different than the other two moderation effects, learning organization has very little moderation effect on the relationship between agile supply chain and internal integration. Since the lines are almost parallel it shows no moderation effect. Consequently, the moderation effect of LO is stronger on the relationship between ASC-SI and ASC-CI.

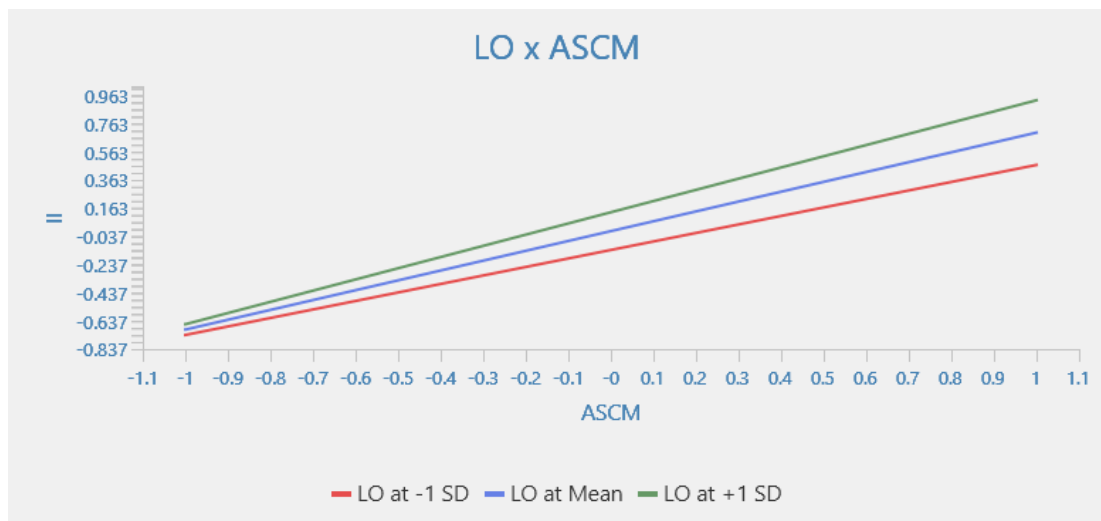


Figure 7.5: Simple Slope Analysis (LO x ASCM -> II)

### 7.3.3. Mediation Analysis

A technique for identifying significant indirect effects paths suggested by Preacher and Hayes (2004: 720) was used to investigate the mediation effects. When the indirect impact is substantial in this process, a mediation hypothesis is accepted, which suggests that its empirical confidence interval does not include zero (Zhao, Lynch, and Chen, 2010: 201). Using Preacher and Hayes' method, a bootstrapping technique with 5000 sub-samples was carried out to calculate significant values and confidence intervals (2008: 15). As depicted in Table 7.15. H10a and H10b were accepted. H10a: operational performance mediates the relationship between supplier integration and financial performance ( $\beta = 0.175$ ,  $p < .05$ ). H10b: operational performance mediates the relationship between internal integration and financial performance ( $\beta = 0.168$ ,  $p < .05$ ). H10c and H19a were rejected. Moreover, H9b and H9d were accepted. H9b: supplier integration mediates the relationship between agile supply chain and operational performance ( $\beta = 0.142$ ,  $p < .05$ ) and H9d: internal integration mediates the relationship between agile supply chain and operational performance ( $\beta = 0.151$ ,  $p < .05$ ). Even though the confidence interval values of H9c, H9a, H9e and H9f are satisfactory, however, their p values were not lower than 0.05, that's why they were rejected.

Table 7.15: Mediation Hypothesis

| Hypothesis | Mediation        | Path Coefficients | Lower CI | Upper CI | P values       | Hypothesis testing results |
|------------|------------------|-------------------|----------|----------|----------------|----------------------------|
| H10a       | SI -> OP -> FP   | 0.175             | -0.024   | 0.181    | <b>0.041**</b> | <b>Accepted</b>            |
| H10b       | II -> OP -> FP   | 0.168             | 0.013    | 0.225    | <b>0.040**</b> | <b>Accepted</b>            |
| H10c       | CI -> OP -> FP   | 0.024             | -0.085   | 0.130    | 0.660          | Rejected                   |
| H9a        | LSCM -> SI -> OP | 0.024             | -0.004   | 0.092    | 0.279          | Rejected                   |
| H9b        | ASCM -> SI -> OP | 0.142             | -0.003   | 0.157    | <b>0.049**</b> | <b>Accepted</b>            |
| H9c        | LSCM -> II -> OP | 0.026             | 0.002    | 0.081    | 0.156          | Rejected                   |
| H9d        | ASCM -> II -> OP | 0.151             | -0.019   | 0.195    | <b>0.045**</b> | <b>Accepted</b>            |
| H9e        | LSCM -> CI -> OP | 0.010             | -0.034   | 0.060    | 0.673          | Rejected                   |
| H9f        | ASCM -> CI -> OP | 0.024             | -0.080   | 0.122    | 0.645          | Rejected                   |

## DISCUSSION and CONCLUSION

The goal of supply chain integration (SCI) is to interact with different parties (suppliers, customers, etc.) so they can pool their resources and work collectively to employ them with greater efficacy and effectiveness to accomplish business objectives. By encouraging leanness and agility through learning organizations, the primary goal of this study is to enhance supply chain integration for operational and financial performance. The complementary objective of the study is to integrate supply chain management methodologies with organizational behavior and strategic management perspectives.

While most of the studies have examined lean and agile approaches together, they mostly focused on the impact of these two approaches on firm performance from different angles such as operational, financial, supply chain, etc. It is essential to look at studies examining the impact of these approaches on supply chain integration before going on to the performance impact of lean and agile approaches.

A lean supply chain is suitable for businesses prioritizing cost, quality, and delivery strategies, but an agile supply chain is suitable for businesses striving for market share in the flexibility strategy (Qi et al., 2017). Although lean and agile supply chain approaches are sometimes seen as competitors, they can really be used simultaneously through a so-called "leagile" strategy (Goldsby et al., 2006). Lean and agile approaches significantly affect both a robust and a resilient supply chain (Ahmet et al., 2021). Survey results from Chinese manufacturing firms demonstrate that supply chain integration is significantly benefited from both lean and agile (Qi et al., 2009). Both Shukor et al., (2021) and Zhuo et al., (2021) have found in their studies that the company's organizational flexibility and supply chain agility were demonstrated to benefit from supply chain integrations. Hani (2021) demonstrated the positive correlation of lean approach on operational performance and furthermore, the positive link between supply chain integration and operational performance was supported. In the Malaysian manufacturing sector, lean and agile approaches found to have a substantial impact on operational performance (Lee et al., 2021). Lean and agile supply chains have been found to improve supply chain performance, which in turn improves firm performance (Kashani and Baharmast, 2017). As it can be seen most of the previous studies concluded the positive relationship between lean and agile approaches on company performance. However, some studies have concluded

that the agile approach has a greater impact on both performance and supply chain integration than the lean approach. The agile and lean supply chain strategy has a favorable and significant impact on company performance in Pakistan's drinking-water business. The agile supply chain strategy, however, has a more notable effect on business performance (Junejo et al., 2022). In their research, Qrunfleh and Tarafdar (2014) revealed that the performance of the supply chain had a full mediating effect on the relationship between the agile supply chain and firm performance, but only a partial mediating effect on the relationship between the lean supply chain strategy and firm performance. Khalfallah and Lakhal (2021) found in their study, with the exception of just-in-time production, agile manufacturing has a direct beneficial link with lean manufacturing approaches. Agile manufacturing also has a favorable effect on operational performance. The effectiveness of operations does not appear to be directly impacted by lean manufacturing techniques. On the other hand, according to Liao et al. (2008) and Um (2017) the agile supply chain by itself cannot significantly improve the business performance; additional elements like customer service and differentiation are needed to amplify the impact. Furthermore, although internal lean approaches can boost operational effectiveness, managers should be aware that they are not always relevant and that they must take an industry's rate of change into account (Chavez et al., 2013). Just as in the current study, it was found that the agile approach has a stronger effect on both integration and performance than the lean approach. According to the results of this study, the primary cause of this is that the lean strategy is utilized less frequently than the agile approach.

For a variety of reasons, a lean supply chain may not directly affect operational performance. One reason is that implementing a lean supply chain is a challenging process that necessitates modifications to the supply chain's many elements, such as inventory management, production processes, and supplier relationships. Before the advantages of these changes are fully appreciated in terms of operational performance, it may take some time. An agile supply chain, on the other hand, places more of an emphasis on flexibility and reactivity to changing circumstances in the market, which may have a more immediate influence on operational performance. A supply chain that is agile is built to react fast to shifts in demand or interruptions in the supply chain, which can shorten lead times and boost delivery efficiency. This could lead to better operational performance, including higher productivity, efficiency, and customer satisfaction. An agile supply chain may also help businesses better align

their supply chains with customer needs, which could account for its beneficial effects on operational performance. Focusing on customer value and responsiveness, which can help businesses comprehend customer demands and choices, characterizes an agile supply chain. Firms may be able to boost their operational performance in terms of quality, speed, and innovation by integrating the supply chain with consumer needs. Lean and agile supply chains can both assist businesses, but depending on their execution and setting, various approaches may have varying effects on operational performance. Firms should thoroughly assess their supply chain objectives and plans to select the best strategy.

When it comes to the relationship between supply chain integration and performance studies, most of the research confirms the positive impact of supply chain integration on performance. For a company to enhance supply chain performance and create an ideal supply chain, an integrated supply chain will be the first essential prerequisite (Nguyen, 2017). While supply chain integration has been examined as a whole in some studies, the effect of each type of integration on performance has been evaluated separately in others. Supply chain integration may improve a company's ability to manage its supply chain, which will enhance the organization's ability to execute sustainably (Mekhum, 2020). Integration of the supply chain improves the capabilities of the supply chain services, which in turn improves market and financial performance (Yang, 2016). The integration of the supply chain and a focus on the market boost business performance (Tseng and Liao, 2015). Employing supply chain integration strategies may help minimize the effects of supply chain risks and improve a company's performance because all three (customer, internal, supplier) supply chain integration activities have a favorable effect on businesses' financial performance (Syed et al., 2019). Shaar (2014) revealed similar findings in his study; supply chain integration (external, strategic and internal) influences a company's both operational and supply chain performance.

Although the effect of supply chain integration on performance is mostly positive, some studies suggest the opposite or conclude that the effect of integration types on performance is not in the same direction and proportion. For example, Pakurar et al. (2019) found in their study that the impact of internal integration is more comprehensive than customer integration, that internal integration affects internal processes, organizational capacity, and the customer, while customer integration has

an effect only on the customer perspective. Similar findings were obtained by Abdallah et al. (2014) in their study, which indicated that while procrastination, information sharing, and internal integration all have a favorable impact on supply chain performance, supplier integration and customer integration have no such impact. In this current investigation, similar results were also discovered. Although it was discovered that internal and supplier integration had a favorable impact on operational performance, customer integration did not. Additionally, it has been found that supplier integration has a weaker impact on performance than internal integration. Furthermore, Lu et al. (2018) argue that there is no linear relationship between supply chain integration and operational performance. They suggest that this relationship would be linear with the moderation effect of a factor such as market uncertainty. It may be because of a similar circumstance that the impact of customer integration on operational performance was not discovered in this study. There may be a variety of causes for this situation, including the size of the customer base, inadequate consumer involvement in the process or failure to position the customer appropriately despite their inclusion, and industry saturation. For instance, considerable rivalry is necessary for a sector to reach saturation, and consumer integration alone may not be enough to boost performance. This should lead one to the following conclusion: despite the fact that customer integration by itself lacks the strength to have an effect on operational performance, this link can be strengthened by adding a moderator or mediator variable that amplifies the effect. Another implication is that internal and supplier integration is more crucial than full consumer involvement, which is corroborated by fieldwork observation. Remember that this observation may change depending on the industry, market, and supply chain structure.

Compared to other variables, the subject of learning organization in the supply chain has been covered less. Authors' best knowledge, no study has been found in which the learning organization is a moderator in the relationship between agile and lean supply chain and supply chain integration. Agyabeng-Mensah et al. (2021) revealed in their study, learning within and across organizations has a favorable effect on lean manufacturing. Similar result was found by Aghakhani et al. (2016) organizational learning benefits from the application of lean thinking. The findings of their study suggest that organizational learning partially mediates the effect of lean techniques on operational performance (Aryarathne and Galahitiyawe, 2020).

Asrini et al. (2020) with a significant effect of SCI and learning on company performance. The relationship between supply chain integration and the performance of the focus company is mediated by inter-organizational learning (Zhu et al., 2018). Their research validates the claims given by the NRBV and dynamic capabilities perspectives, which contend that integration and learning are crucial prerequisites for developing more sophisticated supply chain level strategies (Graham, 2018).

A learning supply chain theoretically provides the important advantages of a really agile, dynamic reaction capability for customers (Sporleder and Peterson, 2003). There is some other research that emphasizes the importance of learning in supply chain and its performance. Such as, the choices of the supply chain's coordination approach are impacted by the learning behavior, as well as the profit of the supply chain with coordination (Jiang et al., 2020). Organizational learning and supply chain management techniques are both impacted by knowledge management competence (Salama, 2017). By managing knowledge in their supply chains over the long term, learning supply chains will generate supply chain capital that will encourage innovation (Khalfan and Maqsood, 2012). In contrast to the answers offered in the literature on supply chain linkages, the experienced nature of learning offers an explanation for the reinforcing nature of interorganizational adaptation (Knoppen et al., 2010). A Learning Organization concept must be put into place in order to provide the necessary support for Enterprise Information System Supply Chain Management (Dumitrache et al., 2009). The effective execution of sustainable supply chain management depends on organizational learning (Oelze et al., 2016).

Consequently, in the current study, the moderating effect of learning organization on the relationship between agile supply chain and supply chain integration was found to be positive however the moderating effect of learning organization on the relationship between lean supply chain and supply chain integration wasn't found significant. The reasons for this can be listed as follows: 1) learning organization and agility are more strategically focused, while the concept of lean is more structured. 2) Compared to the relationship between agile supply chain and supply chain integration, the relationship between lean supply chain and integration may be more complicated. It may be more challenging to pinpoint the moderating impact of learning organizations since there may be additional elements that affect the relationship between lean supply chain and supply chain integration,

such as the kind of sector or organizational culture and many others. 3) The most important reason is that the companies participating in this study apply lean supply chain practices much less than agile supply chain.

All things considered, it's critical to take these elements into account while analyzing the study's findings and to carry out additional research to better comprehend the connections between learning organizations, agile and lean supply chains, and supply chain integration.

Furthermore, it would be valuable to briefly mention the observations gained during the field visits. Some questionnaires were gathered by visiting companies, as it was mentioned in the methods section of the study. In this case, nine companies gave their consent for company visits, during the period the production lines of these enterprises were visited. In this way, questions like the existence of lean and agile applications, their connection to supply chain integration, and even sustainability strategies were addressed through company interviews. Since the focus of this study was on quantitative approaches, qualitative findings were not included because the interviews weren't conducted in an appropriate methodical manner. The author will therefore offer her field research observations. The size and industry of the companies should also be noted before discussing the fieldwork observations. While one of the nine businesses—a company that manufactures waste containers—is a pioneer in its industry, the remaining four—three small enterprises and five medium-sized businesses—are all other businesses. None of them can be considered a corporate company. The key observations during the field visits are listed as follows:

- Three of the nine companies visited were family businesses and they mostly supported the same view: They stated that the biggest source of waste is human and they invested in technological machines to reduce this waste. In addition, they emphasized that there is a shortage of qualified blue-collar workers. Another factor that provides cost advantage is foreign trade. That's how they develop their customer portfolio.
- Five out of nine companies stated that they do not use the same digital system within their own organization, for example, the accounting department and the purchasing department use different systems, which hinders agile communication. However, several of them responded that they are integrated when asked if they are. This leads to the conclusion that the extent of

integration must be specified clearly and that some businesses are unable to decide on the appropriate positioning.

- Three of the nine companies that were at a good level in terms of financial performance mentioned that one of their core competencies were to produce at low cost.
- The layout of five out of nine companies were not effective, the quality control mechanism was very inadequate, which makes it difficult to traceability.

The findings of this study provide evidence for the notion that supply chain integration can considerably improve operational performance through leanness and agility. The results indicate that supply chain integration is positively impacted by both lean and agile supply chain initiatives (internal, external, and customer). The idea that supply chain integration can have a favorable impact on operational performance is further supported by the beneficial effects of lean and agile supply chain strategies on internal and supplier integration. The absence of statistically significant results for customer integration, however, raises the possibility that there are additional elements that affect how customer integration affects operational performance. The relationship between agile supply chain and integration is moderated by learning organizations, which shows that developing a learning company culture might increase the efficacy of agile supply chain approaches in enhancing supply chain integration. This conclusion emphasizes how crucial it is to take organizational culture and learning capacities into account when putting supply chain integration initiatives into practice.

The inclusion of sustainability into the lean and agile supply chain strategies can increase supply chain integration, despite the fact that sustainability was not specifically evaluated in this study. By emphasizing waste reduction and resource efficiency, lean supply chain strategies, for instance, can support sustainable supply chain practices. Similar to this, agile supply chain methods can assist businesses in fast adapting to changes in their supply chain networks, allowing them to handle sustainability issues like climate change and environmental hazards.

The study's conclusions have applications for businesses looking to strengthen their supply chain integration initiatives. This study specifically contends that combining agile and lean supply chain concepts can boost supply chain integration, which in turn can improve operational performance and, therefore, financial performance. This study also emphasizes how crucial it is to take

organizational culture and learning capabilities into account when putting supply chain integration techniques into practice especially implementation of agile supply chain. To achieve long-term success and resilience, supply chain integration activities should also embrace sustainable measures. Organizations may strengthen their supply chain integration by putting these suggestions into practice, which will boost corporate performance, customer happiness, and provide them a competitive edge in the market.

The results of this study can be used by managers to direct their supply chain integration initiatives. Lean and agile supply chain techniques, which concentrate on decreasing waste and boosting flexibility, can both be included into their operations. While putting supply chain integration methods into practice, managers should also take corporate culture and learning skills into account. Last but not least, integrating sustainable practices into supply chain integration initiatives can boost resilience and long-term success.

This study had several limitations, just like all empirical investigations. First, this study was carried out using manufacturing firms in a single nation (i.e., Turkey). Second, even though participating companies made an effort to be chosen from many industries, some industries were nonetheless unavoidable. Also, the multi-industry setting used for this study prevents acquiring industry-specific characteristics. The small sample size prevented multi-group analysis, even though it might have been possible to compare the sectors. To evaluate supply chain integration on a company-by-company basis, however, a survey with only one representative from each firm resulted in a sample size that was not very high and limited observations, despite the fact that gathering data from 162 companies is a good signal. The final restriction was that despite the survey being anonymous, respondents abstained from answering questions about financial performance.

The study's coverage includes a number of proposed areas for future study. Firstly, during the survey collection process, the production facilities of nine companies were visited and more detailed information and observations were obtained apart from the survey questions. Since this process did not progress systematically, it was found insufficient in terms of qualitative research and therefore, qualitative findings were not included. Although a sufficient number of qualitative findings cannot be reached, it will be very useful to conduct in-depth interviews with

the selected companies before conducting the survey. Further studies ought to be conducted using supply chain integration that takes a sustainability view rather than just a lean and agile strategies.. On the other hand, if a large enough sample size is attained, it can be performed by including a variety of sectors, and the similarities and differences between the groups should be investigated. In addition to that, grouping of agile & lean supply chain firms or leagile firms could be compared. Sector-based supply chains might vary in terms of their amount of integration and their chosen implementation methodologies. In addition, it can be tested by designing a research model in which the learning organization is the independent variable rather than the moderator effect. In this study, the effects of lean and agile supply chains are examined separately, future studies can focus on the effect of these two structures on each other, and the effect on integration can be examined by adding possible alternative variables. Lastly, It is critical to repeat this study in other nations with different sectors.

## References

- Abdallah, A. B., Obeidat, B. Y., & Aqqad, N. O. (2014). The impact of supply chain management practices on supply chain performance in Jordan: The moderating effect of competitive intensity. *International Business Research*, 7(3), 13.
- Abdallah, A.B., Abdullah, M.I. and Mahmoud Saleh, F.I. (2017), "The effect of trust with suppliers on hospital supply chain performance: the mediating role of supplier integration", *Benchmarking: An International Journal*, Vol. 24 No. 3, pp. 694-715.
- Abdelilah, B., El Korchi, A., & Amine Balambo, M. (2021). Agility as a combination of lean and supply chain integration: how to achieve a better performance. *International Journal of Logistics Research and Applications*, 1-29.
- Adel, H. M. (2020). Ict, information sharing and a new hybrid lean-agile performance: empirical evidence from automotive hierarchical supply chains. *International Journal of Technology Management and Sustainable Development*, 19(2), 221-245-245. doi:10.1386/tmsd\_00023\_1
- Agarwal, A., Shankar, R. and Tiwari, M.K. (2007), "Modeling agility of supply chain", *Industrial Marketing Management*, Vol. 36 No. 4, pp. 443-457.
- Aghakhani, A., Khoorasgani, G. H., & Shahmansoury, A. (2016). The impact of lean thinking on organizational learning case study: SAIPA Automobile Manufacturing Group. *Mediterranean Journal of Social Sciences*, 7(4 S1), 219.
- Agyabeng-Mensah, Y., Tang, L., Afum, E., Baah, C., & Dacosta, E. (2021). Organisational identity and circular economy: are inter and intra organisational learning, lean management and zero waste practices worth pursuing?. *Sustainable Production and Consumption*, 28, 648-662.
- Ahmed, W., & Huma, S. (2021). Impact of lean and agile strategies on supply chain risk management. *Total Quality Management & Business Excellence*, 32(1-2), 33-56.
- Alam, A., Bagchi, K.P., Kim, B., Mitra, S. and Seabra, F. (2014), "The mediating effect of logistics integration on supply chain performance", *International Journal of Logistics Management*, Vol. 25 No. 3, pp. 553-580.

Alamsjah, F., & Asrol, M. (2021, December). Inter-island Logistics and the Role of an Agile Supply Chain to Achieve Supply Chain Performance: Initial Findings. In 2021 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM) (pp. 270-274). IEEE.

Alfalla-Luque, R., Marin-Garcia, J.A. and Medina-Lopez, C. (2015) An analysis of the direct and mediated effects of employee commitment and supply chain integration on organisational performance, *International Journal of Production Economics*, Vol. 162, pp. 242-257.

Al-Tit, A. (2016). The impact of lean supply chain on productivity of Saudi manufacturing firms in Al-Qassim region. *Polish Journal of Management Studies*, 14(1), 18-27.

Alzoubi, H. M., & Yanamandra, R. (2020). Investigating the mediating role of information sharing strategy on agile supply chain. *Uncertain Supply Chain Management*, 273-284.

Amjad, M. S., Rafique, M. Z., & Khan, M. A. (2021). Modern divulge in production optimization: an implementation framework of LARG manufacturing with Industry 4.0. *International Journal of Lean Six Sigma*.

Antonacopoulou, E. and Chiva, R. (2007), "The social complexity of organizational learning: the dynamics of learning and organizing", *Management Learning*, Vol. 38 No. 3, pp. 277-295.

Argyris, C., Schön, D. A., & n, D. A. S. (1978). *Organizational Learning: A Theory of Action Perspective*: Addison-Wesley Publishing Company.

Ariadi, G., Surachman, Sumiati, & Rohman, F. (2021). The effect of lean and agile supply chain strategy on financial performance with mediating of strategic supplier integration & strategic customer integration: Evidence from bottled drinking-water industry in Indonesia. *Cogent Business & Management*, 8(1), 1930500.

Armistead, C.G., Mapes, J., 1993. The impact of supply chain integration on operating performance. *Logistics Information Management* 6 (4), 9–14.

Arora, A., Gambardella, A., 1990. Complementarity and external linkages: the strategies of large firms in biotechnology. *Journal of Industrial Economics* 38, 361–379.

Aryarathne, S. P., & Galahitiyawee, N. W. K. (2020). The mediating effect of organizational learning on the relationship between lean manufacturing practices and operational performance. In *Proceedings of International Conference on Business Management* (Vol. 17).

Aryee, G., Naim, M. M., & Lalwani, C. (2008). Supply chain integration using a maturity scale. *Journal of Manufacturing Technology Management*.

Asrini, A., Musnaini, M., Setyawati, Y., Kumalawati, L., & Fajariyah, N. A. (2020). Predictors of Firm Performance and Supply Chain: Evidence from Indonesian Pharmaceuticals Industry. *International Journal of Supply Chain Management*, 9(1), 1080-1087.

AYYILDIZ Hasan, Ekrem CENGİZ, “Pazarlama Modellerinin Testinde Kullanılabilecek Yapısal Eşitlik Modeli (YEM) Üzerine Kavramsal Bir İnceleme”, Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, C. 11, S. 1, 2006, ss. 63-84.

Bae, H.S. (2017), “Empirical relationships of perceived environmental uncertainty, supply chain collaboration and operational performance: analyses of direct, indirect and total effects”, *The Asian Journal of Shipping and Logistics*, Vol. 33 No. 4, pp. 263-272.

Bagozzi, R. P. and Yi, Y. (1988). On the Evaluation of Structural Equation Models. *Journal of the Academy of Marketing Science*. 16(1): 74-94.

Baharanchi, S. R. H. (2009). Investigation of the Impact of Supply Chain Integration on Product Innovation and Quality. *Scientia Iranica: Transaction E - Industrial Engineering*, 16(1), 81–89.

Baker, P. (2006), ‘Designing distribution centres for agile supply chains’, *International Journal of Logistics: Research and Applications*, 9 (3), 207-221.

Barney, J., 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17, 99–120.

Barney, J., M. Wright, and D. J. Ketchen Jr. 2001. "The Resource-Based View of the Firm: Ten Years After 1991." *Journal of Management* 27 (6): 625–641.

Basnet, C. (2013). The measurement of internal supply chain integration. *Management Research Review*.

Basu, R. (2001), "New criteria of performance management - A transition from enterprise to collaborative supply chain", *Measuring Business Excellence*, Vol. 5, No. 4, pp. 5-12.

BEAMON, B. M. (1998) "Measuring Supply Chain Performance", *Int. J. Production Economics*, Vol.55, ss.281-294.

Bekele, W. G., Jebiril, N., & Mola, B. T. (2022). The Effects of Agile Supply Chain Management Practices on Operational Performance (The Case of the Bishoftu Automotive Industry). *Journal of Supply Chain Management Systems*, 11.

Bennet, A. and David, B. (2004), *The Partnership between Organizational Learning and Knowledge Management*, Springer, Berlin Heidelberg.

Bicheno, J. (2004), 'The new lean toolbox: Towards fast, flexible flow', PICSIE Books, Buckingham.

Black, T. R. (2002). *Understanding social science research* (2nd ed., pp. 159-178). doi:10.4135/9780857020208.n8.

David Blanchard, "What Keeps You Up at Night?" *Logistics Today* (September 2004): 5

Blanchard, D. (2021). *Supply chain management best practices*: John Wiley & Sons.

Blau, P. (1964). *Exchange and power in social life*. New York, NY: John Wiley & Sons.

Bolstorff, P., & Rosenbaum, R. G. (2007). *Supply chain excellence: a handbook for dramatic improvement using the SCOR model*. AMACOM/American Management Association.

Borgatti, S. and Foster, P. (2003), "The network paradigm in organizational research: a review and typology", *Journal of Management*, Vol. 29 No. 6, pp. 991-1013.

Bowersox, D.J., Closs, D.J. and Stank, T.P. (1999), *21st Century Logistics: Making Supply Chain Integration: A Reality*, Council of Logistics Management, Michigan State University, East Lansing, MI.

Bowersox, D., Closs, D., & Cooper, M. (2002). *Supply Chain Logistics Management* McGraw Hill. International edition.

Bruque-Cámara, S., Moyano-Fuentes, J. and Maqueira-Marín, J.M. (2016), "Supply chain integration through community cloud: effects on operational performance", *Journal of Purchasing and Supply Management*, Vol. 22 No. 2, pp. 141-153.

Cagliano, R., Caniato, F., and Spina, G. (2006). The linkage between supply chain integration and manufacturing improvement programmes. *International Journal of Operations and Production Management*, 26(3), 282–299. doi:10.1108/01443570610646201.

Cao, M. and Zhang, Q. (2011), "Supply chain collaboration: impact on collaborative advantage and firm performance", *Journal of Operations Management*, Vol. 29 No. 3, pp. 163-180.

Carter, C. R., Rogers, D. S., & Choi, T. Y. (2015). Toward the theory of the supply chain. *Journal of Supply Chain Management*, 51(2), 89-97.

Chavez, R., Gimenez, C., Fynes, B., Wiengarten, F., & Yu, W. (2013). Internal lean practices and operational performance: The contingency perspective of industry clockspeed. *International Journal of Operations & Production Management*.

Chen, H., Daugherty, P. J., and Roath, A. S. (2009). Defining and Operationalizing Supply Chain Process Integration. *Journal of Business Logistics*, 30(1), 63–84. doi:10.1002/j.21581592.2009.tb00099.x

Chen, H., Mattioda, D. D., & Daugherty, P. J. (2007). Firm-wide integration and firm performance. *The International Journal of Logistics Management*.

Chen, D.Q., Preston, D.S. and Xia, W. (2013), "Enhancing hospital supply chain performance: a relational view and empirical test", *Journal of Operations Management*, Vol. 31 No. 6, pp. 391-408.

Chen, W., Wei, S., Yin, J., & Chen, X. (2020). How Big Data Analytics Improve Supply Chain Performance: Considering the Roles of Supply Chain and IS Strategy.

CHIN W. Wynne, "The Partial Least Squares Approach to Structural Equation Modeling", *Modern Methods For Business Research*, Vol. 295, No. 2, 1998, ss. 295336.

Choi, T.Y. and Kim, Y. (2008), "Structural embeddedness and supplier management: a network perspective", *Journal of Supply Chain Management*, Vol. 44 No. 4, pp. 5-13.

Christopher, M., 2000. The agile supply chain: Competing in volatile markets. *Industrial Marketing Management* 29, 37–44.

Christopher, M. and Towill, D.R. (2000), 'Supply chain migration from lean and functional to agile and customised', *Supply Chain Management: An International Journal*, vol.5, no.4, pp.206213.

Christopher, M. (2005) *Logistics and Supply Chain Management: Creating Value – Added Networks*, 3rd Edition, Financial Times/Prince Hall, ISBN 9780273681762.

Christopher, M. (2011) *Logistics and Supply Chain Management*, Great Britain, Pearson Education Limited.

Christopher, M., Harrison, A., & Hoek, R. v. (2016). Creating the agile supply chain: issues and challenges. *Developments in logistics and supply chain management*, 61-68.

Cousins, P.D., Menguc, B., 2006. The implications of socialization and integration in supply chain management. *Journal of Operations Management* 24 (5), 604–620.

Cooper, M.C., Lambert, D.M., Pagh, J.D. (1997), 'Supply Chain Management: More Than a New Name for Logistics', *The International Journal of Logistics Management*, vol.8, no.1, pp.113.

Croom, S., Romano, P., Giannakis, M. (2000), 'Supply chain management: An analytical framework for critical literature review', *European Journal of Purchasing & Supply Management*, vo.6, pp.67-83.

Cui, L., Wu, H., Wu, L., Kumar, A., & Tan, K. H. (2022). Investigating the relationship between digital technologies, supply chain integration and firm resilience in the context of COVID-19. *Annals of Operations Research*, 1-29.

Danese, P., Romano, P. and Formentini, M. (2013), "The impact of supply chain integration on responsiveness: the moderating effect of using an international supplier network", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 49 No. 1, pp. 125-140.

Das, A., Narasimhan, R., Talluri, S., 2006. Supplier integration—finding an optimal configuration. *Journal of Operations Management* 24 (5), 563–582.

Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, 173, 121092.

Dekkers, R., de Boer, R., Gelsomino, L. M., de Goeij, C., Steeman, M., Zhou, Q., ... & Souter, V. (2020). Evaluating theoretical conceptualisations for supply chain and finance integration: a Scottish focus group. *International Journal of Production Economics*, 220, 107451.

Devaraj, S., Krajewski, L., Wei, J.C., 2007. Impact of e-business technologies on operational performance: the role of production information in the supply chain. *Journal of Operations Management* 25 (6), 1199–1216.

Diamantopoulos, A., Siguaw, J. A., & Cadogan, J. W. (2000). Export performance: The impact of cross-country export market orientation. In *American Marketing Association. Conference Proceedings* (Vol. 11, p. 177). American Marketing Association.

Droge, C., Jayaram, J., Vickery, S.K., 2004. The effects of internal versus external integration practices on time-based performance and overall firm performance. *Journal of Operations Management* 22 (6), 557–573.

Dumitrache, I., Stanescu, A. M., Caramihai, S. I., Voinescu, M., Moisescu, M. A., & Sacala, I. S. (2009). Knowledge management based supply chain in learning organization. *IFAC Proceedings Volumes*, 42(4), 121-126.

Dyer, J., Cho, D. and Chu, W. (1998), 'Strategic supplier segmentation: The next best practice in supply chain management', *California Management Review*, vol.40, no.2, pp.57-77.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679. doi:10.5465/amr.1998.1255632.

El Mokadem, M. (2017). The classification of supplier selection criteria with respect to lean or agile manufacturing strategies. *Journal of Manufacturing Technology Management*, 28(2), 232-249.

Elmoselhy, S. A. (2013). Hybrid lean–agile manufacturing system technical facet, in automotive sector. *Journal of Manufacturing Systems*, 32(4), 598-619.

Eltantawy, R. a., Giunipero, L., and Fox, G. L. (2009). A strategic skill based model of supplier integration and its effect on supply management performance. *Industrial Marketing Management*, 38(8), 925–936. doi:10.1016/j.indmarman.2008.12.022.

Eltawy, N., & Gallear, D. (2017). Leanness and agility: a comparative theoretical view. *Industrial Management & Data Systems*.

Eyong, M. (2009). Creating a Competitive Supply Chain: Evaluating The Impact of Lean & Agile Supply Chain. Master Thesis.

Fabbe-Costes, N. & Roussat, C. (2011). Supply chain integration: views from a logistics service provider. Paper presented at the Supply Chain Forum: An International Journal.

Fadaki, M., Rahman, S., & Chan, C. (2019). Quantifying the degree of supply chain leagility and assessing its impact on firm performance. *Asia Pacific Journal of Marketing and Logistics*.

Fadaki, M., Rahman, S., & Chan, C. (2020). Leagile supply chain: design drivers and business performance implications. *International Journal of Production Research*, 58(18), 5601-5623.

Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*.

Fawcett, S. E., Ogden, J. A., Magnan, G. M., & Cooper, M. B. (2006). Organizational commitment and governance for supply chain success. *International Journal of Physical Distribution & Logistics Management*.

Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply chain management: An international journal*.

Fawcett, S.E., Wallin, C., Allred, C., Fawcett, A.M. and Magnan, G.M. (2011), "Information technology as an enabler of supply chain collaboration: a dynamic-capabilities perspective", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 38-59.

Fawcett, S.E. and Waller, M.A. (2013), "Considering supply chain management's professional identity: the beautiful discipline (or, 'we don't cure cancer, but we do make a big difference')", *Journal of Business Logistics*, Vol. 34 No. 3, pp. 183-188.

Fisher, M. L. (1997) "What is the right supply chain for your product?", *Harvard Business Review*, March/April, 105–116.

Flumerfelt, S., Bella Siriban-Manalang, A., & Kahlen, F. J. (2012). Are agile and lean manufacturing systems employing sustainability, complexity and organizational learning?. *The Learning Organization*, 19(3), 238-247.

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management*, 28(1), 58-71.

Flynn, B.B., Koufteros, X. and Lu, G. (2016), "On theory in supply chain uncertainty and its implications for supply chain integration", *Journal of Supply Chain Management*, Vol. 52 No. 3, pp. 3-27.

Fornell, C. and Larcker, D. F. (1981). Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*. 18(3): 382-388

Forrester, J. (1961), *Industrial Dynamics*, MIT Press, Cambridge, MA.

Freyer, H. (2014). *Sanayi çağı*. Ankara: Doğu Batı Yayınları.

Frohlich, M.T., Westbrook, R., 2001. Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management* 19 (2), 185–200.

Galbraith, J., 1973. *Designing Complex Organizations*. AddisonWesley, Reading, MA.

Galbraith, J., 1977. *Organization Design*. Addison-Wesley, Reading, MA.

Ganbold, O., Matsui, Y. and Rotaru, K. (2021), "Effect of information technology-enabled supply chain integration on firm's operational performance", *Journal of Enterprise Information Management*, Vol. 34 No. 3, pp. 948-989.

Gefen David, Detmar Straub, Marie-Claude Boudreau, "Structural Equation Modeling and Regression: Guidelines for Research Practice", *Communications of the Association For Information Systems*, Vol. 4, No. 1, 2000, ss. 1-77.

Gehani, R.R. (1995), 'Time-based management of technology: A taxonomic integration of tactical strategic roles', *International Journal of Operations and Production Management*, vol.15, issue2, pp.19-35.

Gephart, M.A. and Marsick, V.J. (1996), "Learning organizations come alive", *Training and Development*, Vol. 50 No. 12, pp. 35-45.

Germain, R., Iyer, K.N.S., 2006. The interaction of internal and downstream integration and its association with performance. *Journal of Business Logistics* 27 (2), 29–53.

Gezici, F., Walsh, B. Y., & Kacar, S. M. (2017). Regional and structural analysis of the manufacturing industry in Turkey. *The Annals of Regional Science*, 59, 209-230.

Ghobakhloo, M., & Azar, A. (2017). Business excellence via advanced manufacturing technology and lean-agile manufacturing. *Journal of Manufacturing Technology Management*.

Gibson, B.J., Mentzer, J.T. and Cook, R.L. (2005), "Supply chain management: the pursuit of a consensus definition", *Journal of Business Logistics*, Vol. 26 No. 2, pp. 17-25.

Giménez Thomsen, C., & Ventura, E. (2003). Logistics-production, logistics-marketing and external integration: Their impact on performance. *Economics and Business Working Paper*, (657).

- Gimenez, C., Ventura, E., 2005. Logistics-production, logistics-marketing and external integration: their impact on performance. *International Journal of Operations & Production Management* 25 (1), 20–38.
- Gligor, D. M., Holcomb, M. C., & Stank, T. P. (2013). A multidisciplinary approach to supply chain agility: Conceptualization and scale development. *Journal of business logistics*, 34(2), 94-108.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122. doi:10.1002/smj.4250171110
- Goldman, S., Nagel, R. and Preiss, K., 1995, *Agile Competitors and Virtual Organizations*, Van Nostrand Reinhold, New York.
- Goldsby, T. J., Griffis, S. E., & Roath, A. S. (2006). Modeling lean, agile, and leagile supply chain strategies. *Journal of business logistics*, 27(1), 57-80.
- Graham, S. (2018). Antecedents to environmental supply chain strategies: The role of internal integration and environmental learning. *International Journal of Production Economics*, 197, 283-296.
- Gulati, R., 1998. Alliances and networks. *Strategic Management Journal* 19 (4), 293–317.
- Gunasekaran, A. (2001). *Agile manufacturing: the 21st century competitive strategy*: Elsevier.
- Gunasekaran, A., McGaughey, R., & Wolstencroft, V. (2001). *Agile manufacturing: Concepts and framework*. *Agile manufacturing: the 21st century competitive strategy*. Elsevier.
- Gunasekaran, A., Yusuf, Y.Y., 2002, *Agile Manufacturing: A Taxonomy of Strategic and Technological Imperatives*, *International Journal of Production Research*, 40(6), 1357-1385.
- Gunasekaran, A., Lai, K.H., Cheng, T.C.E., 2008, *Responsive Supply Chain: A Competitive Strategy In A Networked Economy*, *Omega: The International Journal of Management Science*, 36, 549-564.

- Hage, J., Aiken, M., 1967. Program change and organizational properties: a comparative analysis. *American Journal of Sociology* 72, 503–519.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, 19, 139–151.
- Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. 2016. A primer on partial least squares structural equation modeling (PLS-SEM): Sage publications.
- Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). Advanced issues in partial least squares structural equation modeling. saGe publications.
- Halldorsson, A., Kotzab, H., Mikkola, J. H., & Skjøtt-Larsen, T. (2007). Complementary theories to supply chain management. *Supply chain management: An international journal*.
- Handfield, R. B. and Nichols, E. L. (1999), *Introduction to Supply Chain Management*, 1 st Edition, New Jersey: Prentice-Hall Inc.
- Hani, J. (2021). The moderating role of lean operations between supply chain integration and operational performance in Saudi manufacturing organizations. *Uncertain Supply Chain Management*, 9(1), 169-178.
- Helo, P. (2004), 'Managing agility and productivity in the electronic industry', *Industrial Management and Data Systems*, vol.104, no.7, pp.567-577.
- Henkoff, R. (1994), "Delivering the goods", *Fortune*, 28 November, pp. 64-78.
- Henseler, J., Ringle, C. M. and Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling. *Journal of the Academy of Marketing Science*. 43(1): 115-135.
- Hill, T. (2000), *Manufacturing strategy*, third edition, Palgrave, New York.
- Hirvonen, J. (2018). Design and implementation of Andon system for Lean manufacturing.
- Holbeche, L. (2018). *The agile organization: how to build an engaged, innovative and resilient business*. Kogan Page Publishers.

Homburg, C., Stock, R.M., 2004. The link between salespeople's job satisfaction and customer satisfaction in a business-to-business context: a dyadic analysis. *Journal of Academy of Marketing Science* 32 (2), 144–158.

Hormozi, M.A., 2001, Agile Manufacturing: The Next Logical Step, *Benchmarking: An International Journal*, 8 (2), 132-143.

Huang, M.-C., Yen, G.-F. and Liu, T.-C. (2014), "Reexamining supply chain integration and the supplier's performance relationships under uncertainty", *Supply Chain Management: An International Journal*, Vol. 19 No. 1, pp. 64-78.

Hulland, J. (1999). Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies. *Strategic Management Journal*. 20(2): 195-204.

Huo, B. (2012). The impact of supply chain integration on company performance: an organizational capability perspective. *Supply Chain Management: An International Journal*.

Huo, B., Han, Z., Zhao, X., Zhou, H., Wood, C.H. and Zhai, X. (2013), "The impact of institutional pressures on supplier integration and financial performance: evidence from China", *International Journal of Production Economics*, Vol. 146 No. 1, pp. 82-94.

Huo, B., Han, Z., Chen, H. and Zhao, X. (2015a), "The effect of high-involvement human resource management practices on supply chain integration", *International Journal of Physical Distribution and Logistics Management*, Vol. 45 No. 8, pp. 716-746.

Huo, B., Zhang, C. and Zhao, X. (2015b), "The effect of IT and relationship commitment on supply chain coordination: a contingency and configuration approach", *Information and Management*, Vol. 52 No. 6, pp. 728-740.

Huo, B., Han, Z. and Prajogo, D. (2016a), "Antecedents and consequences of supply chain information integration: a resource-based view", *Supply Chain Management*, Vol. 21 No. 6, pp. 661-677.

Huo, B., Ye, Y., Zhao, X. and Shou, Y. (2016b), "The impact of human capital on supply chain integration and competitive performance", *International Journal of Production Economics*, Vol. 178, pp. 132-143.

Iacovou, C.L., Benbasat, I., Dexter, A.S. (1995), 'Electronic data interchange and small organisations: Adoption and impact of technology', *MIS Quarterly*, vol.19, issue 4, pp.465-485.

Inman, R.A., Sale, R.S., Green, J.R.K.W., Whitten, D., 2011, Agile Manufacturing: Relation to JIT, Operational Performance and Firm Performance, *Journal of Operations Management*, 29 (4), 343-355.

Iqbal, T., Jajja, M. S. S., Bhutta, M. K., & Qureshi, S. N. (2020). Lean and agile manufacturing: complementary or competing capabilities?. *Journal of Manufacturing Technology Management*.

Ismail, H. S., & Sharifi, H. (2006). A balanced approach to building agile supply chains. *International Journal of Physical Distribution & Logistics Management*, 36(6), 431-444. doi:10.1108/09600030610677384

Jacobs, M.A., Yu, W. and Chavez, R. (2016), "The effect of internal communication and employee satisfaction on supply chain integration", *International Journal of Production Economics*, Vol. 171, pp. 60-70.

Jajja, M.S.S., Chatha, K.A. and Farooq, S. (2018), "Impact of supply chain risk on agility performance: mediating role of supply chain integration", *International Journal of Production Economics*, Vol. 205, pp. 118-138.

Jiang, Z. Z., He, N., Qin, X., Sun, M., & Wang, P. (2020). Optimizing production and maintenance for the service-oriented manufacturing supply chain. *Annals of Operations Research*, 1-26.

Jill Jusko, "Building a Better Supply Chain," *IndustryWeek* (August 2009): 26–28.

Jin-Hai, L., Anderson, R.A. & Harrison, R.T. 2003, The Evolution of Agile Manufacturing, *Business Process Management Journal*, 9(2), 170-189.

Johnson, J.L., 1999. Strategic integration in industrial distribution channels: managing the interfirm relationship as a strategic asset. *Journal of Academy of Marketing Sciences* 27 (1), 4–18.

Junejo, I., Siddiqui, M. B., Bhutto, N., & Thebo, J. A. (2022). Role of Agile and Lean Supply Chain Strategy on Firm Performance: Evidence from Drinking-Water Industry of Sindh, Pakistan. *Sustainable Business and Society in Emerging Economies*, 4(2), 365-372.

Kabadayı, N. (2021). 21. Yüzyılda Tedarik Zinciri Yönetimi Güncel Rekabet Stratejileri ve Yaklaşımlar, Kriter Yayınevi.

Kahn, K. B., & Mentzer, J. T. (1998). Marketing's integration with other departments. *Journal of business research*, 42(1), 53-62.

Kaliani Sundram, V.P., Chandran, V. and Awais Bhatti, M. (2016), "Supply chain practices and performance: the indirect effects of supply chain integration", *Benchmarking: An International Journal*, Vol. 23 No. 6, pp. 1445-1471.

Kashani, F. H., & Baharmast, S. (2017). Effect of supply chain information systems on firm performance: An empirical case study. *Engineering, Technology & Applied Science Research*, 7(2), 1552-1558.

Katayama, H., & Bennett, D. (1999). Agility, adaptability and leanness: A comparison of concepts and a study of practice. *International Journal of Production Economics*, 60, 43-51.

Ketokivi, M., & Mahoney, J. T. (2020). Transaction cost economics as a theory of supply chain efficiency. *Production and Operations Management*, 29(4), 1011-1031.

Khalfallah, M., & Lakhal, L. (2021). The impact of lean manufacturing practices on operational and financial performance: the mediating role of agile manufacturing. *International Journal of Quality & Reliability Management*, 38(1), 147-168.

Khalfan, M. M., & Maqsood, T. (2012). Supply chain capital in construction industry: coining the term. *International Journal of Managing Projects in Business*, 5(2), 300-310.

- Khan, H., & Wisner, J. D. (2019). Supply chain integration, learning, and agility: Effects on performance. *Journal of Operations and Supply Chain Management*, 12(1), 14.
- Kidd, P.T., 1994, "Agile Manufacturing: Forging New Frontiers". Addison-Wesley, Wokingham.
- Kim, H.J. (2017), "Information technology and firm performance: the role of supply chain integration", *Operations Management Research*, Vol. 10 Nos 1-2, pp. 1-9.
- Kim, S. W. (2009). An investigation on the direct and indirect effect of supply chain integration on firm performance. *International Journal of Production Economics*, 119(2), 328–346. doi:10.1016/j.ijpe.2009.03.007.
- Knoppen, D., Christiaanse, E., & Huysman, M. (2010). Supply chain relationships: Exploring the linkage between inter-organisational adaptation and learning. *Journal of purchasing and supply management*, 16(3), 195-205.
- Kogut, B., Zander, U., 1992. Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science* 3 (3), 383–397.
- Kotler, P., Keller, K. L., Ancarani, F., & Costabile, M. (2014). *Marketing management* 14/e: Pearson.
- Koufteros, X.A., Cheng, T.C.E., Lai, K.H., 2007. Black-box and gray box supplier integration in product development: antecedents, consequences and the moderating role of firm size. *Journal of Operations Management* 25 (4), 847–870.
- Kumar, G., Banerjee, R.N., Meena, P.L. and Ganguly, K. (2016), "Collaborative culture and relationship strength roles in collaborative relationships: a supply chain perspective", *Journal of Business & Industrial Marketing*, Vol. 31 No. 5, pp. 587-599.
- Lohmöller, J. B., & Lohmöller, J. B. (1989). Predictive vs. structural modeling: Pls vs. ml. *Latent variable path modeling with partial least squares*, 199-226.
- Lam, J. and Postle, R. (2006), 'Textile and apparel supply chain management in Hong Kong', *International Journal of Clothing Science and Technology*, vol.18, no.4, pp.265-277.

Lambert, D. and Cooper, M. (2000), 'Issues in supply chain management', *Industrial Marketing Management*, vol.29, pp.65-83.

Lamey, J. (1996), 'Supply Chain Management', FT Management Report, London.

Larson, P. and Halldorsson, A. (2004), 'Logistics vs. supply chain management: An international survey', *International Journal of Logistics: Research and Applications*, vol.7, issue.1, pp.17-31.

Lawrence, P.R., Lorsch, J.W., 1967. *Organization and Environment: Managing Differentiation and Integration*. Harvard University, Graduate School of Business Administration, Boston, MA.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of Management Review*, 31(3), 638–658. doi:10.5465/amr.2006.21318922.

Lau, A. K. W., Yam, R. C. M., and Tang, E. P. Y. (2010). Supply chain integration and product modularity: An empirical study of product performance for selected Hong Kong manufacturing industries. *International Journal of Operations and Production Management*, 30(1), 20–56. doi:10.1108/01443571011012361

Lee, H. (2000), "Creating value through supply chain integration", *Supply Chain Management Review*, Vol. 4 No. 4, pp. 30-36.

Lee, H.L. (2004), "The triple-A supply chain", *Harvard Business Review*, October.

Lee, H.-Y., Seo, Y.-J., & Dinwoodie, J. (2016). Supply chain integration and logistics performance: the role of supply chain dynamism. *The International Journal of Logistics Management*.

Lee, K. L., & Qi, T. X. (2021). The Effect of Lean and Agile Practices on Supply Chain Operational Performance in Malaysia Manufacturing Industry. *International Journal of Industrial Management*, 12(1), 319-340.

Leuschner, R., Rogers, D. S., & Charvet, F. F. (2013). A meta-analysis of supply chain integration and firm performance. *Journal of Supply Chain Management*, 49(2), 34-57.

- Leufvén, M., Vitrakoti, R., Bergström, A., Kc, A., & Målvist, M. (2015). Dimensions of Learning Organizations Questionnaire (DLOQ) in a low-resource health care setting in Nepal. *Health research policy and systems*, 13(1), 1-8.
- Levine, S., White, P.E., 1961. Exchange as a conceptual framework for the study of interorganizational relationships. *Administrative Science Quarterly* 5, 583–601.
- Li, X., Chung, C., Goldsby, T. and Holsapple, C. (2008), "A unified model of supply chain agility: the work-design perspective", *International Journal of Logistics Management*, Vol. 19 No. 3, pp. 408-35.
- Li, X., Goldsby, T. J., & Holsapple, C. W. (2009). Supply chain agility: scale development. *The International Journal of Logistics Management*.
- Liao, C. L., Qiu, M. Q., & Long, Y. (2008). An empirical study on the relationship among collaborative relationship, agile supply chain and business performance. *Systems Engineering-Theory & Practice*, (6), 115-128.
- Liker, J. K. (2004). *Toyota way: 14 management principles from the world's greatest manufacturer*: McGraw-Hill Education.
- Lin, C.-T., Chiu, H., & Chu, P.-Y. (2006). Agility index in the supply chain. *International Journal of Production Economics*, 100(2), 285-299.
- Liu, X., Qian, C., & Wang, S. (2020). When do 3PLs initiate low-carbon supply chain integration? *International Journal of Operations & Production Management*.
- Lotfi, M., & Saghiri, S. (2018). Disentangling resilience, agility and leanness: Conceptual development and empirical analysis. *Journal of Manufacturing Technology Management*, 29(1), 168-197.
- Lu, D., Ding, Y., Asian, S., & Paul, S. K. (2018). From supply chain integration to operational performance: The moderating effect of market uncertainty. *Global Journal of Flexible Systems Management*, 19, 3-20.
- Malakouti, M., Rezaei, S., & Shahijan, M. K. (2017). Agile supply chain management (ASCM): a management decision-making approach. *Asia Pacific Journal of Marketing and Logistics*.

Manthou, V., Vlachopoulou, M., & Gunasekaran, A. (2001). Agile manufacturing strategic options. *Agile manufacturing: The 21st Century Competitive Strategy*. Kidlington, Elsevier, UK.

Marquez, A.C., Bianchi, C., Gupta, J.N.D., 2004. Operational and financial effectiveness of e-collaboration tools in supply chain integration. *European Journal of Operational Research* 159 (2), 348–363.

Mateos-Aparicio, G. (2011). Partial least squares (PLS) methods: Origins, evolution, and application to social sciences. *Communications in Statistics–Theory and Methods*, 40, 2305–2317.

Meier, R.L., Williams, M.R. and Singley, R.B. (2004), 'Supply Chain Management: Strategic factors from the buyers perspective', *Journal of Industrial Technology*, vol.20, no.2, February to April.

Mekhum, W. (2020). The Role of Supply Chain Integration in Sustainable Performance of Thai Manufacturing Organizations: A Mediation Effect of Supply Chain Performance. *International Journal of Supply Chain Management*, 9(1), 206-214.

Mentzer, J.T., Flint, D.J., Hult, G.T.M. (2001), 'Logistics service quality as a segmentcustomised process', *Journal of Marketing*, 65(4), pp.82-104.

Michael Porter, *Competitive Advantage: Creating and Sustaining Superior Performance* (New York: The Free Press, 1985): 39–43.

Mitra, S., and Singhal, V. (2008). Supply chain integration and shareholder value : Evidence from consortium based industry exchanges. *Journal of Operations Management*, 26, 96–114. doi:10.1016/j.jom.2007.05.002.

Morash, E.A., Droge, C., Vickery, S., 1996. Strategic logistics capabilities for competitive advantage and firm success. *Journal of Business Logistics* 17 (1), 1–22.

Morash, E.A., Clinton, S.R., 1998. Supply chain integration: customer value through collaborative closeness versus operational excellence. *Journal of Marketing Theory and Practice* 6 (4), 104–120.

Moyano-Fuentes, J., Maqueira-Marin, J. M., Martinez-Jurado, P. J., & Sacristan-Diaz, M. (2021). Extending lean management along the supply chain: impact on efficiency. *Journal of Manufacturing Technology Management*, 32(1), 63-84.

Moyano-Fuentes, J., Sacristan-Diaz, M. and Garrido-Vega, P. (2016), "Improving supply chain responsiveness through Advanced Manufacturing Technology: the mediating role of internal and external integration", *Production Planning and Control*, Vol. 27 No. 9, pp. 686-697.

Naim, M. M., Potter, A. T., Mason, R. J. and Bateman, N. (2006). The role of transport flexibility in logistics provision'. *The International Journal of Logistics Management*, 17 (3), 297-311.

NARASIMHAN, R.; A. DAS (2001) "The Impact of Purchasing Integration and Practices on Manufacturing Performance", *Journal of Operations Management*, Vol.19, No.5, ss.593-609.

Narayanan, S., Jayaraman, V., Luo, Y. and Swaminathan, J.M. (2011), "The antecedents of process integration in business process outsourcing and its effect on firm performance", *Journal of Operations Management*, Vol. 29 Nos 1-2, pp. 3-16.

Naylor, J.B., Naim, M.M., Berry, D. (1999), 'Leagility: Interfacing the Lean and Agile manufacturing paradigm in the total supply chain', *International Journal of Production Economics*, vol.62, pp.107-118.

Ngai, E. W., Chau, D. C., & Chan, T. (2011). Information technology, operational, and management competencies for supply chain agility: Findings from case studies. *The Journal of Strategic Information Systems*, 20(3), 232-249.

Nguyen, T. T. H. (2017). Wal-Mart's successfully integrated supply chain and the necessity of establishing the Triple-A supply chain in the 21st century. *Journal of Economics and Management*, (29), 102-117.

Nyaga, G.N., Whipple, J.M. and Lynch, D.F. (2010), "Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ?", *Journal of Operations Management*, Vol. 28 No. 2, pp. 101-114.

O'leary-Kelly, S. W.; B. E. Flores (2002) "The Integration of Manufacturing and Marketing/Sales Decisions: Impact on Organizational Performance", *Journal of Operations Management*, Vol.20, No.3, ss.221-240.

Oliver, R.K. and Webber, M.D. (1992), 'Supply chain management – Logistics catches up with strategy', in Christopher, M.G. (Ed), *Logistics – Strategic Issues*, Chapman and Hall, London, pp.63-75.

Ordun, G. (2020). *Bilgi İşletmelerinde İnsan Davranışı ve Yönetimi*, Nobel Yayıncılık.

Öztürk, O. (2020). *Restoran işletmelerinde Tüketicilerin Karşılaştığı Hizmet hataları Ve Telafisi* (Doctoral dissertation, Bursa Uludag University (Turkey)).

Pagell, M., 2004. Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management* 22 (5), 459–487.

Pagell, M., and Wu, Z. (2009). Building a More Complete Theory of Sustainable Supply Chain Managemnt Using Case Studies of 10 Examples. *Journal of Supply Chain Management*, 45(2), 37–56. doi:10.1111/j.1745-493X.2009.03162.x.

Pakurár, M., Haddad, H., Popp, J., Khan, T., & Oláh, J. (2019). Supply chain integration, organizational performance and balanced scorecard: An empirical study of the banking sector in Jordan. *Journal of international studies*, 12(2).

Park, S.H., and Ungson, G. 2001. "Interfirm Rivalry and Managerial Complexity: A Conceptual Framework of Alliance Failure." *Organization Science* 12(1):37–53.

Peter, S. (1990). *The fifth discipline. The Art & Practice of Learning Organization*. Doubleday Currence, New York.

Petersen, K., Handfield, R., Ragatz, G., 2005. Supplier integration into new product development: coordinating product, process, and supply chain design. *Journal of Operations Management* 23 (3/4), 371–388.

Phadtare, P. (2014). Agile Manufacturing: Literature Review. *Vishwakarma Business Review*, 4(2), 22-28. Retrieved from <https://proxy.bau.edu.tr/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=116829986&lang=tr&site=eds-live>

Powell, T.C., 1992. Organizational alignment as competitive advantage. *Strategic Management Journal* 13 (1), 119–134.

Power, D., Sohal, A., Rahman, S. (2001), 'Critical success factors in agile supply chain management – An empirical study', *International Journal of Physical Distribution & Logistics Management*, vol.31, issue 4, pp.247-265.

Pradabwong, J., Braziotis, C., Tannock, J.D.T. and Pawar, K.S. (2017), "Business process management and supply chain collaboration: effects on performance and competitiveness", *Supply Chain Management: An International Journal*, Vol. 22 No. 2, pp. 107-121.

Prajogo, D., and Olhager, J. (2012). Supply chain integration and performance: The effects of longterm relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, 135(1), 514–522. doi:10.1016/j.ijpe.2011.09.001

Pramanik, P. K. D., Mukherjee, B., Pal, S., Upadhyaya, B. K., & Dutta, S. (2020). Ubiquitous manufacturing in the age of industry 4.0: a state-of-the-art primer. *A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development*, 73-112.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, instruments, & computers*, 36, 717-731.

Putnam, R. (1993) The prosperous community: Social capital and public life, *American Prospect*, 13: 35– 42.

Qi, Y., Huo, B., Wang, Z., & Yeung, H. Y. J. (2017). The impact of operations and supply chain strategies on integration and performance. *International Journal of Production Economics*, 185, 162-174.

Qrunfleh, S., & Tarafdar, M. (2014). Supply chain information systems strategy: Impacts on supply chain performance and firm performance. *International journal of production economics*, 147, 340-350.

Oelze, N., Hoejmose, S. U., Habisch, A., & Millington, A. (2016). Sustainable development in supply chain management: The role of organizational learning for policy implementation. *Business Strategy and the Environment*, 25(4), 241-260.

Raduan, C. R., Jegak, U., Haslinda, A., & Alimin, I. I. (2009). Management, strategic management theories and the linkage with organizational competitive advantage from the resource-based view. *European Journal of Social Sciences*, 11(3), 402-418. Retrieved from <http://www.europeanjournalofsocialsciences.com/>.

Rafique, M. Z., Qureshi, H. I., Malkana, M. U., Haider, S. M., & Atif, M. (2020). A lean-green-agile and resilient combination towards sustainable manufacturing-a review. *Technical Journal*, 25(01), 30-49.

Ragatz, G.L., Handfield, R.B., Petersen, K.J., 2002. Benefits associated with supplier integration into new product development under conditions of technology uncertainty. *Journal of Business Research* 55 (5), 389–400.

Rahimi, A., & Alemtabriz, A. (2022). Providing a model of LeAgile hybrid paradigm practices and its impact on supply chain performance. *International Journal of Lean Six Sigma*.

Rai, A., Patnayakuni, R. and Nainika, S. (2006), "Firm performance impacts of digitally enabled supply chain integration capabilities", *MIS Quarterly*, Vol. 30 No. 2, pp. 225-246.

Rajaguru, R., and M. J. Matanda. 2019. "Role of Compatibility and Supply Chain Process Integration in Facilitating Supply Chain Capabilities and Organizational Performance." *Supply Chain Management: An International Journal*. doi:10.1108/SCM-05-2017-0187.

Ramanathan, U. and Gunasekaran, A. (2014), "Supply chain collaboration: impact of success in long-term partnerships", *International Journal of Production Economics*, Vol. 147 No. 1, pp. 252-259.

Redding, J. (1997), "Hardwiring the learning organization", *Training and Development*, Vol. 51 No. 8, pp. 61-67.

Reichhart, A. and Holweg, M. (2007), 'Creating the customer-responsive supply chain: A reconciliation of concepts', *International Journal of Operations & Production Management*, 27 (11), 1144-1172.

Richardson, G.B., 1972. The organization of industry. *Economic Journal* 82, 883–897.

Ringle, C. M., Wende, S., & Becker, J.-M. 2015. *SmartPLS 3*. Boenningstedt: SmartPLS GmbH.

Rockart, J. F. and J. E. Short (1989), "IT in the 1990s: Managing Organizational Interdependence," *Sloan Management Review*, 30, 2, 17-33.

Romano, P. (2003) "Co-ordination and Integration Mechanisms to Manage Logistics Processes Across Supply Networks", *Journal of Purchasing and Supply Management*, Vol.9, No.3, ss.119-134.

Rosenzweig, E.D., Roth, A.V., Dean Jr., J.W., 2003. The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers. *Journal of Operations Management* 21 (4), 437–456.

Ruyle, K. E., De Meuse, K. P., & Hughley, C. W. (2021). *Becoming a Learning Agile Organization. The Age of Agility: Building Learning Agile Leaders and Organizations*, 345.

Salama, I. E. E. (2017). The impact of knowledge management capability, organizational learning, and supply chain management practices on organizational performance. *The Business & Management Review*, 8(5), 37-51.

Samaddar, S., Nargundkar, S. and Daley, M. (2005), 'Inter-organizational information sharing: The role of supply network configuration and partner goal congruence', *European Journal of Operational Research*, vol.174, pp.744–765.

Sarah R. Sphar, "A Supply Chain Check-up," *Supply Chain Technology News* (October 2001): 34.

Sarkis, J., & Talluri, S. (2001). Agile supply chain management. *Agile Manufacturing: The 21st Century Competitive Strategy*, 359-376.

Schoenherr, T. and Swink, M. (2012), "Revisiting the arcs of integration: cross-validations and extensions", *Journal of Operations Management*, Vol. 30 Nos 1/2, pp. 99-115.

Schotter, A. and Beamish, P. W. (2014). *The Hassle Factor: An Explanation for Managerial Locational Shunning. Location of International Business Activities* (pp. 181-225). London: Palgrave Macmillan.

Sendil Kumar, C., & Panneerselvam, R. (2007). Literature review of JIT-KANBAN system. *The International Journal of Advanced Manufacturing Technology*, 32, 393-408.

Sharifi, H., Ismail, H., & Reid, I. (2006). Achieving agility in supply chain through simultaneous "design of" and "design for" supply chain. *Journal of Manufacturing Technology Management*.

SHARP, J.M., IRANI, Z., DESAI S., 1999, Working Towards Agile Manufacturing Systems, *International Journal of Production Economics*, 62, 155-169.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. 2019. Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. *European Journal of Marketing*.

Shukor, A. A. A., Newaz, M. S., Rahman, M. K., & Taha, A. Z. (2021). Supply chain integration and its impact on supply chain agility and organizational flexibility in manufacturing firms. *International Journal of Emerging Markets*, 16(8), 1721-1744.

Singh, P.J. and Power, D. (2014), "Innovative knowledge sharing, supply chain integration and firm performance of Australian manufacturing firms", *International Journal of Production Research*, Vol. 52 No. 21, pp. 6416-6433.

Slack N. (1987), 'The flexibility of manufacturing systems', *International Journal of Operations and Production Management*, 7(4), 35-45.

Song, S., Shi, X. and Song, G. (2019), "Supply chain integration in omni-channel retailing: a human resource management perspective", *International Journal of Physical Distribution and Logistics Management*, Vol. 50 No. 1, pp. 101-121.

Sönmezoğlu, F. (1989). Uluslararası Politika ve Dış Politika Analizi. İstanbul: Filiz Kitabevi.

Sporleder, T., & Peterson, H. C. (2003). Intellectual capital, learning, and knowledge management in agrifood supply chains. *Journal on Chain and Network Science*, 3(2), 75-80.

Srinivasan, M. M., & Mandyam, S. (2011). Building lean supply chains with the theory of constraints. New York, NY: McGraw-Hill.

Srinivasan, R., & Swink, M. (2015). Leveraging supply chain integration through planning comprehensiveness: An organizational information processing theory perspective. *Decision Sciences*, 46(5), 823-861.

Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of business logistics*, 22(1), 29-48.

Stewart, G. (1997), 'Supply-chain operations reference model (SCOR): The first cross-industry framework for integrated supply-chain management', *Logistics Information Management*, vol.10, Issue 2, pp. 62–67.

Stevens, G. C. (1989). Integrating the supply chain. *international Journal of physical distribution & Materials Management*.

Stock, G.N.; Greis, N.P. & Kasarda, J.D. (1998): "Logistics, strategy and structure: A conceptual framework"; *International Journal of Operations and Production Management*; Vol.18 no.1; pages 37-52.

Swanson, D., Goel, L., Francisco, K., & Stock, J. (2018). An analysis of supply chain management research by topic. *Supply Chain Management: An International Journal*.

Swink, M., Narasimhan, R., Wang, C., 2007. Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management* 25 (1), 148–164.

Syed, M. W., Li, J. Z., Junaid, M., Ye, X., & Ziaullah, M. (2019). An empirical examination of sustainable supply chain risk and integration practices: A performance-based evidence from Pakistan. *Sustainability*, 11(19), 5334.

Tachizawa, E. M. and Thomsen, C. G. (2007), 'Drivers and sources of supply flexibility: An exploratory study', *International Journal of Operations & Production Management*, 27 (10), 1115-1136.

Teece, D. J., G. Pisano, and A. A. Shuen. 1997. "Dynamic Capabilities and Strategic Management." *Strategic Management Journal* 18 (7): 504–534.

Tekin, M., Arslandere, M., Etlioğlu, M., Koyuncuoğlu, Ö., & Tekin, E. (2019). An application of SMED and Jidoka in lean production. In *Proceedings of the International Symposium for Production Research 2018* 18 (pp. 530-545). Springer International Publishing.

Thornton, L.M., Esper, T.L. and Autry, C.W. (2016), "Leader or lobbyist? How organizational politics and top supply chain manager political skill impacts supply chain orientation and internal integration", *Journal of Supply Chain Management*, Vol. 52 No. 4, pp. 42-62.

TOBB (Union of Chambers and Commodity Exchanges of Turkey), 2020, <https://mobil.tobb.org.tr/MansetResimleri/26166-3.pdf>

TOYLAN, N. V., & GÖKTEPE, E. A. (2010). Öğrenen organizasyon olarak üniversiteler: Türkiye'deki bir devlet üniversitesinde durum analizi. *Sosyal ve Beşeri Bilimler Dergisi*, 2(1), 61-68.

TSE (Turkish Statistical Institute), [TÜİK - Veri Portalı \(tuik.gov.tr\)](http://tuik.gov.tr)

Tse, Y. K., Zhang, M., Akhtar, P., & MacBryde, J. (2016). Embracing supply chain agility: an investigation in the electronics industry. *Supply Chain Management: An International Journal*.

Tseng, P. H., & Liao, C. H. (2015). Supply chain integration, information technology, market orientation and firm performance in container shipping firms. *The International Journal of Logistics Management*.

TUSIAD (Turkish Industry and Business Association) (2016). Industry 4.0 in Turkey as an imperative for global competitiveness – An emerging market perspective, <https://tusiad.org/en/reports/item/9011-Industry-40in-turkey-as-an-imperative-for-global-competitiveness> , accessed 22.03.2022.

Um, J. (2017). The impact of supply chain agility on business performance in a high level customization environment. *Operations management research*, 10, 10-19.

Uzzi, B., 1999. Embeddedness in the making of financial capital: how social relations and networks benefit firms seeking financing. *American Sociological Review* 64, 481–505.

Van der Vaart, T., & Van Donk, D. P. (2008). A critical review of survey-based research in supply chain integration. *International Journal of Production Economics*, 111(1), 42-55.

Ventura, E., & Giménez Thomsen, C. (2002). Supply chain management as a competitive advantage in the Spanish grocery sector.

Vickery, S.K., Jayaram, J., Droge, C., Calantone, R., 2003. The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management* 21 (5), 523–539.

Von Krogh, G., Rossi-Lamastra, C., & Haefliger, S. (2012). Phenomenon-based research in management and organisation science: When is it rigorous and does it matter? *Long Range Planning*, 45(4), 277–298. doi:10.1016/j.lrp.2012.05.001.

Walters, D. (2007), 'Global logistics – New directions in supply chain management', Kogan Page, London.

Wang, Z., Huo, B., Qi, Y. and Zhao, X. (2016), "A resource-based view on enablers of supplier integration: evidence from China", *Industrial Management and Data Systems*, Vol. 116 No. 3, pp. 416-444.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. doi:10.1002/smj.4250050207.

Wieland, A., & Wallenburg, C. M. (2013). The influence of relational competencies on supply chain resilience: A relational view. *International Journal of Physical Distribution & Logistics Management*, 43(4), 300–320. doi:10.1108/ijpdIm-082012-0243.

Wheelwright, S.C., 1984. Manufacturing strategy: defining the missing link. *Strategic Management Journal* 5, 77–91.

Whetten, D.A., 1977. Toward a contingency model for designing interorganizational service delivery systems. *Organization and Administrative Sciences* 4, 77–96.

Williamson, O. E. (2013). *The transaction cost economics project*. Elgar.

Willis, G., Genchev, S.E. and Chen, H. (2016), "Supply chain learning, integration, and flexibility performance: an empirical study in India", *The International Journal of Logistics Management*, Vol. 27 No. 3, pp. 755-769.

Womack, J. P., & Jones, D. T. (2015). *Lean solutions: how companies and customers can create value and wealth together*: Simon and Schuster.

Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 24(1), 1-32.

Wong, C. Y., Boon-itt, S., and Wong, C. W. Y. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, 29(6), 604–615. doi:10.1016/j.jom.2011.01.003.

Wong, C.W.Y., Lai, K. and Bernroider, E.W.N. (2015), "The performance of contingencies of supply chain information integration: the roles of product and market complexity", *International Journal of Production Economics*, Vol. 165 No. 7, pp. 1-11.

Wong, C.W.Y., Sancha, C. and Thomsen, C.G. (2017), "A national culture perspective in the efficacy of supply chain integration practices", *International Journal of Production Economics*, Vol. 193 No. 11, pp. 554-565.

Xu, D., Huo, B. and Sun, L. (2014), "Relationships between intra-organizational resources, supply chain integration and business performance: an extended resource-based view", *Industrial Management & Data Systems*, Vol. 114 No. 8, pp. 1186-1206.

Yang, C.-S. (2016), "The antecedents and consequences of supply chain service capabilities in the context of container shipping", *The International Journal of Logistics Management*, Vol. 27 No.2, pp. 236-262.

- Yang, Q., Geng, R., & Feng, T. (2020). Does the configuration of macro-and micro-institutional environments affect the effectiveness of green supply chain integration? *Business Strategy and the Environment*, 29(4), 1695-1713.
- Yao, A. C., & Carlson, J. G. (2003). Agility and mixed-model furniture production. *International Journal of Production Economics*, 81, 95-102.
- Yu, W., Jacobs, M. A., Salisbury, W. D., & Enns, H. (2013). The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective. *International Journal of Production Economics*, 146(1), 346-358.
- Yu, W., Jacobs, M.A., Chavez, R. and Feng, M. (2017), "The impacts of IT capability and marketing capability on supply chain integration: a resource-based perspective", *International Journal of Production Research*, Vol. 55 No. 14, pp. 4196-4211.
- Yu, W., Chavez, R., Jacobs, M., Wong, C. Y., & Yuan, C. (2019). Environmental scanning, supply chain integration, responsiveness, and operational performance: an integrative framework from an organizational information processing theory perspective. *International Journal of Operations & Production Management*.
- Yuen, K. F., Wang, X., Ma, F., Lee, G., & Li, X. (2019). Critical success factors of supply chain integration in container shipping: an application of resource-based view theory. *Maritime Policy & Management*, 46(6), 653-668.
- Zaheer, S., Amjad, M. S., Rafique, M. Z., & Khan, M. A. (2020). A K-Chart based implementation framework to attain lean & agile manufacturing. *International Journal of Production Management and Engineering*, 8(2), 123-135.
- Zhang, M. and Huo, B. (2013), "The impact of dependence and trust on supply chain integration", *International Journal of Physical Distribution & Logistics Management*, Vol.43No. 7, pp. 544-563.
- Zhang, C., Gunasekaran, A., & Wang, W. Y. C. (2015). A comprehensive model for supply chain integration. *Benchmarking: An International Journal*.
- Zhao, L., Huo, B., Sun, L., & Zhao, X. (2013). The impact of supply chain risk on supply chain integration and company performance: a global investigation. *Supply Chain Management: An International Journal*.

- Zhao, X., Lynch Jr, J. G. and Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research*. 37(2): 197-206.
- Zhu, Q., H. Krikke, and C. J. C. Marjolein. 2018. "Supply Chain Integration: Value Creation Through Managing InterOrganizational Learning." *International Journal of Operations & Production Management* 38 (1): 211–229.
- Zhuo, N., Ji, C., & Yin, N. (2021). Supply chain integration and resilience in China's pig sector: case study evidences from emerging institutional arrangements. *Environmental Science and Pollution Research*, 28, 8310-8322.
- Zinn, W. and Goldsby, T.J. (2014), "Logistics professional identity: strengthening the discipline as galaxies collide", *Journal of Business Logistics*, Vol. 35 No. 1, pp. 23-28.
- Zsidisin, G.A., Hartley, J.L., Bernardes, E.S. and Saunders, L.W. (2015), "Examining supply market scanning and internal communication climate as facilitators of supply chain integration", *Supply Chain Management*, Vol. 20 No. 5, pp. 549-560.
- Zubir, M. A. B., & Pandiyan, K. S. V. (2014). A meta-analysis of supply chain integration and firm performance: The mediating effect of competitive advantage. *SSRN Electronic Journal*. doi:10.2139/ssrn.2503240.



# **APPENDICES**

## APPENDIX 1: QUESTIONNAIRE FORM IN ENGLISH

Dear Participant,

This survey study was prepared to be used in the doctoral thesis on "Supply chain integration through lean and agile approaches" at Istanbul University, Institute of Social Sciences, Department of Business & Management. Your answers will only be used for scientific purposes and will not be shared with third parties in any way, within the scope of the protection of personal data. We would like to remind you that every question must be answered in order to analyze the data.

Thank you very much for your contribution.

Yasemin Ülker & Prof. Dr. Güven Ordun  
İstanbul University

### COMPANY INFORMATION

Sector where company operate:

City where company locate:

Total Number of Employees:

a)0-50                      b) 51-250                      c) 251-500                      d) 501-2000                      e) 2000 den fazla

Total Number of Suppliers:

a)0-50                      b) 51-250                      c) 251-500                      d) 501-2000                      e) 2000 den fazla

Markets :    ( ) Only domestic    ( ) Only International (except Turkey)    ( ) Domestic and International

Which Of The Following Lean Applications Is Implemented In Your Company?

- a) 5S Technique
- b) Kanban
- c) Pull system
- d) Value flow mapping
- e) Value chain analysis
- f) A3 report (PDCA)
- g) Kaizen

### FORMU DOLDURANIN:

|                                                         |                                                               |
|---------------------------------------------------------|---------------------------------------------------------------|
| Cinsiyet                                                | ( ) Kadın ( ) Erkek ( ) Belirtmek istemiyorum                 |
| Yaş                                                     | .....                                                         |
| Öğrenim Durumu                                          | ( ) Lise ( ) Önlisans ( ) Lisans ( ) Yüksek lisans ve doktora |
| Formu Dolduranın Mevcut İşyerindeki Toplam Çalışma Yılı | .....                                                         |

|                     |       |
|---------------------|-------|
| <b>Birim Unvanı</b> | ..... |
|---------------------|-------|

| <b>Answer the following statements according to your level of participation. (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree)</b> | <b>1-Strongly disagree</b> | <b>2- Disagree</b> | <b>3- Neither agree nor disagree</b> | <b>4- Agree</b> | <b>5- Strongly agree</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|--------------------------------------|-----------------|--------------------------|
| Value stream mapping is used to identify and eliminate waste throughout our supply chain                                                                                    |                            |                    |                                      |                 |                          |
| Our supply chain generates high stock turnover and minimizes inventory                                                                                                      |                            |                    |                                      |                 |                          |
| Our supply chain uses lean manufacturing techniques (such as pull flow, Kanban systems and setup time reduction)                                                            |                            |                    |                                      |                 |                          |
| Process and product standardization is a common practice in our supply chain                                                                                                |                            |                    |                                      |                 |                          |
| Our supply chain delivers in small lot sizes                                                                                                                                |                            |                    |                                      |                 |                          |
| Our supply chain does long term forecasting of customer demands serving only the current market segments                                                                    |                            |                    |                                      |                 |                          |
| In our supply chain, the strategy for handling uncertainty consists of using queues and buffers to protect sub-processes                                                    |                            |                    |                                      |                 |                          |
| Our supply chain structure seldom changes                                                                                                                                   |                            |                    |                                      |                 |                          |

| <b>Answer the following statements according to your level of participation. (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree)</b> | <b>1-Strongly disagree</b> | <b>2- Disagree</b> | <b>3- Neither agree nor disagree</b> | <b>4- Agree</b> | <b>5- Strongly agree</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|--------------------------------------|-----------------|--------------------------|
| 1. This organisation is flexible in terms of product volume                                                                                                                 |                            |                    |                                      |                 |                          |
| 2. The production processes of this organisation are flexible in terms of product models and configurations.                                                                |                            |                    |                                      |                 |                          |
| 3. This organisation exhibits flexibility in both organisation and organisational issues                                                                                    |                            |                    |                                      |                 |                          |
| 4. This organisation has flexible workforce                                                                                                                                 |                            |                    |                                      |                 |                          |
| 1. This organisation has the capabilities necessary to sense, perceive and anticipate market changes                                                                        |                            |                    |                                      |                 |                          |

|                                                                                                                                                          |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 2. This organisation reacts immediately to incorporate changes into its manufacturing processes and systems                                              |  |  |  |  |  |
| 3. This organisation has the capabilities to recover from change                                                                                         |  |  |  |  |  |
| 1. This organisation can quickly get new products to market.                                                                                             |  |  |  |  |  |
| 2. This organisation has the capabilities to deliver products to customers in a timely manner and to quickly respond to changes in delivery requirements |  |  |  |  |  |
| 3. This organisation has the capabilities to achieve fast operations time                                                                                |  |  |  |  |  |
| 1. This organisation's strategic vision emphasises the need for flexibility and agility to respond to market changes                                     |  |  |  |  |  |
| 2. This organisation has the appropriate technology and technological capabilities to quickly respond to changes in customer demand                      |  |  |  |  |  |
| 3. This organisation has the capabilities to meet and exceed the levels of product quality demanded by its customers                                     |  |  |  |  |  |

| <b>Answer the following statements according to your level of participation. (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree)</b> | <b>1-Strongly disagree</b> | <b>2- Disagree</b> | <b>3- Neither agree nor</b> | <b>4- Agree</b> | <b>5- Strongly agree</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|-----------------------------|-----------------|--------------------------|
| We have a high level of information sharing with major customers about market information.                                                                                  |                            |                    |                             |                 |                          |
| We share information with major customers through information technologies.                                                                                                 |                            |                    |                             |                 |                          |
| We have a high degree of joint planning and forecasting with major customers to anticipate demand visibility.                                                               |                            |                    |                             |                 |                          |
| Our customers provide information to us in the procurement and production processes.                                                                                        |                            |                    |                             |                 |                          |
| Our customers are involved in our product development processes.                                                                                                            |                            |                    |                             |                 |                          |
| We share information with our major suppliers through information technologies.                                                                                             |                            |                    |                             |                 |                          |
| We have a high degree of strategic partnership with suppliers.                                                                                                              |                            |                    |                             |                 |                          |
| We have a high degree of joint planning to obtain rapid response ordering processes (inbound) with suppliers.                                                               |                            |                    |                             |                 |                          |
| Our suppliers provide information to us about production and procurement processes.                                                                                         |                            |                    |                             |                 |                          |
| Our suppliers are involved in our product development processes.                                                                                                            |                            |                    |                             |                 |                          |

|                                                                                                                                 |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| We have a high level of responsiveness within our plant to meet other departments' needs.                                       |  |  |  |  |  |
| We have an integrated system across functional areas of plant control.                                                          |  |  |  |  |  |
| Within our plant, we emphasize information flows amongst purchasing, inventory management, sales, and distribution departments. |  |  |  |  |  |
| Within our plant, we emphasize physical flows amongst production, packing, warehousing, and transportation departments.         |  |  |  |  |  |

| Please rate your company's performance in each of the following areas relative to the industry average and its competitors. | Well below the industry average | Below industry average | Same as industry | Above industry average | Well above the industry average |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------|------------------|------------------------|---------------------------------|
| 1. Average return on investment over the past 3 years.                                                                      |                                 |                        |                  |                        |                                 |
| 2. Average profit over the past 3 years.                                                                                    |                                 |                        |                  |                        |                                 |
| 3. Profit growth over the past 3 years.                                                                                     |                                 |                        |                  |                        |                                 |
| 4. Average return on sales over the past 3 years.                                                                           |                                 |                        |                  |                        |                                 |
| 5. Customer satisfaction                                                                                                    |                                 |                        |                  |                        |                                 |
| 6. Product customization                                                                                                    |                                 |                        |                  |                        |                                 |
| 7. Delivery speed                                                                                                           |                                 |                        |                  |                        |                                 |
| 8. Logistics cost                                                                                                           |                                 |                        |                  |                        |                                 |
| 9. Delivery dependability                                                                                                   |                                 |                        |                  |                        |                                 |
| 10. Responsiveness                                                                                                          |                                 |                        |                  |                        |                                 |
| 11. Order flexibility                                                                                                       |                                 |                        |                  |                        |                                 |
| 12. Delivery flexibility                                                                                                    |                                 |                        |                  |                        |                                 |
| 13. Information systems support                                                                                             |                                 |                        |                  |                        |                                 |
| 14. Order fill capacity                                                                                                     |                                 |                        |                  |                        |                                 |
| 15. Advance ship notification                                                                                               |                                 |                        |                  |                        |                                 |
| 16. Inventory turn                                                                                                          |                                 |                        |                  |                        |                                 |
| 17. Return on assets                                                                                                        |                                 |                        |                  |                        |                                 |

| Answer the following statements according to your level of participation. (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree) | 1-Strongly disagree | 2- Disagree | 3- Neither agree nor disagree | 4- Agree | 5- Strongly agree |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-------------------------------|----------|-------------------|
| In my organization, people help each other learn.                                                                                                                    |                     |             |                               |          |                   |
| In my organization, people are given time to support learning                                                                                                        |                     |             |                               |          |                   |
| In my organization, people are rewarded for learning.                                                                                                                |                     |             |                               |          |                   |

|                                                                                                                   |  |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| In my organization, people give open and honest feedback to each other.                                           |  |  |  |  |  |
| In my organization, whenever people state their view, they also ask what others think.                            |  |  |  |  |  |
| In my organization, people spend time building trust with each other.                                             |  |  |  |  |  |
| In my organization, teams/groups have the freedom to adapt their goals as needed.                                 |  |  |  |  |  |
| In my organization, teams/groups revise their thinking as a result of group discussions or information collected. |  |  |  |  |  |
| In my organization, teams/groups are confident that the organization will act as their recommendations.           |  |  |  |  |  |
| My organization creates systems to measure gaps between current and expected performance.                         |  |  |  |  |  |
| My organization makes its lessons learned available to all employees.                                             |  |  |  |  |  |
| My organization measures the results of the time and resources spent on training.                                 |  |  |  |  |  |
| My organization recognizes people for taking initiatives.                                                         |  |  |  |  |  |
| My organization gives people control over the resources they need to accomplish their work.                       |  |  |  |  |  |
| My organization supports employees who take calculated risks.                                                     |  |  |  |  |  |
| My organization encourages people to think from a global perspective.                                             |  |  |  |  |  |
| My organization works together with the outside community to meet mutual needs.                                   |  |  |  |  |  |
| My organization encourages people to get answers from across the organization when solving problems.              |  |  |  |  |  |
| In my organization, leaders mentor and coach those they lead.                                                     |  |  |  |  |  |
| In my organization, leaders continually look for opportunities to learn.                                          |  |  |  |  |  |
| In my organization, leaders ensure that the organization's actions are consistent with its values.                |  |  |  |  |  |

## APPENDIX 2: QUESTIONNAIRE FORM IN TURKISH

Değerli Katılımcı,

Bu anket çalışması, İstanbul Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı'nda "Tedarik Zinciri Entegrasyonuna Çevik ve Yalın Yaklaşımlar" konulu doktora tezinde kullanılmak üzere hazırlanmıştır. Cevapların sadece bilimsel amaçla kullanılacak olup, kişisel verilerin korunması kapsamında 3. kişilerle hiçbir şekilde paylaşılmayacaktır. Verilerin analiz edilebilmesi için her sorunun mutlaka yanıtlanması gerektiğini hatırlatmak isteriz.

Şimdiden bilime sağlamış olduğunuz katkı için çok teşekkür ederiz.

Yasemin Ülker & Prof. Dr. Güven Ordun  
İstanbul Üniversitesi

### FİRMA BİLGİLERİ

İşletmenin Sektörü:

İşletmenin Bulunduğu Şehir:

Çalışan Kişi Sayısı:

a) 0-50                      b) 51-250                      c) 251-500                      d) 501-2000                      e)

2000 den fazla

Tedarikçi sayısı

a) 0-50                      b) 51-250                      c) 251-500                      d) 501-2000                      e) 2000 den

fazla

İşletmenin Pazarları: ( ) Sadece yurtiçi ( ) Sadece yurt dışı ( ) Her iki Pazar

İşletmenizde Aşağıda Belirtilen Yalın Uygulamalardan Hangisi veya Hangileri

Uygulanmaktadır?

- a) Yalın üretimde 5S tekniği
- b) Kanban sistemi
- c) Çekme sistemi (pull system)
- d) Değer akışı haritalaması
- e) Değer zinciri analizi
- f) A3 raporu (PUKÖ)
- g) Kaizen

### FORMU DOLDURANIN:

|                |                                                               |
|----------------|---------------------------------------------------------------|
| Cinsiyet       | ( ) Kadın ( ) Erkek ( ) Belirtmek istemiyorum                 |
| Yaş            | .....                                                         |
| Öğrenim Durumu | ( ) Lise ( ) Önlisans ( ) Lisans ( ) Yüksek lisans ve doktora |

|                                                                |       |
|----------------------------------------------------------------|-------|
| <b>Formu Dolduranın Mevcut İşyerindeki Toplam Çalışma Yılı</b> | ..... |
| <b>Birim Unvanı</b>                                            | ..... |

| <b>Aşağıda belirtilen ifadeleri katılım durumunuza göre cevaplayınız. (1-kesinlikle katılmıyorum, 2-katılmıyorum, 3-ne katılıyorum ne katılmıyorum, 4-katılıyorum, 5- kesinlikle katılıyorum)</b> | <b>1- Kesinlikle Katılmıyorum</b> | <b>2- Katılmıyorum</b> | <b>3- Ne Katılıyorum Ne Katılmıyorum</b> | <b>4- Katılıyorum</b> | <b>5- Kesinlikle Katılıyorum</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------|------------------------------------------|-----------------------|----------------------------------|
| 1.Değer akışı haritalaması, tedarik zincirimiz boyunca israfı belirlemek ve ortadan kaldırmak için kullanılır.                                                                                    |                                   |                        |                                          |                       |                                  |
| 2.Tedarik zincirimiz stok devir hızının artmasını sağlayacak stokları asgari düzeyde tutar.                                                                                                       |                                   |                        |                                          |                       |                                  |
| 3.Tedarik zincirimizin belirsizlikle mücadele stratejisi alt süreçleri korumak için kuyrukları ve arabellekleri kullanmaktan geçer.                                                               |                                   |                        |                                          |                       |                                  |
| 4.Süreç ve ürün standardizasyonu, tedarik zincirimizde yaygın bir uygulamadır.                                                                                                                    |                                   |                        |                                          |                       |                                  |
| 5.Tedarik zincirimiz küçük partiler halinde teslimat yapar.                                                                                                                                       |                                   |                        |                                          |                       |                                  |
| 6.Tedarik zincirimiz, yalnızca mevcut pazar bölümlerine hizmet eden müşteri taleplerinin uzun vadeli tahminlerini yapar.                                                                          |                                   |                        |                                          |                       |                                  |
| 7.Tedarik zincirimiz, tedarikçilerle uzun dönemli ve işbirlikçi ilişkiler gözetir (bu ilişki operasyonel düzeyde sermaye ve iş ortaklığını da kapsar).                                            |                                   |                        |                                          |                       |                                  |
| 8.Tedarik zinciri yapımız nadiren değişir.                                                                                                                                                        |                                   |                        |                                          |                       |                                  |

| <b>Aşağıda belirtilen ifadeleri katılım durumunuza göre cevaplayınız. (1-kesinlikle katılmıyorum, 2-katılmıyorum, 3-ne katılıyorum ne katılmıyorum, 4- katılıyorum, 5- kesinlikle katılıyorum)</b> | <b>1- Kesinlikle Katılmıyorum</b> | <b>2- Katılmıyorum</b> | <b>3- Ne Katılıyorum Ne Katılmıyorum</b> | <b>4- Katılıyorum</b> | <b>5- Kesinlikle Katılıyorum</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------|------------------------------------------|-----------------------|----------------------------------|
| 1. Bu işletme, ürün hacmi açısından esnekler.                                                                                                                                                      |                                   |                        |                                          |                       |                                  |
| 2. Bu işletme, üretim süreçleri, ürün modelleri ve yapılandırmaları açısından esnekler.                                                                                                            |                                   |                        |                                          |                       |                                  |
| 3. Bu işletme organizasyonel sorunlarda esnekler.                                                                                                                                                  |                                   |                        |                                          |                       |                                  |
| 4. Bu işletme, esnek iş gücüne sahiptir.                                                                                                                                                           |                                   |                        |                                          |                       |                                  |
| 5. Bu işletme, pazar değişikliklerini algılamak ve tahmin etmek için gerekli yeteneklere sahiptir.                                                                                                 |                                   |                        |                                          |                       |                                  |
| 6. Bu işletme, değişiklikleri üretim süreçlerine ve sistemlerine dahil etmek için hemen tepki verir.                                                                                               |                                   |                        |                                          |                       |                                  |

|                                                                                                                                                 |  |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 7. Bu işletme, değişimleri düzeltme ve adaptasyon yeteneğine sahiptir.                                                                          |  |  |  |  |  |
| 8. Bu işletme, hızla yeni ürünleri pazara sunabilir.                                                                                            |  |  |  |  |  |
| 9. Bu işletme, ürünleri müşterilere zamanında teslim etme ve teslimat gereksinimlerindeki değişikliklere hızla yanıt verme becerisine sahiptir. |  |  |  |  |  |
| 10. Bu işletmenin üretim süreçlerini hızlandırma becerisi vardır.                                                                               |  |  |  |  |  |
| 11. Bu işletmenin stratejik vizyonu, piyasa değişikliklerine yanıt vermek için esnek ve çevik olma ihtiyacını vurgular.                         |  |  |  |  |  |
| 12. Bu işletme, müşteri talebindeki değişikliklere hızlı bir şekilde yanıt vermek için uygun teknolojiye ve teknolojik yeteneklere sahiptir.    |  |  |  |  |  |
| 13. Bu işletme, müşterilerinin talep ettiği ürün kalitesini karşılama hatta talep edilen kalite seviyesini aşma yeteneklerine sahiptir.         |  |  |  |  |  |

| <b>Aşağıda belirtilen ifadeleri katılım durumunuza göre cevaplayınız. (1-kesinlikle katılmıyorum, 2-katılmıyorum, 3-ne katılıyorum ne katılmıyorum, 4- katılıyorum, 5- kesinlikle katılıyorum)</b> | <b>1- Kesinlikle Katılmıyorum</b> | <b>2- Katılmıyorum</b> | <b>3- Ne Katılıyorum Ne Katılmıyorum</b> | <b>4- Katılıyorum</b> | <b>5- Kesinlikle Katılıyorum</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------|------------------------------------------|-----------------------|----------------------------------|
| Ana müşterilerimizle piyasa bilgileri hakkında bilgi paylaşımımız yüksek düzeydedir.                                                                                                               |                                   |                        |                                          |                       |                                  |
| Ana müşterilerimizle bilgi teknolojileri aracılığıyla bilgi paylaşıyoruz.                                                                                                                          |                                   |                        |                                          |                       |                                  |
| Ana müşterilerimizle talebin görünürlüğünü tahmin etmek için yüksek düzeyde ortak planlama ve tahminleme yapmaktayız.                                                                              |                                   |                        |                                          |                       |                                  |
| Müşterilerimiz bize tedarik ve üretim süreçleri ile ilgili bilgi verir.                                                                                                                            |                                   |                        |                                          |                       |                                  |
| Müşterilerimiz, ürün geliştirme süreçlerimizde yer almaktadır.                                                                                                                                     |                                   |                        |                                          |                       |                                  |
| Ana tedarikçilerimizle bilgi teknolojileri aracılığıyla bilgi paylaşıyoruz.                                                                                                                        |                                   |                        |                                          |                       |                                  |
| Tedarikçilerimizle yüksek derecede stratejik ortaklığa sahibiz.                                                                                                                                    |                                   |                        |                                          |                       |                                  |
| Tedarikçilerimizle hızlı yanıt sipariş süreçleri elde etmek için yüksek düzeyde ortak planlama yaparız.                                                                                            |                                   |                        |                                          |                       |                                  |
| Tedarikçilerimiz bize üretim ve satın alma süreçleri hakkında bilgi verir.                                                                                                                         |                                   |                        |                                          |                       |                                  |
| Tedarikçilerimiz, ürün geliştirme süreçlerimizde yer alır.                                                                                                                                         |                                   |                        |                                          |                       |                                  |
| Diğer bölümlerin ihtiyaçlarına hızlı yanıt verme becerisine sahibiz.                                                                                                                               |                                   |                        |                                          |                       |                                  |
| Tesisimiz içerisinde fonksiyonların birbirlerine entegre olduğu bir sistem bulunmaktadır.                                                                                                          |                                   |                        |                                          |                       |                                  |
| Tesisimizde satın alma, envanter yönetimi, satış ve dağıtım departmanları arasındaki bilgi akışına önem veririz.                                                                                   |                                   |                        |                                          |                       |                                  |

|                                                                                                                        |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| Tesisimizde üretim, paketleme, depolama ve nakliye departmanları arasındaki entegrasyona (fiziksel akış) önem veririz. |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

| Lütfen şirketinizin performansını sektör ortalamasına ve rakabetçilerine göre aşağıdaki alanların her birinde derecelendirin. | Sektör ortalamasının çok altında | Sektör ortalamasının altında | Sektör ortalamasıyla aynı | Sektör ortalamasının üstünde | Sektör ortalamasının çok üstünde |
|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------|---------------------------|------------------------------|----------------------------------|
| 1. Son 3 yılda ortalama yatırım getirisi (Average Return on Investment)                                                       |                                  |                              |                           |                              |                                  |
| 2. Son 3 yıldaki ortalama kâr.                                                                                                |                                  |                              |                           |                              |                                  |
| 3. Son 3 yılda kâr artışı.                                                                                                    |                                  |                              |                           |                              |                                  |
| 4. Son 3 yıldaki ortalama satış getirisi (Average return on sales)                                                            |                                  |                              |                           |                              |                                  |
| 5. Müşteri memnuniyeti                                                                                                        |                                  |                              |                           |                              |                                  |
| 6. Ürün özelleştirme (product customization)                                                                                  |                                  |                              |                           |                              |                                  |
| 7. Teslimat hızı                                                                                                              |                                  |                              |                           |                              |                                  |
| 8. Lojistik maliyeti                                                                                                          |                                  |                              |                           |                              |                                  |
| 9. Teslimat güvenilirliği                                                                                                     |                                  |                              |                           |                              |                                  |
| 10. Duyarlılık (Responsiveness)                                                                                               |                                  |                              |                           |                              |                                  |
| 11. Sipariş Esnekliği                                                                                                         |                                  |                              |                           |                              |                                  |
| 12. Teslimat Esnekliği                                                                                                        |                                  |                              |                           |                              |                                  |
| 13. Sipariş doldurma kapasitesi                                                                                               |                                  |                              |                           |                              |                                  |
| 14. Önceden gemi bildirimi (Advance Ship Notification)                                                                        |                                  |                              |                           |                              |                                  |
| 15. Envanter dönüşü                                                                                                           |                                  |                              |                           |                              |                                  |
| 16. Varlıkların getirisi (Return on asset)                                                                                    |                                  |                              |                           |                              |                                  |

| Aşağıda belirtilen ifadeleri katılım durumunuza göre cevaplayınız. (1-kesinlikle katılmıyorum, 2-katılmıyorum, 3-ne katılıyorum ne katılmıyorum, 4-katılıyorum, 5- kesinlikle katılıyorum) | 1- Kesinlikle Katılmıyorum | 2- Katılmıyorum | 3- Ne Katılıyorum Ne Katılmıyorum | 4- Katılıyorum | 5- Kesinlikle Katılıyorum |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|-----------------------------------|----------------|---------------------------|
| Çalışanlar, öğrenmek için birbirine yardımcı olur.                                                                                                                                         |                            |                 |                                   |                |                           |
| Çalışanlara öğrenme için yeterli zaman tahsis edilir.                                                                                                                                      |                            |                 |                                   |                |                           |
| Çalışanlar, öğrenme için ödüllendirilir                                                                                                                                                    |                            |                 |                                   |                |                           |
| Çalışanlar, birbirlerine dürüst ve açık geri besleme verir.                                                                                                                                |                            |                 |                                   |                |                           |
| Kişi kendi görüşlerini söylediğinde, diğerlerinin de düşüncesini sorar.                                                                                                                    |                            |                 |                                   |                |                           |
| Çalışanlar, karşılıklı güven ortamı sağlamak için zamanını harcar.                                                                                                                         |                            |                 |                                   |                |                           |
| Bölüm/departmanlar, kendi hedeflerini ihtiyaçları doğrultusunda uyarlama serbestisine sahiptir.                                                                                            |                            |                 |                                   |                |                           |

|                                                                                                                     |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| Bölüm/departmanlar, elde edilen bilgilere ya da grup tartışmalarına göre görüşlerini gözden geçirirler.             |  |  |  |  |  |
| Bölüm/departmanlar, organizasyonun onların önerilerini dikkate alacağından emindir.                                 |  |  |  |  |  |
| Kurumun hali hazırdaki ve beklenen performans arasındaki farkı tespit edecek ölçme sistemleri kurar.                |  |  |  |  |  |
| Kurumun, problemlerden elde ettiği derslerin tüm çalışanlar tarafından öğrenilmesini sağlar.                        |  |  |  |  |  |
| Kurumun, öğrenme için harcanan kaynakların ve zamanın değerlendirilmesini yapar.                                    |  |  |  |  |  |
| Kurumum, çalışanların inisiyatif almasını onaylar.                                                                  |  |  |  |  |  |
| Kurumum, çalışanların görevlerini yaparken ihtiyaç duyacakları kaynaklar üzerinde kontrol sahibi olmalarını sağlar. |  |  |  |  |  |
| Kurumum, kabul edilebilir risk alan çalışanları destekler.                                                          |  |  |  |  |  |
| Kurumum, çalışanların geniş çaplı bir perspektifle düşünmesini teşvik eder.                                         |  |  |  |  |  |
| Kurumum, ortak ihtiyaçları karşılamak için farklı organizasyonlarla birlikte çalışır                                |  |  |  |  |  |
| Kurumum, çalışanların bir problemi çözerken tüm kurum içinden cevap ve destek almasını teşvik eder.                 |  |  |  |  |  |
| Liderler, astlarını yetiştirmek için çaba gösterir.                                                                 |  |  |  |  |  |
| Liderler, sürekli olarak öğrenme için fırsat ararlar.                                                               |  |  |  |  |  |
| Liderler, kurumun faaliyetlerinin benimsenen değerlerle uyumlu olmasını sağlarlar.                                  |  |  |  |  |  |

## APPENDIX 3: CURRICULUM VITAE

### Education

- University of Dokuz Eylül, Business Faculty, Business Administration Department, (2011-2016)
- University of Economics in Katowice (Erasmus Program) (2015-2016)
- University of Dokuz Eylül, Social Science Institutions, Business Administration (MBA-with thesis) (2016-2018)

### Academic Publications

- **Ülker**, Y. (2023). Enhancing Supply Chain Integration (SCI) with Company (Crew) Resource Management (CRM): A Conceptual Framework Proposition *Journal of Organizational Behavior Review*, 5 (2) , 173-189. Retrieved from <https://dergipark.org.tr/tr/pub/jobreview/issue/79091/1252376>.
- Dursun, E., **Ülker**, Y. and Gunalay, Y. (2022), "Blockchain's potential for waste management in textile industry", *Management of Environmental Quality*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/MEQ-03-2022-0085>. (**Scopus, Q1**)
- Azer, Ö.A., **Ülker** Y. and Min, W. (2021). The Strategic Importance of The "Belt and Road Initiative" Connectivity with The "Middle Corridor" Program in Turkey. *Journal of Security Sciences*, 10(2), ss.543-566, doi:10.28956/gbd.1028717.
- **Ülker**, Y. (2019) "The Perception of Employees on Psychological Contract and Its Relation with Innovative Work Behavior" *İnsan ve Toplum Bilimleri Araştırmaları Dergisi* , 8 (4) , 3096-3113 . DOI: 10.15869/itobiad.621699
- Bacaksız, P. & **Ülker**, Y. (2017) "Context and Interaction between Social Innovation and Collaborative Consumption: The Conceptual Study". *Journal of Social and Humanities Sciences Research*, 4(5), pp.1856-1860.

### Ongoing Publications

- Ülker, Y. & Demirel, B. (2023), "The Sustainability Integration, Barriers and the Perceptions in the Supply Chain: Case from a Developing Country", **Under revision of Global Sustainability Journal**".

### Conferences (Full Published Papers)

- **Ülker**, Y. & Demirel, B. (2021) "Exploring the Sustainable Supply Chain Integration: A Case Study of Dogus Group" *19th International Logistics and Supply Chain Congress*, October 21-22, 2021.
- Dursun, E., **Ülker**, Y. & Gunalay, Y. (2021) "Blockchain's Potential for Waste Management in Textile Sector" *19th International Logistics and Supply Chain Congress*, October 21-22, 2021.
- **Ülker**, Y. & Şengelen, H. E. (2018) "Entrepreneurship, innovation and

competitiveness effects on economic growth in different economic ecosystems: GEM and GCR data evidence". *ICONACH, 2nd International Conference on New Approaches in Social Sciences and Humanities*.

- **Ulker, Y. & Şengelen, H. E. (2018)** "The Role Of Social Entrepreneurship on Sharing Economy". *RESSCONGRESS, 2nd International Symposium of Educational Sciences and Social Sciences*

### Traineeships

- Erasmus Traineeship: Les Amis La Giraudiere/ Project Management Assistant (France/ July, 2022- Sept, 2022)
- Erasmus Traineeship: Università Popolare Anidra (ICARO) /Web Marketing Intern (Italy/July, 2017- Sep, 2017)
- British Town Language School/ English Teacher (Nov,2016- March, 2017)
- Internship at Maxion İnci Jant A.Ş. Company/ Logistic Intern (July-Sept, 2015)
- Internship at Glokal Dış Ticaret Ltd.Şti. Company/ Foreign Trade Intern (July-Sept, 2014)

### Courses / Workshops/ Certificates

- Erasmus Program for University Staff, University of Free State, Bloemfontein, South Africa (2023)
- Ph.D. workshop (Agility Program) in Poznan University of Technology, 2022 (Poland), Fully-funded.
- Ph.D. workshop at SGH Warsaw School of Economics, 2022 (Poland), Fully-funded.
- Erasmus Program for University Staff, Krakow University of Economics, Poland / International Week Program (2018)
- Erasmus Program for University Staff, Siauliai State College, Lithuania / International Week Program (2019)
- Chinese Course For Beginners, Tallinn University, Estonia, 2016
- Youth In Action Programme (Erasmus Projects : Moldova and Canakkale) / (2013-2015)
- Cape English Language School (Cape Town/ South Africa), 2012

### Languages

- Turkish (Mother Language)
- English (Advanced/ Proficiency Level)
- Italian (Pre Intermediate)
- French (Pre Intermediate)