

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE
ENGINEERING AND TECHNOLOGY

**DETERMINING THE IMPORTANCE OF SUSTAINABLE SUPPLY CHAIN
MANAGEMENT AND ITS CONTRIBUTION TO COMPETITIVE
ADVANTAGE OF LOGISTIC FIRMS**



M.Sc. THESIS

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Department of Management Engineering

Management Engineering Programme

June 2018

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**SÜRDÜRÜLEBİLİR TEDARİK ZİNCİRİ YÖNETİMİNİN ÖNEMİ VE
LOJİSTİK FİRMALARININ REKABETÇİ AVANTAJINA KATKISI**

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To my parents



FOREWORD

This report is my graduation research project for the master degree of management engineering program in Istanbul Technical University. The research is conducted at management engineering department of Istanbul technical university between October 2017 and May 2018. I would like to express my sincere gratitude to my first supervisor Assoc. Prof. Dr. Hatice Camgoz Akdag for her great support and guidance during my research process, and her continuous encouragement during hard times of my research. Also, I would like to express my sincere gratitude for my co-advisor Assoc. Prof. Dr. Jafar Rezaei for his invaluable feedbacks on every step of my research project. I would like to thank Tuğçe Beldek, for her great support during my thesis project. Moreover, I would like to thank my parents for their continuous support and absolute patience during these months while I was working on my graduation project.

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ABBREVIATIONS

App	: Appendix
BSC	: Balance Score Card
BWM	: Best Worst Method
CSR	: Corporate Social Responsibility
LSP	: Logistic Service Provider
MCDM	: Multi-Criteria Decision Making Method
SCM	: Supply Chain Management
SSCM	: Sustainable Supply Chain Management
SBSC	: Sustainable Balance Score Card
3PL	: Third Party Logistic



SYMBOLS

w_n^*	: Optimal weights
A_B	: The result vector of best criteria over all other criteria
a_{Bj}	: The preference of the best criterion over the criterion j
A_w	: The result vector of all other criteria over the worst criteria
a_{jw}	: The preference of option j over the worst criterion





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DETERMINING THE IMPORTANCE OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT AND ITS CONTRIBUTION TO COMPETITIVE ADVANTAGE OF LOGISTIC FIRMS

SUMMARY

Today as never before, there is considerable attention and concern over environmental and ecological issues. Social, economic and environmental aspects of every enterprise have drawn the attention of managers and public. Business practices regarding sustainability are gaining growing attention and the applicable initiatives lead to competency for firms. Considering the role of competitive strategies for implementing the sustainability initiatives requires deep Investigation from both Industry and academic level.

The intensified competition among the organizations to become global and environmental friendly, causes supply chain managers to contemplate a group of elements upstream and downstream side of the of their supply chain. Recognition of sustainable supply chain management enforces firms to contemplate SSCM as an excellence flag to maximize the profit level, manage the risk possibility and reach an outstanding brand image. Sustainable supply chain management is defined in literature as “The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short and long-term”. SSCM’s target is to distribute enhanced quality level of products and services while increasing efficiency, customer satisfaction, waste and cost reduction and act environmental-friendly. Previous studies are mainly focused on investigating the role of operational tools that can improve environmental performance of the firms. There is a need to increase the understanding of the relationship between competitive strategies and sustainable supply chain management initiatives. Furthermore, recent literature implies that shippers' demands for environmental-friendly logistics services are also increasing. Although the green supply chain management field has been rapidly evolving for the past 20 years, there still exists significant necessity for further development. In this research, based on the delineated characteristics and attributes of SSCM, the final objective would be to specify the most contributing factors of social, economic and environmental pillars of sustainable supply chain management and figure out how these would prepare the prerequisite for competitive advantage to the firms. Through the comprehensive literature review, it has been tried to figure out the most and highly cited indicators of sustainability pillars. There was a vast amount of indicators mentioned for each pillar of sustainability through the supply chain management literature, which are presented later with their related references. It has been tried to select the most pertaining and effective indicators, which will elaborate the importance of sustainability initiatives. A preset of

indicators were prepared for each pillar of SSCM and later these indicators were discussed with expert logistic consultants and practitioners. The final set of indicators are prepared considering feedbacks from expert and scholars in supply chain and logistics field. Beside this the most common and efficient competitive strategies which are highly mentioned by studies through the last years are investigated. From all these studies, the highly cited competitive strategies are those which are introduced by Porter, namely as cost leadership strategy and differentiation leadership strategy. In this research, cost leadership and differentiation strategies are selected as two main categories of competitive strategies which are implemented by firms. Then three pillars of sustainability are classified considering two competitive strategies. Social and environmental initiatives of sustainability are categorized as differentiation strategies and economic initiatives of sustainability are categorized as cost leadership strategy. Differentiation strategies are explained as the initiatives or actions which are implemented to offer a unique product or service. Considering the defined purpose of differentiation strategy, the social and environmental initiatives which are taken into account by firms while designing to make their supply chain more sustainable could offer their customers a unique type of service, which will in turn improve their brand image, customer satisfaction level and eventually competitiveness in the market. Cost leadership strategies are defined as the tremendous effort which is shown by organizations in lowering their costs. Regarding this definition economic initiatives of sustainability are pertaining to any actions or plans which could lower the expenses of organization's operations. It is necessary to mention that in some cases implementation of sustainability initiatives might increase the costs of organizations at first point but in long term this will result in saving additional cost for organizations. For instance, green building and fuel-efficient cars are two cases which requires initial investment by firms which in long-term would control fuel consumption level and lower the allocated budget amount for such expenses. Considering the nature of the research and the diversity of indicators for assessment, a multi-criteria decision making method is selected as the methodology approach of this research project. Since there was no secondary data available for this research the primary data is collected through questionnaire. The questionnaire is prepared in two language, Turkish and English via google forms. The questionnaire is distributed to mainly two group of respondents, which were experts (scholars) and industry people. The experts were including the academicians with expertise in sustainability, logistics and supply chain management and logistics consultants. The industry group of respondents were including, logistic practitioners, supply chain managers, retailers, shippers and logistics managers. The questionnaire is distributed via email, phone call, face to face interview and LinkedIn contacts. Through LinkedIn it has been tried to contact the related people who has experience in logistics and supply chain management investigating their profile and written experiences. Beside this, the international logistics and service provider companies in Istanbul are contacted to inquire for their cooperation in our data collection process. The implemented methodology is a multi-criteria decision making method which is called Best Worst Method. The method is firstly defined by Rezaei, and has been applied to many research since 2015. The defined indicators for each pillar of sustainability are received their weights which are calculated based on the collected information from respondents via questionnaires. Then considering these weights the indicators are prioritized and their importance level is elaborated from market and firm point of view. The comparison analysis among these factors and their achieved weights is implemented and explained in chapter four of this research. These results are useful for firms and organizations which are seeking to figure out which

indicators have the higher level of importance. In order to the point that there is a vast amount of indicators for sustainability measures, it is crucial to figure out the most influencing and applicable indicators for organization. The different level of importance of indicators which could be applied to improve sustainability performance of firms necessitates that organizations must investigate on the most pertaining indicators for their organizations. The results of this research project elaborates the existing doubts and concerns from market point of view while assessing their suppliers or service providers. Deliberation of these requirements from market side, would clarify the most efficient and applicable initiatives, so the organizations could chose precisely about their strategies and investments. The study would also delineate the importance of competitive advantages which are the result of sustainability initiatives that protects and improves firm's position in the competing market.





SÜRDÜRÜLEBİLİR TEDARİK ZİNCİRİ YÖNETİMİNİN ÖNEMİ VE LOJİSTİK FİRMALARININ REKABETÇİ AVANTAJINA KATKI BELGESİ

ÖZET

Bugün hiç olmadığı kadar, çevresel ve ekolojik konular üzerinde kayda değer bir ilgi ve endişe bulunmaktadır. Her işletmenin sosyal, ekonomik ve çevresel yönleri yöneticilerin ve kamuoyunun dikkatini çekmiştir. Sürdürülebilirliğe ilişkin iş uygulamalarına olan ilgi giderek artmakta ve uygulanabilir girişimler firmaların yetkinliğine öncülük etmektedir. Sürdürülebilirlik girişimlerinin uygulanmasına yönelik rekabetçi stratejilerin rolü göz önünde bulundurulduğunda, hem endüstriyel hem de akademik derin bir araştırma yapılması gerekmektedir. Organizasyonlar arasında küresel olma ve çevre dostu hale gelme rekabetinin artması, tedarik zinciri yöneticilerinin tedarik zincirinin aşağı ve yukarı akışları boyunca bir grup unsuru düşünmelerine neden olmaktadır. Sürdürülebilir tedarik zinciri yönetiminin tanınması, firmaların Sürdürülebilir Tedarik Zinciri Yönetimi'ni kar seviyesini en üst düzeye çıkarmak, risk olasılığını yönetmek ve olağanüstü bir marka imajına ulaşmak için bir mükemmellik bayrağı olarak tasarlamasını zorunlu kılmaktadır. Sürdürülebilir tedarik zinciri yönetimini şöyle tanımlamıştır: “Ürünlerin tedariki, üretimi ve dağıtımı ile ilgili malzeme, bilgi ve sermaye akışlarını verimli ve etkin bir şekilde yönetecek şekilde tasarlanan temel örgütler arası iş sistemleriyle ekonomik, çevresel ve sosyal konuların gönüllü olarak bütünleştirilmesi yoluyla koordine edilmiş tedarik zincirlerinin oluşturulması veya paydaşların ihtiyaçlarını karşılamak ve kısa ve uzun vadede kurumun karlılığını, rekabet gücünü ve esnekliğini geliştirmek için yapılan hizmetlerdir.”

Sürdürülebilir Tedarik Zinciri Yönetimi yüksek kalitede ürün ve hizmet dağıtımı ile verimliliği ve müşteri memnuniyetini artırmayı, atık ve maliyeti azaltmayı ve çevre dostu olmayı hedefler. Yapılan çalışmalar ağırlıklı olarak firmaların çevresel performansını artırabilecek operasyonel araçların rolünü araştırmaya odaklanmıştır. Rekabet stratejileri ile sürdürülebilir tedarik zinciri yönetimi girişimleri arasındaki ilişkinin anlaşılmasını arttırmaya ihtiyaç vardır. Ayrıca, yakın zamandaki literatür araştırması, sevkiyatçıların çevre dostu lojistik hizmetleri taleplerinin de arttığını göstermektedir. Yeşil tedarik zinciri yönetimi alanı son 20 yıldır hızla gelişmesine rağmen, daha fazla gelişme için hala önemli bir ihtiyaç bulunmaktadır. Literatür taramasında da değinildiği gibi, çevresel izleme ve Yeşil Tedarik Zinciri Yönetimi ile işbirliğine dayanan diğer yaklaşımlar arasında önemli farklılıklar bulunmaktadır. Mevcut çalışmalarda her iki uygulama türünü de dikkate alan bir azınlık olduğu açıktır. Dahası, çevre sorunlarına karşı kamu bilincinin artması, yöneticilerin kendi ürünleri ve üretim süreçlerinde çevresel sorunlarla başa çıkmalarını zorunlu kılmıştır. Organizasyonlar, Sivil Toplum Kuruluşları, devlet kurumları, işçiler ve son müşteriler de dahil olmak üzere çeşitli paydaşlardan gelen çevresel konulara ilişkin bir grup soruşturma ile karşı karşıyadır. Rekabetçi tedarik zinciri yönetimi, firmaların pazarda rekabetçi kalması için zorunlu bir ön şarttır, çünkü rekabet kuruluşlar arasında değil, tedarik zincirleri içinde yer almaktadır. Birçok ve çeşitli paydaşların artan baskısı,

örgütlerin faaliyetlerinin ekonomik, çevresel ve sosyal yönlerini ele almalarına neden olmuştur. Bu durum, sürdürülebilirlik kavramının önemine ve bununla ilgili uygulamalara yol açmaktadır. Sürdürülebilirlik, (WCED, 1987), geleceğin nesillerinin kendi ihtiyaçlarını karşılayabilme yeteneğinden ödün vermeden, bugünün ihtiyaçlarını karşılayacak kaynaklardan yararlandığı şekilde tanımlanmaktadır. İşletmelerde sürdürülebilirlik için sekiz tanım kategorize edilmiştir. Literatürde iş dünyasındaki sürdürülebilirliğin özellikleri şu şekilde belirlenmiştir: ekonomik odak, çevresel odak, sosyal odak, paydaş odak, gönüllü odaklılık, esneklik ve uzun vadeli odaklanma. Tedarik Zinciri Yönetimi'nin temel özellikleri, akış odağı, koordinasyon odağı, paydaş odak noktası, ilişki odağı, değer odağı, verimlilik odağı ve performans odağı olarak tanımlanmaktadır. Sürdürülebilir tedarik zinciri yönetimi kavramı, bu tüm ilgili unsurlarla birlikte kabul edilmelidir. Sürdürülebilir tedarik zinciri yönetimi (SSCM) ve yeşil tedarik zinciri yönetimi (GSCM) kavramı ortaya çıktığı ve yazarların dikkatini çektiği için, her bir kavramın kesin tanımını netleştirmek için bazı araştırmalar yapılmıştır. Bu çalışmada, Sürdürülebilir Tedarik Zinciri Yönetimi'nin belirlenmiş özelliklerine dayanarak, nihai hedef sürdürülebilir tedarik zinciri yönetiminin sosyal, ekonomik ve çevresel özelliklerinin en çok katkıda bulunan faktörlerini belirlemek ve bunların firmalara rekabet avantajını nasıl sağlayacağını ortaya koymaktır. Yapılan kapsamlı literatür çalışması ile, en fazla atıf alan, sürdürülebilirliğin önemli kişilerinin göstergeleri ortaya çıkmıştır. Tedarik zinciri yönetimi literatüründe yer alan sürdürülebilirliğin belirtilmiş olan birçok göstergesi ileride ilgili referanslarla sunulmuştur. Sürdürülebilirlik inisiyatiflerinin önemini vurgulayacak en doğru ve etkili göstergeler seçilmeye çalışılmıştır. Sürdürülebilir Tedarik Zinciri Yönetimi'nin her bir ayağı için, önceden göstergeler hazırlanmış ve daha sonra bu göstergeler uzman lojistik danışmanları ve uygulayıcıları ile tartışılmıştır. Son gösterge seti, tedarik zinciri ve lojistik alanındaki uzman ve akademisyenlerden alınan geri bildirimler dikkate alınarak hazırlanmıştır. Bunun yanı sıra, son yıllarda yapılan çalışmalarla en çok dile getirilen en yaygın ve verimli rekabet stratejileri araştırılmıştır. Tüm bu çalışmalardan en çok atıf alan rekabet stratejileri Porter tarafından maliyet liderliği ve farklılaştırma liderliği olarak adlandırılmıştır. Bu araştırmada, maliyet liderliği ve farklılaşma stratejileri, firmalar tarafından uygulanan iki ana strateji kategorisi olarak seçilmiştir. Daha sonra, bu iki rekabetçi strateji göz önünde bulundurularak sürdürülebilirliğin üç ayağı sınıflandırılmıştır. Sürdürülebilirliğin sosyal ve çevresel inisiyatifleri farklılaşma stratejileri olarak ve sürdürülebilirliğin ekonomik inisiyatifleri maliyet liderliği stratejileri olarak kategorize edilmiştir. Farklılaşma stratejileri, benzersiz bir ürün veya hizmet sunmak için uygulanan girişimler veya eylemler olarak açıklanmaktadır. Farklılaşma stratejisinin tanımlanmış olan amacını göz önünde bulundurarak, tedarik zincirlerini daha sürdürülebilir hale getirmek için tasarlarken firmaların göz önünde bulundukları sosyal ve çevresel inisiyatifler, müşterilerine benzersiz bir hizmet türü sunacak, bu da marka imajını ve müşteri memnuniyetini geliştirerek aynı zamanda pazardaki rekabet avantajını da artıracaktır. Maliyet liderliği stratejileri, kuruluşların maliyetlerini düşürmede gösterdikleri muazzam çaba olarak tanımlanmaktadır. Bu tanımdan yola çıkılarak, sürdürülebilirliğin ekonomik inisiyatifleri, kurumun faaliyetlerinin giderlerini azaltabilecek herhangi bir eylem veya planla ilgili olduğu söylenebilir. Bazı durumlarda, sürdürülebilirlik inisiyatiflerinin uygulanmasının, kuruluşların maliyetlerini ilk noktada artırabileceğini belirtmek gerekir, ancak uzun vadede bu, kuruluşlar için ek maliyet tasarrufu sağlayacaktır. Örneğin, yeşil bina ve yakıt tasarruflu araçlar, uzun vadede yakıt tüketimi seviyesini kontrol edebilecek ve bu harcamalar için tahsis edilen bütçe miktarını düşürebilecek firmaların ilk yatırımını

gerektiren iki durumdur. Araştırmanın niteliği ve değerlendirme için göstergelerin çeşitliliği göz önüne alındığında, bu araştırma projesinin metodoloji yaklaşımı olarak çok kriterli bir karar verme yöntemi seçilmiştir. Bu araştırma için ikincil veri bulunmadığından, birincil veriler anket yoluyla toplanmıştır. Anket, Google formları aracılığıyla Türkçe ve İngilizce olarak iki dilde hazırlanmıştır. Anket, çoğunlukla akademisyen ve endüstri uzmanı olan iki katılımcı grubuna dağıtılmıştır. Akademisyenler, sürdürülebilirlik, lojistik ve tedarik zinciri yönetimi konusunda uzmanlığa sahip olan kişilerden seçilmiştir. Ankete katılan endüstri grubu ise lojistik danışmanları, lojistik pratisyenleri, tedarik zinciri yöneticileri, perakendeciler, sevkiyatçılar ve lojistik yöneticilerini kapsamaktadır.

Anket, e-posta, telefon görüşmesi, yüz yüze görüşme ve LinkedIn iletişimiyle dağıtılmıştır. LinkedIn kullanarak, lojistik ve tedarik zinciri yönetiminde araştırma yapan ve yazılı deneyimleri ilgili kişilerle iletişim kurmaya çalışılmıştır. Bunun yanı sıra, veri toplama sürecinde işbirliği yapabilmek için İstanbul'daki uluslararası lojistik ve servis sağlayıcı firmalarla bağlantıya geçilmiştir. Uygulanan metodoloji, Best Worst Method olarak adlandırılan çok kriterli bir karar verme yöntemidir. Yöntem ilk olarak Rezaei, tarafından tanımlanmıştır ve 2015'ten beri birçok araştırmaya uygulanmıştır. Sürdürülebilirliğin her bir ayağının tanımlanmış göstergelerine, anket yoluyla katılanlardan toplanan bilgilere dayanarak hesaplanan ağırlıklar verilmiştir. Daha sonra bu ağırlıklar göz önünde bulundurularak göstergelere öncelik verilmiş ve bunların önem düzeyi piyasa ve firma bakış açısından detaylandırılmıştır. Bu sonuçlar, hangi göstergelerin daha yüksek öneme sahip olduğunu bulmaya çalışan firmalar ve kuruluşlar için yararlı olmuştur. Sürdürülebilirlik önlemleri için çok miktarda göstergelerin olduğu noktadan hareketle, organizasyon için en etkili ve en uygulanabilir göstergeleri belirlemek çok önemlidir. Firmaların sürdürülebilirlik performansını arttırmak için uygulanabilecek göstergelerin farklı düzeydeki önemi, kuruluşlarının en uygun göstergelerini araştırmak zorunda kalmasını gerektirmektedir.

Bu araştırma projesinin sonuçları, tedarikçileri veya hizmet sağlayıcılarını değerlendirirken mevcut endişeleri piyasa bakış açısından detaylandırmaktadır. Bu gereksinimlerin pazar tarafından düşünülmesi, en verimli ve uygulanabilir girişimleri açıklığa kavuşturacak, böylece kuruluşlar stratejilerini ve yatırımlarını tam olarak seçebileceklerdir. Çalışma aynı zamanda firmanın rakip pazardaki konumunu koruyan ve geliştiren sürdürülebilirlik inisiyatiflerinin sonucu olan rekabet avantajlarının önemini de açıklayacaktır.

1. INTRODUCTION

R. and L. (2009) described Supply Chain Management as “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction”. The defined explanation of SCM clarifies the complexity of the process through a firm’s supply chain and the diverse effects of it on the environment and society. As sustainable development is gaining more and more attention in recent years in industry and society, there grows the necessity of a clear set of indicators and how they could be measured to assess the progress. Efforts are taking place to design and define metrics, to grasp the explicit meaning of sustainability ideas and transfer these meanings to a set of quantitative measures. Terms of “indicators” and “metrics” are used interchangeably in literature which are about sustainability arguments (Tanzil & Beloff, 2006). Metrics and indicators are recognized as practical tools to assess and evaluate the progress of sustainability initiatives (Ahi & Searcy, 2015a). There are variety of predefined and relative metrics, such as Global Reporting Initiatives, that provides a set of defined metrics regarding the sustainability context (GRI, 2015). In this research, it has been tried to clarify the most important factors of sustainable development for logistic firms and the relation between sustainability initiatives and competitive advantage of firms. Type of implemented competitive strategies by firms are investigated in this research to elaborate its relation with sustainability initiatives. In literature most of the definitions of competitive strategies are based on Porter, (1980) work which defined two generic strategies to achieve a higher level performance; cost leadership and differentiation (Laari et al., 2017; H. E. Salavou, 2015). In this research, cost and differentiation are taken as the base of classifications for sustainability pillars. The initial design of sustainability pillars classification based on competitive strategies is

presented in Figure 1.1 . Differentiation strategies are classified from two perspective, which are market and firm. The classification of sustainability pillars base on competitive advantage strategies is implemented regarding (Fraj-Andrés et al ., 2009; Gimenez et al ., 2012; Longoni & Cagliano, 2015; Longoni et al ., 2014; Purba & Diane, 2005; Laari et al ., 2017) work. The social and environmental pillars are considered as differentiation strategies from market and firms perspective. Market differentiating strategy defines the social and environmental factors, which are critical from market perspective. Firm capability differentiating strategy defines what type of social and environmental strategies should be implemented by firms to be sustainable and gain competitiveness. Cost strategy of competitiveness is related to economic pillar of sustainability, and the factors are investigated considering the implementation of aforementioned strategies from market and firm's capability strategies for both social and environmental pillar. The interaction between each of these factors from market and firm side are investigated and how these interactions would affect economic pillar is considered as a base to define economic factors. The necessity of a clear and precise set of indicators and the existing paucity in the literature about those indicators highlights the final objective of this research, which is clarified in the following section. To conclude, this research will investigate how firms and people with logistics and supply chain related backgrounds, perceive the diverse criteria of sustainable development and how they prioritize these different criteria considering their competitiveness. The selected criteria for assessment in this research are including, pollution level, customer satisfaction, legislation, philanthropy and greening expenses. The data of the research will be conducted through online questionnaire, from two main category of respondents; experts and industry . Best Worst Method as one the multi-criteria decision making methods will be applied as the methodology of this research. The outline of this research is as follow, the first chapter discusses the problem statement, research objective and research questions. Second chapter presents the studied literature about the mostly cited sustainability metrics for supply chain management and also the most applied competitive strategies in logistic firms. In third chapter the applied methodology, data collection process and questionnaire distribution is discussed. Chapter four presents the obtained results and their analysis and finally the conclusion of this research is presented in chapter five



Figure 1.1 Sustainability pillars classification based on competitive strategies.

1.1 Problem Statement

Absence of practical set of factors can contribute to the bewilderment and inefficiency concerning the theory and implementations of sustainable supply chain management initiatives in any of the industry sectors. Investigation on the metrics of SSCM could enable firms and organization to implement the appropriate concepts and enhance the performance level of the business in sustainable development. (Markley & Davis, 2007; Sarkis et al., 2011; Seuring & Müller, 2008a). Consciously, firms are investigating the actions which would result in improved social, environmental and economic outputs (Gimenez et al., 2012; Longoni et al., 2014). The enhanced public awareness regarding environmental issues or market-driven force about being eco-friendly enforces companies to seek for improved sustainability measures (Hussain et al., 2016). Beside this, enhancement of companies' financial performance requires to work jointly with customers to define environmental targets (Laari, Töyli, Solakivi, & Ojala, 2016). Several authors have called for more research on the most influencing factors of SSCM adaptation initiatives (e.g. (Ahi & Searcy, 2015a; Centobelli et al., 2017; Rajeev et al., 2017). Laari et al., (2017), mentioned that there is a research gap on investigation between the green supply chain management and competitive strategies. Longoni and Cagliano (2015) Suggests managerial implications for firms about social and environmental priorities which could be considered as a source of competitiveness in short and long-term planning. Hoejmose et al., (2013) explores the relation between socially responsible SCM and business strategies, and proves the existence of direct and indirect relationship among them. As it is stated above, there is a research demand on the investigation of a clear set of sustainable supply chain initiatives, which could bring superiority to the firms in their competition environment. The necessity of attributes which could enable business to stay profitable is gaining more and more attention as any time before. This is why taking into account different type of initiatives regarding each pillar of sustainability could result in benefit for companies through diverse aspects (Fraj-Andrés et al., 2009; Longoni & Cagliano, 2015). Enhancement of firms' performance level regarding sustainability indicators would result as their flag of excellence in business world. The studied literature clarifies that, there is no clear set of factors and their precise importance level which logistic firms should consider while designing for their supply chain to become more sustainable and gain competitive advantage of it. logistic firms should consider while

designing for their supply chain to become more sustainable and gain competitive advantage of it.

1.1 Research Objective and Research Questions

In this research, we are trying to figure out the most important factors of sustainability initiatives regarding the competitive strategies of logistic firms and to delineate how these factors would result in competitive advantage for firms. Also, the research will elaborate the importance level of these factors and their priority for implementation based on obtained weights with BWM method. The different level of obtained importance for each of these factors would clarify the efficiency and applicability level of factors for firms based on their capabilities and resources. The interaction between each of these factors from the market and firm side are investigated to grasp how firms are trying to respond to market and society demand in sustainable development.

The main research question is:

1. What are the most important and contributing factors of sustainability pillars regarding differentiation and cost leadership competitive strategies of the logistic firm's supply chain?

Sub-questions:

1. What are the competitive strategies of the firm? Which category do they fall in (cost or differentiation)?
2. Is there a homogeneous group of respondents' with the same group of preferences of criteria, considering the type of their competitive strategy?
3. Is there a difference in the rank of each pillar's criterion, by a diverse group of respondents?

1.2 Research Relevance

The impact and result of human activities on the environment cannot be ignored anymore. The increased public awareness and established principles by governments as it is mentioned before urge companies and organizations to improve their actions and facilities to be more environmental-friendly. The enhanced public pressure and awareness toward sustainable development results in a market desire for obtaining

environmental friendly products and services. This leads to a competition in the market among firms toward being more environmental-friendly so that they could grasp their customer's attention and enhance their satisfaction level. Logistic and service providers as one of the organizations with a high level of CO₂ emissions should consider their supply chain activities impact on the environment. Improvements in service industry's supply chain activities toward being more sustainable could only be assessed if there is a clear set of metrics to be measured. Decision makers and policy makers for such organizations could improve their strategies toward sustainability issues if they could comprehend the precise and most influencing factors and their importance level. Thus, this research aims to elaborate on the most important and influencing factors of sustainable supply chain management and their contribution to the competitive advantage of logistics firms. Our study results would delineate the most contributing factors for logistic firms, in order to be more sustainable and competitive.

2. LITERATURE REVIEW

Through the literature a variety of different definitions for Green supply chain management and Sustainable supply chain management exists. There are considerable amount of research in GSCM and SSCM in recent years, and also a number of published literature reviews on these fields (Alison et al., 2012; Cristina & M., 2012; Maisam & Fredrik, 2012; Sarkis et al., 2011; Seuring & Müller, 2008b). The published literature highlights the importance of the research on the GSCM and SSCM and underscores that SCM and its activities has an important impact on the natural environment. This clarifies an ongoing need to a precise and exact definition of these concepts, and the main objective of these concepts. To understand the scope of SSCM activities and comprehend the measurement criteria of such activities, it is necessary to define the contents of SSCM, in a way that could delineate the focus and goal of the concept. For instance, Srivastava, (2007), defines GSCM as “Integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.” Green supply chain practices are activities which are referred to a verity of actions that are performed by organizations to minimize or lower the impact of their activities on the natural environment (Sarkis et al., 2010; Stephan & D., 2006). Taticchi et al., (2014), defined SSCM as: “the management of supply chain operations, resources, information, and funds in order to maximize the supply chain profitability while at the same time minimizing the environmental impact and maximizing the social well-being”. The vast amount of published definitions for SSCM and GSCM points that these concepts are investigated from diverse perspectives and research considered their different angles. Despite the existing definitions of these concepts, several authors underscored the ongoing need for a precise definition of the contents and scope of these concepts. Ahi and Searcy (2013), investigated 12 definitions of SSCM and 22 definitions of GSCM to provide a comprehensive definition for SSCM. They considered seven eminent characteristics of business sustainability and supply chain management through their research. The key characteristics of business sustainability

were including, social, environmental, economic, resilience, long-term focus and the SCM characteristics were compromised of stakeholder, relationships, performance indicators, effectiveness, coordination and flow. Ahi and Searcy (2013) offered the following definition of SSCM: “The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term” (Ahi & Searcy, 2013). Classification of green supply chain practices has been mentioned several times in literature. One of the most broad frameworks for this type of classification has been proposed by Zhu et al. (2008b). Green Supply Chain Practices are categorized by authors into five main categories, which are; “internal environmental management, green purchasing, customer cooperation with environmental concerns, investment recovery, and eco-design dimensions”(Sara et al., 2012). A more specific three-fold classification is proposed by Zhu et al. (2007a) as follow: Environmental performance indicators (i.e. reduction in wastewater, and solid wastes, decrease the air emission level, reduction in environmental accidents, lessen the usage of hazardous materials and improve a company’s environmental situation). The published literature proposes a large number of indicators for assessment of the sustainable supply chain management. Issues addressed by these research could be classified from two perspectives namely as the ones which assessed from supply chain management side and the second group are those that assessed from sustainability management side (Seuring & Müller, 2008a). The key addressed issues in these assessments are including evaluation of environmental impacts, performance measurement and monitoring, guidelines for future plans, gained advantages, progress assessment and investigation on the critical issues (Ahi & Searcy, 2015a). Despite the existing literature on identification of metrics for measuring SSCM performance, there is lack of research which are specifically about measuring performance in Sustainable supply chain, but it is clear that the interest for these type of research is growing fast (Ahi et al., 2016; Ahi & Searcy, 2015a; Gold & Schleper, 2017). The complex interactions which exists in a supply chain and the large number of players and stakeholders through the supply chain complicates the integration of sustainability context to supply chain

management. This complexity also intensifies due to the fact that sustainability has its multi pillars namely, economic, environmental and social, and the interaction among all these factors should be investigated over time to comprehend the results (Ahi et al., 2016). As it is clear from the studied literature, there is a vast amount of information on the SSCM and its characteristics. It is quite necessary to mention that not all of these factors would have the same impact on the overall performance of the SSCM, and organizations while designing and planning for their competitive strategies should consider the importance of these factors. With respect to aforementioned definitions and characteristics of SSCM, it has been tried to chose the most cited and pertaining factors to logistic firm's supply chain. The studied literature about sustainability pillars and pertaining factors are presented in the following section.

2.1 Metrics of Sustainable Supply Chain Management

The published literature proposes a large number of indicators for assessment of the sustainable supply chain management. Despite the existing literature on identification of metrics for measuring SSCM performance, there is lack of research which are specifically about measuring performance in Sustainable supply chain, but it is clear that the interest for these type of research is growing fast (Ahi et al., 2016; Ahi & Searcy, 2015a; Gold & Schleper, 2017). The complex interactions which exists in a supply chain and the large number of players and stakeholders through the supply chain complicates the integration of sustainability context to supply chain management. This complexity also intensifies due to the nature of sustainability which has its multi pillars (Ahi et al., 2016). It is quite necessary to mention that not all of these factors would have the same impact on the overall performance of the SSCM, so the results of our study would elaborate the importance level of diverse factors. In this research, we tried to figure out the most related and efficient metrics, which are useful for assessing supply chain performance in logistic firms. These metrics are classified to three groups of sustainability pillars, namely as economic, environmental and social, considering two competitive strategy which are cost and differentiation. The economic pillar is categorized as cost leadership strategy, and social and environmental initiatives are classified as differentiation strategies. Social and environmental differentiation strategies outputs are considered as a resource for economic metrics selection Social and environmental differentiation strategies are considered from two

perspective, market and firm. To conclude, five different main group of metrics will be assessed, where each of these metrics has its own sub-dimensions. Each of these metrics are presented with their own sub-dimensions in following sections.

2.1.1 Economic metrics of sustainable supply chain

Sustainable supply chain management has its own specific characteristics, and measurement metrics. Economic focus is one of the popular and mostly cited indicator of it. Economic dimension of sustainability has been investigated with many research, and there is a high level of focus and attention over it in the literature (Chunguang & Joseph, 2014; Dubey et al., 2016; Dues et al., 2013). Dyllick and Hockerts (2002), states that “economic sustainability requires firms to manage several types of economic capital: financial capital (i.e. equity, debt), tangible capital (i.e. machinery, land, stocks) and intangible capital (i.e. reputation, inventions, know-how, organizational routines)”. Thus there is an intense need for companies to manage their very type of economic capital, to improve their performance, and as the definition elaborates, it is not just about financial performance. Purba and Diane (2005) defined five manifest variables to measure economic performance of organizations that are listed as “market share”, “sales”, “profit margin”, “new market opportunities”, and “product price increase”. Market share had received the highest weight among these factors based on their study results. Environmental management (EM) initiatives that firms are taking into account, , beside its environmental efficiencies aims to improve firm’s economic performance by reduction in costs, lowering risk level on non-compliance, and improve brand reputation and marketing advantage . Purba and Diane (2005), also listed “productivity improvement”, “improved efficiency”, “cost savings” and “quality improvement” as variables which competitiveness must be investigated through them. Since, the “cost saving” is diagnosed as a competitiveness factor, it highlights the importance of company’s financial performance overreaching competitive advantages (Purba & Diane, 2005). The firm’s strategies over economic issues would affect their total performance and their position in the competing market. In the literature, many of sustainability indicators are identified to assess economic performance of the firms. “Sustainability cost”, “Total supply chain cost” & “Operational revenues” are named as three main indicators of SSCM characteristics considering economic focus by Ahi et al. (2016). One of the most eminent and highly referenced metrics of performance measurement systems for logistic providers is cost

and all its sub-dimensions, which covers all operating costs of supply chain (Gong & Yan, 2015). Barbosa-Póvoa et al., (2017), mentioned cost as the main economic objective function of sustainability which is considered in 59% of the related papers. Efficient and effective sustainable practices could increase financial performance of the organizations, lead to higher revenues and increase their profitability. Lieb and Lieb (2010) presents the 25 CEOs idea about the impact of sustainability initiatives, and declares that there is a positive impact on companies' performance measures in cost-saving indicators. Oberhofer and Dieplinger (2014), with Carter and Rogers (2008), assigns economic factor as the conclusive factor for organizations sustainable development. The studied literature clearly elaborates the importance of economic pillar in sustainable developments and as it is mentioned by several authors, it contributes to the competitiveness of firms. The predefined competitive strategies cost leadership, directly relates to economic pillar of sustainability since its definition delineates the tremendous efforts that organizations are taking into account to lower their expenses through supply chain process. It is obvious that the firms operations and initiatives will have different level of impacts and they must choose the strategies based on their competitive targets. This clarifies the necessity of a clear set of indicators, so that the managers could refer to them while making their sustainable development decisions. Table 2.1, presents the selected economic criteria for assessment in our research.

- Profitability is one of the key indicators of sustainability to measure the economic pillar. Profitability is studied in 25% of the papers as one of the most important economic dimensions of sustainability (Barbosa-Póvoa et al., 2017). Profitability could be considered as an ultimate result of green initiatives implementation for organizations (Oberhofer & Dieplinger, 2014). Gong and Yan (2015) considers profitability as one of corporate management assessment criteria and defines it as “the value from customer and the market”. Ahi and Searcy (2013) assign profitability as one the targets of supply chain and sustainability initiatives integration in their SSCM definition. Profitability is listed as one of the sub-factors of microeconomic factors of the economic pillar (Lovrić, Li, & Vervest, 2013). Three type of a firm performance is defined by Golobic and Smith (2013) as “market-based”, accounting-based” and “operational based”.

Table 2.1: Economic metrics.

	Factors	Description	Reference
Economic	Profitability	Access to new market opportunities that results in higher profit	(Cunha Callado & Jack, 2015) (Oberhofer & Dieplinger, 2014) (Purba & Diane, 2005) (Gong & Yan, 2015) (Barbosa-Póvoa et al., 2017) (Ahi & Searcy, 2013) (Golicic & Smith, 2013)
	Market share	Intrusive pricing strategies to increase economies of scale	(Sara et al., 2012) (Gong & Yan, 2015) (Purba & Diane, 2005) (Daugherty, 1998) (Laari et al., 2016) (Hubbard, 2009)
	Greening expenses	Cost Increase due to the implementation of green initiatives (Inbound & Outbound)	(Zhu, Sarkis, and Lai (2007) (Orsato, 2006) (Min & Galle, 2001) (Min and Galle (1997) (Walker, Di Sisto, and McBain (2008)
	Marketing Investment	Amount of allocated budget for marketing	(Chen, Shih, Shyur, & Wu, 2012) (Jang, Kim, and Bonn (2011) (Avlonitis, and Carrigan, 2017) (Papadas, Avlonitis, & Carrigan, 2017) (Rajeev et al. (2017) (Harik, El Hachem, Medini, and Bernard (2015)
	Revenue Maximization	Returns more than average level	(Cunha Callado & Jack, 2015) (Purba & Diane, 2005) (Sara et al., 2012)

Any of the performance assessing types has its own sub-dimensions, for instance, market-based deals with financial indicators (i.e. market share, brand equity), and operational based centers on aspects related to efficiency (i.e. costs, quality). Accounting based performance is about the profitability which could be measured in terms of return ratios and earnings (Golicic & Smith, 2013). Profitability as a performance indicator or as an output of sustainability initiatives represents a significant level of importance which elaborates how successful are organizations while implementing green initiatives through their supply chain process. As it is mentioned before, in this research it has been tried to figure out the relationship between economic sustainability performances indicators and cost leadership as a competitive strategy. As it is mentioned in section 2.1, social and environmental differentiation initiatives are considered as a base to select economic metrics. As it is stated by Hill, (1988), differentiation could lead the firm to a low-cost position in the market. This elaborates the relationship between differentiation and cost leadership strategies, and the necessity of their implementation at the same time (Hill, 1988). Increased profitability for firms, is a result of green initiatives implementation, which is highlighted by Purba & Diane, (2005). Laari (2017), declared the positive relation between sustainable supply chain management and competitive advantage. Thus, profitability as a highly cited economic factor will be assessed in our study.

- Market share is described as “firm-specific sales revenue divided by total sales revenues for all firms in the industry”(Dickinson & Sommers, 2012, p. 10). The study discusses that higher levels of market share elaborates that there is not enough substitute options for customers to select, and this expands the profitability of firms. (Dickinson & Sommers, 2012). Market share has been studied and measured as an economic performance indicator for many years, and several authors referred to it as a positive outcome of firm’s adequate strategies not only for economic performance but also operational performance as well (Daugherty, 1998; Gong & Yan, 2015; Sara et al., 2012; Stank et al., 2003). Stank et al., (2003), Tried to investigate the relation between logistic sector performance and the business performance. They figured a conceptual model which shows market share as the result of an adequate loyalty and satisfaction level that exists in customers from firm’s operations. The study

results proves the existence of a factual link between market share and customer loyalty level (Stank et al., 2003). The logistic capabilities of firm and the strategies pertaining to logistic activities of a firm are contributing to the overall performance of the firm (Daugherty, 1998). In the study by Daugherty (1998), the relation between customer satisfaction level and expanding market share has been proved and are presented as the results of logistic initiatives of a firm. Gong and Yan (2015), Considered profitability as one of the performance indicators of corporate management under the profitability criteria; and declared the necessity of improving strategies pertaining to market share. In order to improve the financial performance, Laari et al. (2016), declared that environmental goals should be targeted considering customers and this highlights the importance of customer satisfaction. Laari et al. (2016) assigned market share as an indicator of financial performance in their questionnaire. Maury (2018) defines Long-term profitability and sustained market share as two of his variables for competitive advantage metrics to explore how constant profitability is influenced by organizations sustainable competitive advantage strategies. Maury (2018), measured competitive advantage metrics pertaining to economic. As it is mentioned before, in this research it has been tried to figure out the relation between economic sustainability performance indicators and cost leadership as competitive strategy. In other words, the research tried to investigate, how to focus on cost leadership as a competitive strategy and implement the most important sustainability initiatives under economic pillar. The above mentioned studies formulate a necessity toward considering market share as an indicator of organizations sustainability performance.

- Greening expenses identified by Zhu et al. (2007) as the impacts of green supply chain initiatives on the company's performance from three perspectives that are including; "operational performance", "economic performance", and "environmental performance". Assessing the economic performance of the company, to measure green initiatives impact, would have two folds; first fold is positive, due to cost saving implementations (e.g. reduction in energy consumption level); and second fold is negative due to cost increases of green initiatives implementation (e.g. purchasing ecological material) (Zhu et al.,

2007). As the price plays a crucial part in the competitive market, and the willingness of customer for lower prices, investment on the implementation of green initiatives could be the barrier of offering lower prices (Orsato, 2006). Higher investments in greening initiatives would result in higher final prices for the offered products or services, and this would lower the competitive power of the organization among rivals (Min & Galle, 2001). It is clear that the idea of minimizing the production or logistic cost is in contract with greening the supply chain process. Min and Galle (1997) pointed out that the high expenses of green initiatives and programs implementations is the main obstacle to improving green purchasing behavior. Greening costs of the supply chain management have been identified by Walker et al. (2008) as one the internal barriers of environmental supply chain practices. This is due to the fact that competitors are identified by Walker et al. (2008) as one of the key drivers of sustainable supply chain management initiatives. Adoption of green programs for firms might result in higher investment costs. Since the competition is so crucial in today's business world for organizations to survive and stay profitable, it seems logical for them to try offer lower prices. Thus, greening expenses will be assessed in our study as an important part of environmental differentiation strategies implementation by firms.

- Marketing investment is the amount of budget which is allocated for marketing investments is so important from the industry expert's point of view, and during the interviews, they mentioned it several times. Industry experts named marketing investment as one of the main factors which influence their position in the market. The sustainability initiatives which are integrating to supply chain management process of firms should grab the attention of a target group of customers who care about the implementation of green initiatives. Jang et al. (2011) names these target group as "health-conscious consumer". Consumer's response to their concerns about global warming issue and climate change is to buy and use products or services which are called green. So, they look for their desired features in the market, and the companies which could satisfy these type of concerns would have the flag of excellence from their perspective (Chen et al., 2012). Chen et al. (2012), Defines three efficient and effective approach for organizations to have green marketing and green

service; adequate usage of the existing information and technology tools; information transparency and disclosure regarding their products and services; and administer the responsible producer principles. It is obvious that the disclosure of information about firms actions requires marketing investments. The marketing performance of a company depends on the decisions which are taking place in the internal, strategic and tactical level of the organization's initiatives Papadas et al. (2017). For instance, the tactical initiatives of a firm deals with activities like increasing the usage of recycled materials, this could enhance the brand image of the company in short-term (Papadas et al., 2017). This highlights the influence of marketing investments to improve and maintain the company's reputation for public and society, which would lead to competitive advantage. As it is mentioned before, in this research it has been tried to figure out the relationship between economic sustainability performances indicators and cost leadership as a competitive strategy. Implemented environmental and social differentiation strategies by logistic firms should be disclosed to market and society. Information disclosure requires marketing investments, and this might increase the costs of logistic firms. To conclude, regarding the studied literature and interviews, marketing investment is selected as an assessment criterion for economic pillar in our research.

- Revenue maximization is defined by Sara et al. (2012), as the measured 3PL company's performance considering three measurement criteria namely as economic performance, environmental performance and operational performance, and each of these criteria have their own sub-criteria. For instance, increasing revenue is a sub-criteria for economic performance measurement in their study. Improvement in the environmental performance of a company influences the financial performance of the company (Purba & Diane, 2005). For instance, a good environmental performance results in marketing advantage for firms, this leads to higher market share and increased revenues for firms (Purba & Diane, 2005). From the other side, reduction in the waste amount of non-hazardous and hazardous materials, leads to lower operating costs for firms and ultimately improves the environmental performance of the firm (Purba & Diane, 2005). Cunha Callado and Jack

(2015), Considered four main perspective for balance scorecard (BSC) which are listed as financial perspective”, “customer perspective”, “internal process perspective” and “learning & development”. “Revenue per product” and “revenue per employee” are considered as financial perspective metrics which are relating to supply chain roles (Cunha Callado & Jack, 2015). It is obvious that revenue maximization motivates the implementation of sustainability initiatives and it is a result of such implementations. Based on industry expert’s view, policymakers in organizations consider revenue maximization as a target goal while designing their future scenarios. They believe that having returns more than average amount of returns, is highly critical for firms to protect and improve their position in the market. The relation between green initiatives implementation and competitive advantage are proved by Laari, (2017) study. Thus, revenue increases as a result of being green for logistic firms while implementing social & environmental differentiation strategies, motivates us to take revenue maximization as another economic pillar to assess in our study.

2.1.2 Environmental metrics of sustainable supply chain

The studied literature shows a growing concern and attention over sustainability initiatives implementation in industry due to global warming and increased emission levels (Lammgård & Andersson, 2014). Colicchia et al., (2013), highlights the significant role of service industry on emission levels and environmental impact of supply chain. The study investigates the indicators of performance measurement system to assess company’s performance, and clarifies the drivers and barriers of such factors application Colicchia et al., (2013). The necessity and importance of investigation through the most important pillars of environmental sustainability and their relation to competitiveness has been mentioned by several authors (Ahi et al., 2016; Ahi & Searcy, 2015a; Cunha et al., 2015).The critical role of environmental initiatives in logistic service providers are highlighted by many research and the reasons of such growing importance for sustainability initiatives are described as;

- Environmental sustainability is considered as a prosperity factor for logistic firms in reducing their costs and improving financial performance;
- Implementation of environmental sustainability initiatives leads to higher profits for firms (e.g. Customer request for eco-labeled products & services)

- Enhanced demand for mobility of goods leads to a higher attention over sustainability programs

(Centobelli et al., 2017; Lammgård, 2012; Marchet et al., 2014)

Marchet et al. (2014) reviewed 72 papers, which are researches about green initiatives in freight transportation and logistics industry and highlights that there is a scarcity in literature which are specifically about sustainability initiatives from logistic firms perspective. He also mentioned that the subject of “green building & warehousing” and “internal management” are not addressed well; the achieved advantageous from implementation of sustainability initiatives are not adequately measured; and the environmental performance of firms is just measured from visible perspectives.

Centobelli et al. (2017) provided a systematic review of the sustainability initiatives in the service industry for papers between years 1960-2014, to identify research gaps and investigate the appropriate research questions. The study identifies research gaps briefly as;

- Investigation on the complete set of environmental sustainability indicators that are applicable in logistic service providers (LSPs) case; the impact of these initiatives application on firm’s performance from diverse aspects
- The adaptation and assessment of the most effective initiatives for LSPs; and investigation on barriers and drivers of these implementations

Lammgård (2012) discussed the high level of competency in pricing for intermodal train services in the transport sector. There are growing and intense pressure on service industry to lower their carbon footprint and other environmental impacts; and one way to lower CO₂ emissions is to set a target emission level for a certain year (Lammgård, 2012). It states that firms which are active toward implementation of sustainability initiatives will have a competitive advantage as the economic growth goes on. Beside this, Lammgård (2012) highlights the necessity of collaboration with other firms to enhance the loading factor of trains. The above-mentioned literature clarifies the meaningful importance on the investigation of environmental impacts of LSPs activities and the key factors contributing to environmental performance measurement systems. Factors identification process is designed considering influencing factors from two perspectives; first, the key metrics to measure the environmental performance of LSPs and their contribution to competitive advantages of firms.

Through this research, environmental initiatives are considered as differentiation strategy which is defined by Porter (1980) as a competing strategy. Being different presents the strategies of the firm to offer a unique service or product for customers. It has been tried to choose the high cited and referenced metrics of environmental sustainability initiatives of logistic firms, considering their contribution to competitiveness. The environmental metrics of SSCM which are assessed in this research are provided in Table 2.2. It is necessary to mention that the environmental factors are classified from two perspectives, which are firm capability and market desire.

- Trucks with lower level fuel consumption, Lieb and Lieb (2010), gathered the information toward investigating on the most important reasons to establish initiatives pertaining to sustainability from CEOs. Based on the results, the most weighted response for such initiatives implementation was the “corporate desire to do the right thing”. The second most weighted initiative was the “pressure from customer”, and the third weight was given to “a desire to attract green customers”, and the fourth reason was “competitive pressures” (Lieb & Lieb, 2010). Through these data collection, a wide range of programs to establish sustainability initiatives were highlighted by CEOs, including usage of alternative fuels and using fuel-efficient trucks (Lieb & Lieb, 2010). The environmental assessment of firms performance takes a different type of indicators into account. Most of these indicators are investigated due to their potential impact on global warming. CO₂ emission as one of the indicators has been considered in 24.5% of the papers. (Barbosa-Póvoa et al., 2017). The intensified level of competition among logistics service providers and the pressure from the market for a decreased price leads to a necessity for a precise investment plan for firms. Environmental management programs in organizations comprise diverse factors pertaining to energy, transportation, labor training, recycling and emission amount. For instance, logistics service providers are investigating the initiatives relating to fuel consumption and emission level. “Environmentally friendly company cars” is validated as one of the key factors of a company’s EM measurement indicators (Oberhofer & Dieplinger, 2014). “Internal Transport Efficiency Measures” as a concept for initiatives which could be implemented individually or as a joint venture by

vehicle or energy suppliers has been defined by Arvidsson et al. (2013). The concept has as its sub-dimensions such as “driver efficiency” and “vehicle efficiency”. Vehicle efficiency depends on three factors; driver, fuel usage and the vehicle (Arvidsson et al., 2013). Vehicles have their normal life-length between 15-20 years and their replenishment could decrease fuel usage by 75%, so replenishment of trucks with new ones could result in significant reduction of fuel usage (Åkerman & Höjer, 2006). The use of hybrid and electric vehicles could reduce the level of fuel consumption in highways by 65% and 75% for city driving (Åkerman & Höjer, 2006). Colicchia et al. (2013), Investigated on factors of “Intra-organizational environmental practices by the LSPs” and listed five key dimensions for it. They assigned strategies pertaining to distribution and transportation as one of these key dimensions. The sub-dimensions of these strategies are including usage of alternative fuels, vehicles with lower fuel consumption level, vehicles with lower pollution level, and reducing the speed of vehicles, so that it would result in lower pollution and fuel consumption (Colicchia et al., 2013). As part of their questionnaire, Lin and Ho (2011), used five dependent metrics to assess the energy saving initiatives of logistics companies in China where “fuel saving vehicles” is one of them. Lammgård and Andersson (2014), investigated on the importance level of influencing factors logistic service provider selection process. Usage of “trucks from the high environmental classes” gained the third highest rank among the factors of environmental aspect for transport provider selection. Thus, considering the type of cars which are in use by logistics service providers is important, and in recent literature, it gained attention and support from scholars. However, regarding logistic practitioners opinion, using these type of environmental-friendly cars requires initial investments by organizations. The high expenses of such implementations is considered to be the main barrier to its implementation. Regarding the presented literature, and the high attention over the factor, trucks with lower fuel consumption level will be assessed in our study as an environmental criterion from firm’s capabilities perspective.

Table 2.2: Environmental metrics.

	Factors	Description	Reference
Environmental	Trucks with lower fuel consumption	Environmental friendly cars with less fuel consumption level	(Lieb & Lieb, 2010) (Barbosa-Póvoa et al., 2017) (Oberhofer & Dieplinger, 2014) (Arvidsson et al., 2013) (Åkerman & Höjer, 2006) (Colicchia et al., 2013) (Lin and Ho (2011) (Lammgård & Andersson, 2014)
	Packaging management & waste	Using the ecological type of material for packaging and reduction in packaging waste	(Colicchia et al., 2013) (Dekker et al., 2012) (Oberhofer & Fürst, 2013) (Arvidsson et al., 2013) (Aguezzoul (2014)
	Warehousing and green building	Design and establish building and facilities with efficient energy consumption	(Haw-Jan & C., 1995) (Colicchia et al., 2011) (Colicchia et al., 2013) (Lieb & Lieb, 2010) (Dekker et al., 2012) (Stindt, 2017) (Oberhofer & Dieplinger, 2014)
	Legal compliance	Laws & Legislation	(Sara et al., 2012) (Gold et al., 2009; Seuring & Müller, 2008a) (Milne, 1996) (Taticchi et al., 2014) (Shibin et al., 2017) (Ahi & Searcy, 2015b)

Table 2.2 (continued): Environmental metrics.

	Factors	Description	Reference
Environmental	Diverse modes of transportation	Switching transportation mode based on the existing transportation way to optimize the cost and environmental effects	(Lammgård & Andersson, 2014) (Colicchia et al., 2013) (Lin and Ho, 2008) (Lieb and Lieb, 2010) (Ciliberti et al. 2008) (Mondragon et al. 2009)
	External collaboration	Align with other 3pls or service providers Cooperation with related organizations	(Aguazzoul, 2014) (Lieb & Lieb, 2010) (Gold et al., 2009) (Colicchia et al., 2013) (Lammgård & Andersson, 2014) (Arvidsson et al., 2013)
	Pollution level	The amount of pollutants	(Banasik et al., 2016) (Lammgård & Andersson, 2014) (Ahi and Searcy (2015a) (Ahi & Searcy, 2015b) (Harik et al., 2015) (Colicchia et al., 2013)
	Environmental hazard	The impact of firms activities on the environment	(Brandenburg & Rebs, 2015; Lammgård & Andersson, 2014; V. Mani et al., 2016b) (Tacke et al., 2014) (Yingli et al., 2015) (Lin & Ho, 2008)

- Packing management & waste, the implementation of initiatives for packaging management is not considered widely, and only some actions toward reducing the amount of packaging waste are considered (Colicchia et al., 2013). Packaging items like pallets, roll-cages, and containers are mentioned by Dekker et al. (2012), as an important factor which must be considered. A supply chain is a complex process in which its characteristics are also influenced by the type of product which goes through this process. Dekker et al. (2012), investigates not only the inventory of products but also the type of products which are friendlier to the environment. The study considered product features from a different perspective which are listed as; The production way of products (level of emission); Transportation way of products and their inventory type; Possible reverse logistics for products; Material packaging and recyclable items; These aspects could be considered while selections are made by the organization toward their supply chain to lower or minimize the environmental impacts (Dekker et al., 2012). Returnable package items are also mentioned by several experts during interviews. They also referred to the type of materials which pallets are made from since it influences the time of usage per pallet. Using pallets which are made from recyclable materials by 3PLs, could enhance the company image in the market, based on industry experts point of view. Reduction in the amount of packaging material has been considered as one the factors for environmental practices of transport sector by Oberhofer and Fürst (2013) as a sub-dimension for corporate resource protection processes. Packaging efficiency is highlighted by Arvidsson et al. (2013), as a sub-factor for “Joint Transport Efficiency Measures with the Customers”. Based on the study results by Arvidsson et al. (2013), packaging efficiency is implemented by organizations to reduce the transportation times, and as a critical factor for competency. Increasing the number of packages per transportation might increase the risk of damage and decrease the packaging efficiency, so improving the packaging efficiency is a competitive factor among service providers (Arvidsson et al. (2013). Aguezzoul (2014) investigated the items which are associated with contracts with logistic service providers, and “packaging” and “palletizing” are among these factors. Thus, since the logistic firms are the target section of the industry for this research, it

is highly important to consider packaging management as one of the criteria to be assessed.

- Warehouse & green building are the places where are making the most amount of waste from packaging through the supply chain. The usage of reusable materials for containers; performing the freight consolidation actions to utilize the capacity usage; and facilitating the warehouses with disposal and recycling equipment would lower the environmental impact of the warehouses and also decrease the operation costs (Haw-Jan & C., 1995). Energy consumption level of the warehouses and the generated amount of CO₂ point to the environmental impact of the warehouse's activities (Colicchia et al., 2011). The initiatives of designing and establishing green warehouses comprise diverse factors and there are defined certifications for these initiatives implementations, such as US Green building Council (Lieb & Lieb, 2010). For instance, Lieb and Lieb (2010), names some of these initiatives as, installation of energy efficient lightening systems and motion sensors, development of waste recycling actions and implementation of clean energies in distribution centers (DCs) for electric power generation such as windmills. Regarding Kyoto Protocol, LSPs which are participating in critical logistic activities such as delivering chilled or frozen goods should implement the special type of initiatives, like consumption of natural and sustainable fluids and changeover programs of facilities. (Colicchia et al., 2013) “Green warehousing”, has been identified by Dubey et al. (2017) as one of the drivers for sustainable supply chain management initiatives. Yingli et al. (2015) highlighted the importance of establishing recycling facilities in warehouses. “Sustainable warehousing and inventory management” has been identified by Stindt (2017) as one of the nine important concepts of SSCM. The growing attention and concern from the public; legislation and intense competition in the market, force the organizations to create value by implementing the sustainable concepts into their supply chain. Dekker et al. (2012), Highlights the importance of green building and facilities in recent years, and names facilities as the third driver of SSCM. The study defines few environmental aspects for facilities; “Internal transport and emissions”, “energy use of facilities”, “emissions of transport units used for transport to or from facilities”, “congestion around facilities”(Dekker et al.,

2012). The efficiency of buildings and facilities is also mentioned by several practitioners during interviews. And they highlighted that greening expenses for facilities are one of the main economic factors of sustainability pillars. Besides this, the establishment of such facilities could result in higher reputation for firms which could be advertised as their capabilities. Thus, there is a connection between green building initiatives and marketing investment of logistics firms. Establishing green facilities should disclosure to the market, which would increase firm's reputation about their capabilities to the market. Considering the importance of green facilities, this criterion will be assessed in our study as an environmental differentiation, from firm perspective.

- Legal compliance is the incentives for implementation of sustainability initiatives are pushed from diverse groups, and as the public awareness grows toward climate change and pollution levels, the pressures increases as well. The governments have established defined principles and roles which should be implemented by organizations to achieve the defined objectives (Gold et al., 2009; Seuring & Müller, 2008a). Although the concept of sustainability and the initiatives pertaining to it are not new due to Milne (1996), but there are still many organizations who are not willing to adopt sustainability initiatives, unless they are legally forced to do it (Taticchi et al., 2014). Seuring and Müller (2008a), identified “lack of customer demand” for sustainable services and products and “governmental regulation” as the top two incentives for sustainability programs implementations. The study elaborates that the development of governmental principles could improve the overall sustainability performance of the firms. Shibin et al. (2017), identified ten enablers for improving sustainable supply chain management performance including: “Coercive pressure”, “Mimetic pressure” and “Normative pressure”. “Coercive pressure” talks about any type of pressure which is created by external organizations or government. “Mimetic pressure” arises due to the existing competition among firms, they try to imitate each other. “Normative pressure” arises in a market where the consumer is looking for environmental-friendly products or services. The study highlighted these type of pressures as the key factors of social and environmental sustainability initiatives, and their forcing power could improve the overall performance regarding sustainability

issue (Shibin et al., 2017). The expenses which are paid as penalties and fines for non-compliance of settled legal principles are defined by Ahi and Searcy (2015b) as one the main barriers for sustainability initiatives implementation. Air pollutants emission, hazardous materials, complaints from customers, and idle time of work due to specific work accident injuries, are also listed as other possible barriers which can challenge the sustainability programs (Ahi & Searcy, 2015b). To conclude, it is clear that the forcing power of legislation would enforce organizations to consider their stakeholders right. For instance, the implementation of legal principles could enhance the customer satisfaction level from organizations activities and this eventually leads to a higher reputation for the firm in the market. Which means a higher social performance from the organization.

- Diverse modes of transportation is among the top priorities for the selection process of service provider have been identified by Lammgård and Andersson (2014). Seven factors which are the results of a component analysis for valuation of service provider's properties are presented including sub-dimensions. The factors are listed as; "basic service aspects", "environmental aspects", "IT and additional logistics services", "modal aspects" and "relational aspects", "loading/volume" and "price". Under the modal aspects, they referred to diverse modes of transport (e.g. train, barge, flight), the combined form of inter-modal transportation and usage of detachable carriers (Lammgård & Andersson, 2014). Using alternative modes of transportation by logistic companies or service providers are highlighted by Colicchia et al. (2013) as one the strategies for distribution and transportation executives. Shifting between different modes of transportation could be implemented in cooperation with other logistic service providers. Evaluating the possible other modes of transportation could result in lower pollution amounts and increase the environmental performance of companies. From the other side, it could also cause a reduction in fuel consumption and allocated budget amount for fuel usage (Ciliberti et al, .2008; Mondragon et al. 2009). The implementation of diverse transportation modes requires close cooperations with other logistic service providers, which in this research is considered as external collaboration. The existing relation between diverse modes of transportation

and external collaboration clarifies the necessity of transportation modes evaluation. Thus, the importance of diverse modes of transportation will be assessed as one of the environmental initiatives of firm's capability in this research.

- External collaboration's importance is highlighted by recent literature for firms to stay competitive. The objective of supply chain management is to optimize the flow of physical and information through the process, reducing the costs and enhancing the value of delivered products or services (Aguazzoul, 2014). Companies are becoming partners to reach their sustainability efforts through settled formal sustainability programs and this approach is widely common in 3PL industry (Lieb & Lieb, 2010). These environmental associations are highly imperative to the accomplishment of sustainability goals of 3PL Companies (Lieb & Lieb, 2010). This partnership provides connection to other companies experience and insights including; access to data, and larger networks to comfort 3PL to achieve sustainability goals. These alliances highlight the 3PL companies potential to impact future public policies in pertaining fields (Lieb & Lieb, 2010). Implementation of sustainability initiatives requires a strong relationship among all companies since establishing the initiatives of economic, social and environmental through the whole life-cycle of product requires achievement of a comprehensive set of metrics. A strong link among the involved partners of the supply chain could improve the implementation of sustainability programs. So, the "development of a collaborative paradigm" for supply chain management is considered as an eminent factor for competitive advantage (Gold et al., 2009). Establishing such a strong linkage for companies through their supply chain would results in priorities among their rivals (Gold et al., 2009). Although the necessity of the topic of collaboration with customers and suppliers is approved and confirmed in the literature, case studies and reports reveal an ongoing lack of these type of collaborations (Colicchia et al., 2013). Improvement of external collaboration is quite necessary for the service industry, and due to that necessity, the external collaboration will be assessed in our research as an environmental differentiation strategy.

- Pollution level, greenhouse gas (GHG) as an indicator for assessing the environmental performance, has been used in 60% percent of the publications (Banasik et al., 2016). Diverse forms of greenhouse gases could be listed as; CO₂ emissions, carbon footprint, air pollution and also in some cases GHGs are assigned to be the most important reason of global warming (Banasik et al., 2016). It has been addressed that 50,000 megatons of CO₂ emissions are released annually by diverse human activities and the logistics and transportation sector is a major contributor to this by releasing 28000 megatons, approximately 5.5% of the total amount (World Economic Forum, 2009). Road freight transport is the major element of this emissions and shares a large portion of the footprint (World Economic Forum, 2009). CO₂ emissions are known to be an important contributor to global warming, so logistic companies should take actions to lower their emission levels as a part of their corporate social responsibility (CSR). The pollution level of firm's operations is considered to be a supply chain risk for them, and reduction in the amount of pollutants would bring competitive priorities for them (Lammgård & Andersson, 2014). These environmental priorities could be used by suppliers while advertising for their products and services (Lammgård & Andersson, 2014). Ahi and Searcy (2015a), investigated on the metrics and measures of green supply chain assessment and provided the most frequent measures until 2012. Their study results highlights the paucity over an established agreement on how the sustainability performance must be measured. Air emissions and greenhouse gas emissions are among the top five metrics, which are mentioned more than 20 times in the literature (Ahi & Searcy, 2015a). This elaborates the importance of polluting factors while assessing the environmental impacts of logistics service providers. The Air pollutants emission are identified by Ahi and Searcy (2015b) as one of the main barriers to sustainability initiatives implementation. A list of metrics for assessment of the industry performance while integrating the sustainability pillars are prepared by (Harik et al., 2015). Three main environmental criteria are elaborated by Harik et al., (2015) as "atmosphere", "policies" and "standards". Atmosphere criteria entails greenhouses gas emission level as one of the metrics for pollution measurement. Reduction in pollution level necessitates some initial infrastructure, which could be related to facility or vehicle expenses. In other

words, we called these expenses as green expenses and considered them as one of the economic factors to be assessed in this research. To conclude, pollution level is considered to be an environmental criterion in our research for assessment, since its importance is evidenced by aforementioned research.

- Environmental hazard or global warming is a fact and the impact of global warming had already started to be visible in the surrounding environment. CO₂ emissions has been selected as one of the main contributors of global warming by many authors. The logistics sector, service industry and transportation is a main resource of air pollutants. The transportation activities of service providers and the type of facilities that they are using could highly influence the emission levels. This elaborates the importance of green initiative implementation through the supply chain process of organizations (Brandenburg & Rebs, 2015; Lammgård & Andersson, 2014; V. Mani et al., 2016b). Tacken et al. (2014), has defined initiatives namely as “decarbonization initiatives” for logistic operators from literature review, four of them are listed as; Enhancing the usage of environmental friendly transportation types, Reduction in energy consumption level, Combination of goods, Establishing environmental friendly logistic service.

To lessen the environmental impact of service industry, technology and ICT achievements have gained attention over recent years, but Yingli et al. (2015) declares that the investigation is not deep and the exact impact of it on improving the environmental performance is not clear yet. Yingli et al. (2015), study results confirms the positive influence of ICT solutions implementations on road transport sector, and CO₂ emissions amount cut down. ICT solutions in freight transport would optimize the routing, energy consumption and collaboration on transportation network (Yingli et al., 2015). Another example which is mentioned by Lin and Ho (2008), is about United Parcel Service (UPS) as an LSP. In order to decrease the fuel consumption level and also cut down the CO₂ emission amount, the company uses a route planner software (Lin & Ho, 2008). Some other logistic service provider companies in Taiwan, started to use alternative fuels for their road freight transports (Lin & Ho, 2008). Logistic firms or service providers should take responsible manners due

to their large impact on global warming and CO₂ emission level (Tacke et al., 2014). The emission level of freight transport operations is not the only part of LSPs environmental performance, their packaging waste is also considered to be another environmental hazard of service providers operations. To conclude, it is obvious that reduction in environmental hazards would bring advantageous for organizations, since they would not pay high expenses due to penalties and this would increase their public image. This will finally result in a greater market share for them, which could increase their profitability (Laari, 2017).

2.1.3 Social metrics of sustainable supply chain

The social dimension of sustainability did not receive the same attention as other two pillars, and there is a dearth on the literature about social dimension metrics and indicators (Alison et al., 2012; Badri Ahmadi et al., 2017; V.Mani et al., 2018; Seuring & Müller, 2008b). Rahdari and Anvary Rostamy (2015) reviewed the current literature about sustainability indicators, to define the most common set of sustainability indicators. They proposed a general framework of sustainability indicators for each pillar of sustainability. Based on their study results, the existing dimensions of sustainability indicators in the current literature are portioned as 48.63% for environmental dimension, 26.82% for governance dimension and 24.55% for social dimension. This clarifies the paucity of investigated dimensions about social pillar. In their work, sustainability indicators under the social dimension are categorized to four main criteria of “general”, “management system”, “human”, and “safety” then each of them has three defined sub-criteria (Rahdari & Anvary Rostamy, 2015).

V. Mani et al. (2018), Investigated the main dimensions of social sustainability related to suppliers in emerging economies for Indian manufacturing industries. Their results prove an efficient relation between the supply chain performance and supplier social sustainability initiatives. Also, the study highlights “labor practices” and “product responsibility” as the most influencing factors. V. Mani et al. (2018), research confirms the importance of social sustainability for buyers and its impact on the supply chain process. Badri Ahmadi, et al. (2017) identified the main dimensions of social sustainability and evaluated them using a multi-criteria decision making (MCDM) which is called ‘best worst method’ (BWM). They proposed a framework which provides information for managers while making decisions toward social sustainability

implementations. The study prioritized the metrics of sustainability according to their obtained weights. The results of their analysis highlighted “contractual stakeholder influence” as the most influencing factor and “occupational health and safety management system” as the least important factor.

Dubey et al. (2017) refer to ethics and social values as a critical driver for sustainable supply chain management (SSCM). The study results prove that social values, ethics, and institutional pressures influence firm’s competitiveness targets. To reach the SSCM, organizations need to use specific tools to diagnose their current situation, analyze it and figure out the influencing factors; and plan for adequate strategies to improve these factors. Focus on implementing the green initiatives improves the company’s brand image which in turn improves cost savings, enhances customer demand and finally leads to a better economic performance and higher profitability (Dubey et al., 2017). In this research it has been tried to choose the most important factors of social sustainability pillars which are pertinent to the logistics sector, considering their contribution to competitive strategies of firms. The Table 2.3, presents the most important and high cited factors from our literature study.

- Employee training is identified by Badri Ahmadi., et al. (2017a), investigated on the social dimension of sustainable supply chain management using BWM and the “training education and community influence” was selected as one of the most important indicators of the social pillar in SSCM. The study by Jung, (2017) highlighted the significance of LSPs activities on the environment and that service industry should not only consider the price of service or the quality of offered service but also the pertaining issues about the socially responsible manner and the importance of educating employees. “Organizational learning/training process and program” has been determined as one the factors of having socially responsible manner (Jung, 2017). Organizational training is defined as “The existence, variety, and level of the educational programs related to safe driving, safe handling of parcels, and customer services”(Jung, 2017). A mathematical multi-objective modal has been proposed by Azadnia et al. (2015). The model’s main objectives are explained as; maximizing the total score of sustainability pillars (social, environmental & economic), and lowering the total cost. The alternatives of maximizing the qualitative measure of social dimension are listed as; “occupational health and safety management

system”, “worker safety and labour health” and “training education and Community development” (Azadnia et al., 2015). Badri Ahmadi, (2017b), designed a modal for supplier selection process, considering sustainability issues, while selecting supplier in the telecom industry. “Training education and community influence” is one of the proposed alternatives of this modal to measure social sustainable performance. “Organizational learning frameworks” are categorized under the metrics which are belonging to company’s policies toward their staff and employee by Harik et al., (2015). Hubbard (2009), Presented a sustainable balanced scorecard (SBSC), which could simplify the sustainable evaluation of organizations by stakeholders. The SBSC measures the organization’s performance considering six different criteria including “learning and development performance”. Walker et al. (2008), identified “lack of training” as on the internal barriers of integrating environmental issues to supply chain management practices. Thus, the importance of educating and training programs could be understood better, if the lack of such training and its results could be elaborated or measured. Employee training will be assessed in our research as a social differentiation strategy from firm perspective.

- Human rights is mentioned by V. Mani et al. (2016a), as one of the Identified six dimensions for supply chain social sustainability including “human right”, “philanthropy”, “safety”, equity”, “ethics” and “health & welfare”. The study considered both upstream and downstream side of the supply chain while investigating on the pertaining factors and highlighted the paucity of literature on the social indicators of the sustainable supply chain. Luthra et al. (2017), Identified 22 sub-dimension of social sustainability evaluation criteria while investigation on supplier’s selection. Under the social dimension, “the interests & rights of employees” is selected as a key indicator. A modal for green supplier selection has been developed by Kuo et al. (2010). Corporate social responsibility (CSR) is one of the six dimensions of this modal which is developed by Delphi study.

Table 2.3: Social Metrics.

	Factors	Description	Reference
Social	Employee Training	Average hour of training & career development programs for employees by organizations	(Badri Ahmadi et al., 2017) (Jung, 2017) (Azadnia et al., 2015) (Harik et al., 2015) (Walker et al. (2008) (Hubbard, 2009) (Folke et al., 2005)
	Human Rights	Human rights regarding, child or forced labor and wages Freedom in bargaining and association	(V. Mani et al., 2016b) (Harik et al., 2015) (Kolk, 2004) (Yakovleva et al., 2012) (Barbosa-Póvoa et al., 2017) (Luthra et al., 2017) (Kuo et al., 2010) (Jung, 2017) (Hutchins & Sutherland, 2008)
	Occupational health and safety	The possible risks form occupation disease, injury rates or incidence Implementation of health & safety initiatives mentioned in official agreements	(Barbosa-Póvoa et al., 2017) (Venkatesh Mani et al., 2018) (Rajeev et al., 2017) (Hubbard, 2009) (Amindoust et al., 2012) (Luthra et al., 2017) (Jung, 2017) (Azadnia et al., 2015) (Hutchins & Sutherland, 2008).

Table 2.3 (continued) : Social Metrics.

	Factors	Description	Reference
Social	Stakeholder engagement plan		(Luthra et al., 2017) (Amindoust et al. (2012) (Kuo et al. (2010) Badri Ahmadi et al., 2017) (Rahdari & Anvary Rostamy, 2015)
	Brand Image	The reputation and loyalty of brand among consumers	(Sara et al., 2012) (Purba & Diane, 2005) (Shibin et al. (2017) (Harik et al. (2015) (Lieb & Lieb, 2010)
	Philanthropy	“The extent to which the provider actively participates in aiding the society through donations and commercial initiatives (the ratio of the philanthropy budget to sales)” (Jung, 2017)	(Hutchins & Sutherland, 2008) (V. Mani et al., 2016b) (Jung, 2017) (Hutchins and Sutherland (2008) (Harik et al., 2015) (Hubbard, 2009)
	Transparency and information disclosure	“Providing information to their customers and stakeholders regarding material used, carbon emissions and toxins released during production, etc.” (Luthra et al., 2017)	(Luthra et al., 2017) (Rahdari & Anvary Rostamy, 2015) (Badri Ahmadi et al., 2017) (Kuo et al., 2010)
	Customer satisfaction	Delivery time, Delivery reliability	(Gong & Yan, 2015) (Colicchia et al., 2013) (Lieb & Lieb, 2010) (Gong and Yan (2015) (Cunha Callado & Jack, 2015) (Ahi and Searcy (2015a) (Harik et al., 2015)

“Human rights and participation” has been determined as one the factors of having socially responsible manner for organizations under the management policies (Jung, 2017). “Labor equity” is determined to be an assessment criterion of social performance by Hutchins and Sutherland (2008), while assessing the sustainable supply chain management. They defined the measurement value, based on the amount of wage per employee in an organization. They used “the ratio of the average hourly labor cost (including benefits and taxes) to the total compensation package (converted to an hourly measure) for the company’s highest paid employee (often the Chief Executive Officer or CEO)” As this ratio is closer to one, the compensation equity is higher for the organization(Hutchins & Sutherland, 2008). Harik et al. (2015), proposed a sustainability index to evaluate the adaptation of sustainability initiatives for manufacturing companies. A list of metrics for assessment of the industry performance while integrating the sustainability pillars are prepared by the study, the indicators of the social pillar are classified into three different groups. “Employee related rights” are categorized under the metrics which are belonging to company’s policies toward their stuff and employee (Harik et al., 2015). To conclude, human rights are cited several times by the aforementioned studies, which highlights the importance of this factor for assessment as a social criterion.

- “Safety” and “health” were among the six main dimensions for the social aspect of the sustainable supply chain which has been identified by (V. Mani et al., 2016a). Badri Ahmadi et al., (2017b), elaborates the most eminent factors of socially sustainable supply chain using a multi-criteria decision-making method (BWM). Through their factor investigation form the current literature the “work health and safety” and “occupational health and safety” are selected as two of the most cited indicators of social pillar. Luthra et al. (2017), Identified 22 sub-dimension of sustainability evaluation criteria while investigation of suppliers under the pillars of sustainability. Under the social dimension, “occupational health & safety” is selected as one of its indicators, and the study results proved the importance of it among the top five indicators (Luthra et al., 2017). “Work safety and labor health” is one the factors which

decision makers are taking into account while evaluating and selecting suppliers, (Amindoust et al., 2012). The study by Jung, (2017), highlighted the significance of LSPs activities on the environment, and the necessity of being socially responsible. “Occupational health and safety” has been determined as one the factors of having socially responsible manner for organizations (Jung, 2017). Health & safety is mentioned by Azadnia et al. (2015), as a key indicator of social pillar. “Healthcare” is also determined to be a measure of social performance assessing by Hutchins and Sutherland (2008). The study assigned “healthcare” metric to be an important measure while characterizing the organization’s role in providing or supporting the issues related to health care of employees and their families. “Safety” is also determined by this work as one of the important factors of developing the social performance, since the established safety standards in a workplace could decrease the lost hours as the reason of work injuries. “Healthcare” got the highest weight among all others factors for social performance evaluation based on study results by Hutchins & Sutherland, (2008). Health and safety related initiatives could enhance the companies productivity and efficiency. As it is mentioned by Purba (2005), increased efficiency would lead to the competitive advantage of firms. Thus, health & safety will be assessed in our research as a social pillar which contributes to the competitiveness of firms.

- Stakeholder engagemnet plan have been explained by Kuo et al. (2010), as the defined rights of stakeholders, customers, and the associations. The study considered this factor as one the six dimensions of its green supplier selection modal. Luthra et al., (2017), highlighted the importance of “stakeholders right” by indicating that as one of the sub-dimensions of social sustainability while investigation on supplier’s evaluation criteria. “The rights of stakeholders” is one the factors which decision makers are taking into account while evaluating and selecting suppliers, confirmed by Amindoust et al. (2012). Stakeholders is a sub-factor of social indicators assessment framework which is proposed by Rahdari and Anvary Rostamy (2015). Their study addressed the importance of providing the right and comprehensive framework for stakeholders to evaluate the sustainability indicators which are taking into account by organizations. Rahdari and Anvary Rostamy (2015), highlighted the existing complaint from

stakeholders and investors about the darkness and difficulty of comprehending the environmental, social & governance (ESG) data. They declared that the proposed framework could elaborate on and clarify the performance of organizations, and simplify the comparison among organizations for stakeholders (Rahdari & Anvary Rostamy, 2015). Thus, Stakeholders engagement is one of the main factors for decision makers, while selection of their service provider. Considering the rights of the members of the society who are involved in the logistic firm's actions is so important. Since this initiative could result in higher satisfaction level from firm customers and result in a higher position for the company in the market. Such differentiation would lead to competitiveness for the firm, as it is also stated by (Laari et al., 2017). Stakeholder engagement plan is considered as a social differentiation strategy for logistic firms in our study.

- Brand image is elaborated by the studied literature in recent years' service providers are under pressure from public to consider environmental impacts of their company through their supply chain, and this would directly increase their public image (Sara et al., 2012). Enhancing the corporate image of the company could be a result of improving the company's environmental management initiatives. Enhanced brand image would lead to competitive advantage for firms (Purba & Diane, 2005). Shibin et al. (2017), highlighted the importance of brand value in the competing market and pointed that brand value could be reached as the result of companies strategies such as reverse logistics. Economic indicators are categorized to three main groups by Harik et al. (2015) including "brand management" as one of these groups. The expenses which companies are investing on branding is defined as the way how it could be measured by Harik et al. (2015) . This elaborates the importance of brand image from the market point of view, and the necessity of programs which should be considered by organizations to protect and improve their reputation in the market. The conducted research by Lieb and Lieb (2010), defined five main reasons for establishing the sustainability programs by organizations, which are listed as; "Corporate desire to do the right thing", "Corporate desire to attract green customers", "Corporate desire to enhance company image", "Pressure from customers", "Competitive pressures" (Lieb

& Lieb, 2010) The research asked CEOs to choose the main reasons of sustainability initiatives implementation, through questionnaires. The conducted results highlighted the “desire to enhance the company’s image” as the third most important reason for sustainability programs establishment (Lieb & Lieb, 2010) . In our study, the customer’s desire for a higher reputation of the company, considered to be a social factor, since it is important from the market perspective. It is clear that the initiatives to meet such a request from market, are a part of organizations financial, environmental and social programs and decisions. Enhancing the environmental performance of organization would increase their public image (Laari et al., 2017). Based on this discussions, it can be highlighted that environmental initiatives are influencing social initiatives of sustainable development. So, the positive correlation between them, necessitates their implementation as differentiation strategies.

- Transparency & information disclosure is highlighted by (Luthra et al., 2017), as one of the sub-dimensions of social sustainability while investigation on supplier’s evaluation criteria. Information disclosure is about preparing the right information for the stakeholders and customers about the used materials the released amount of toxins and emissions (Luthra et al., 2017). A modal for green supplier selection has been developed by Kuo et al. (2010). Corporate social responsibility (CSR) is one of the six dimensions of this modal which is developed by Delphi study. Information disclosure is one of the metrics which are identified to measure CSR while investigating on green supplier selection (Kuo et al., 2010). Transparency and information disclosure is a sub-factor of social indicators assessment framework which is proposed by Rahdari and Anvary Rostamy (2015). Boosting transparency and providing information about the ongoing programs and initiatives during the supply chain process would advance the sustainable development. Gong and Yan (2015), tried to investigate the most important indicators for assessing the logistic service company’s supply chain. They defined two assessment area for logistic service providers evaluation, namely as “customer service” and “corporate management”. “Information” is assigned as a sub-category of corporate management criteria. Gong & Yan, (2015), defined information disclosure as

an assessment criteria, to elaborate the level and accuracy of provided information by organizations. As it was mentioned in section 2.1.1.4, the implemented sustainability initiatives should be acknowledged and advertised to public, in order to improve the company's image in the market. Information disclosure requires marketing investment, and this why marketing investment is selected as a economic metric in our study. This elaborates the relation among diverse pillars of sustainability. To conclude, information transparency and disclosure will be assessed in our study, to investigate its contribution to competitive strategies of firms.

- Philanthropy has been defined by Jung (2017) as “The extent to which the 3PL provider actively participates in aiding the society through donations and commercial initiatives (the ratio of the philanthropy budget to sales)”. Jung (2017), explored the dimensions of social sustainability in evaluating the logistics service providers (LSP). Also “price” and “customized service” are pointed as two other categories of LSP evaluation. Philanthropy is identified by the paper as one the influencing social criteria for LSPs evaluation process (Jung 2017) . “Philanthropy” was one of the six main dimensions which has been identified by V. Mani et al. (2016a) as pertaining dimensions of social aspect of sustainable supply chain. “Philanthropy” is also determined to be a measure of social performance assessing by Hutchins and Sutherland (2008) while implementing supply chain decisions. Hutchins and Sutherland (2008), presented the following definition for philanthropy; an organizations role is not just limited to its operations as a part of business world, it comprises greater areas than just business world and involves the company's role in the society (e.g. allocated budget for charity, funding for students, supporting artworks). Harik et al. (2015), developed a sustainability index to evaluate the adaptation of sustainability initiatives for manufacturing companies. A list of metrics for assessment of the industry performance while integrating the sustainability pillars are prepared by the study, the indicators of social pillar are classified as; “Society related”, “Direct employee-related”, “Company's employee-related policies” (Harik et al., 2015). The “society related” metrics of the index are including; “philanthropy” as one of the metrics for evaluation and it is measured by the amount of money allocated to aiding educational, art or

charity activities (Harik et al., 2015). Hubbard (2009), Presented a sustainable balanced scorecard (SBSC), which could simplify the sustainable evaluation of organizations by stakeholders. The SBSC measures the organization's performance considering six different criteria including social performance. "Philanthropic investment" is assigned to be one of the sub-dimensions of social criteria (Hubbard, 2009). The philanthropy will be assessed in this research as a social differentiation strategy for logistic firms, which could result in competitiveness for them due to market desire.

- Customer satisfaction, as an important factor for 3PL customers are seeking to figure out whether the company meets sustainability goals such as, Reduction in carbon footprints; Reduction in fuel, water, and energy consumption; Disposal of hazardous materials and recycling programs; Implementation of renewable energy sources in facilities; Environmental friendly cars; Various Certification programs; (Colicchia et al., 2013; Lieb & Lieb, 2010). One of the main reasons to consider customer satisfaction as a metric to assess social performance is to figure out how important are the sustainability initiatives from customer's point of view in extending existing contracts with service providers or signing new contracts. Gong and Yan (2015) mentioned customer service as one of the assessment areas, considering three criteria's namely, "Tangibles", "Assurance," and "Empathy". "Tangibles", are referred to capacity and range of logistic services, "Assurance" entails loyalty toward the customer and their satisfaction level, and "Empathy" is about the connection between customers and service providers (Gong & Yan, 2015). Cunha Callado and Jack (2015) defines four supply chain roles, namely "Input suppliers", "Retailers", "Producers" and "Distributors". Their analyzed results prove the importance of customer satisfaction in all four pre-defined SC roles (Cunha Callado & Jack, 2015). "Customer satisfaction" has been mentioned by Ahi and Searcy (2015a) as one of the most frequent factors in the literature for assessing the performance of green supply chain. As it is mentioned before in this research, it has been tried to investigate the existing relationships among the diverse factors. In this research, the customer satisfaction is considered to be a social factor for firms from a market perspective. Gong and Yan (2015), highlighted customer relationship as a powerful factor to bring competitiveness

for firms. The initiatives which the companies are implementing to improve their customer satisfaction is in direct relation to the amount of budget that they are expanding to enhance customer satisfaction level (Harik et al., 2015). So, the factor itself could be considered as a social metric, but the efforts of the company to improve it, are also a part of company's economic performance.

2.2 Competitive Strategies

2.2.1 Cost leadership strategies

The role of industrial organizations in society and the impact of their operations on the natural environment has received increasing attention in recent years. The increasing pressure from various stakeholders and the intense competition among organizations in the market, motivates firms to extend their sustainability programs and implement the pertaining initiatives. Therefore, environmental sustainability is considered to be a source of competitive advantage for firms (Laari et al., 2017; Longoni & Cagliano, 2015; Purba & Diane, 2005). Laari et al. (2017), highlights the paucity of research on the relation between green supply chain management (GSCM) and competitive strategies. Longoni and Cagliano (2015), addressed the sustainability initiatives as key priorities for competitive advantage, and also highlights the dearth of guidelines on how sustainability initiatives could be integrated to operations. Porter (1980), has defined three different competitive strategies, including “overall cost leadership” strategy. As it has been mentioned before, the other two strategies are named as “differentiation”, and “focus”. Based on definition which is provided by Porter (1980), cost leadership strategy necessitates, “construction of efficient-scale facilities”, “vigorous pursuit of cost reduction from experience, tight cost and overhead control”, “avoidance of marginal customer accounts”, “cost minimization in areas like R&D” and “service, sales force, and advertising” (Porter, 1980). As it is clear from the defined requirement for this strategy, the companies who established cost leadership as their competitive strategy would show a tremendous effort, to minimize their cost in every action. Implementing a low-cost strategy, would enable the company to have earnings and stay profitable even though the rivals are competing hard. Low-cost strategy powers the company to resist in case of increasing the expenses of input material by suppliers. A low-cost strategy could also save the company from all five competitive forces, and place the company in a favorable place among competitors (Porter, 1980).

The requirements of achieving a low-cost strategy are addressed by Porter (1980), as desirable access to raw material, special designed products with easy manufacturing, serving the main group of customers to increase the volume and a high level of market share. Laari et al. (2017), Investigated on both logistic providers and logistic user companies to figure the type of their competing strategy, and how the competing strategies are applied to their supply chain. The study results proved that a major part of logistic service providers (LSPs), implemented operation differentiation strategy as their competitive strategy, and cost leadership was only selected by a few number of LSPs (Laari et al., 2017). The conducted research by Longoni and Cagliano (2015), through investigating of how firms are integrating sustainability initiatives to their operation strategies, confirmed the existence of a linkage between sustainability actions and achievement of competitive priorities. The study considered three traditional configuration models, listed as “market-oriented”, “price-oriented” and “capability-oriented”. Their study results shows that, the companies are expanding their existing operation strategies by integrating sustainability actions to achieve competitive priorities. Longoni and Cagliano (2015), study also highlighted that nowadays, firms are preferring market-oriented strategies rather than price oriented strategies. Market-oriented strategies are about flexible designs and after sales programs. Considering the environmental impact of operations, and hearing the voice of customer are examples of these type of strategies, which could result in competitive advantage for firms. Hybrid strategies are also selected by 6% of LSPs, which means they are combining differentiation and cost leadership strategies (Longoni & Cagliano, 2015). A different type of relation between sustainability practices and cost-saving outcomes has been proved by (Lieb & Lieb, 2010). The conducted survey results shows that, different type of reasons are mentioned by participated CEOs as their motivation to implement sustainability programs. Many of the involved companies elaborated that sustainability practices leads to cost saving results for them (Lieb & Lieb, 2010). This might be in contrast with the general belief toward sustainability practices, that this type of initiatives implementation is increasing costs for companies. Lammgård and Andersson (2014), conducted a survey-based research on the importance of environmental issues while selecting a service provider. The survey was conducted in 2003-2012, and the respondents are said to be shippers, who are dealing with freight transportation service purchasing. The shippers were asked to rank the

priorities such as price, delivery time or environmental efficiency while doing their selection. Price received the top priority, and there was no shift in its placement, although environmental issues got attention from the majority of shippers (Lammgård & Andersson, 2014). The importance of price addresses that there are many companies that have cost leadership strategies as their competing strategy. In our study, cost leadership strategy is selected as one of the competitive strategies, and it has been tried to measure economic pillar of sustainability initiatives regarding this strategy. As it is stated by Hill (1988), differentiation strategies implementation could lead the firm to a low-cost situation. Laari (2017), also declared the direct relation between green initiatives in supply chain and competitive advantage. To conclude, in our research social and environmental differentiation strategies are considered as a base to identify the economic dimension of SSCM, which results in cost leadership strategy and contributes to the competitiveness of logistic firms.

2.2.2 Differentiation strategies

Laari et al. (2017), examined on both logistic service providers and user companies to figure the type of their competing strategy, and how the competing strategies are applied to their supply chain. The study results proved that a major part of logistic service providers (LSPs), implemented operation differentiation strategy as their competitive strategy (49%), followed by marketing differentiation (16%) , (6%) have hybrid strategy, and (27%) have stuck in the middle strategy. Cost leadership was only selected by a few number of LSPs, (1%) of them (Laari et al., 2017). Hybrid strategy is defined for the firms which are implementing cost and differentiation strategies together, and the firms which does not consider any of these strategies with a high value are classified as having stuck-in-the-middle strategy (Laari et al., 2017). Another research which addressed the integration of sustainability issues to operation strategies is conducted by Longoni and Cagliano (2015). The research highlighted the social and environmental actions which are considered as a key resource for gaining competing priorities by firms. Three traditional configuration modal namely as “market-oriented”, “price-oriented” and “capability-oriented” are considered to comprehend, how the current strategies should be modified to include sustainability action. Each of these modal are briefly explained by Longoni and Cagliano (2015), as;

- Market-oriented: the focus of competition in this modal is flexibility of design and actions for after sale;
- Price-oriented: the focus of competition in this modal is price, then followed by quality and delivery;
- Capability-oriented: the focus of this modal is to upgrading capabilities while trying to reach innovativeness

Longoni and Cagliano (2015), study results shows that organizations while integrating social and environmental actions to their current operational plans, are applying sustainability actions to existing operation models. In other words, they are expanding traditional models by integrating sustainability initiatives. The study also declares that the implementation of sustainability actions to operation strategies are not placing constraints on organization, but they contribute to a higher operational and financial performance for firms, and eventually results in competitive advantage for firms. New servers are placing the importance on sustainability initiatives and they are more focused on market-oriented rather than traditional priorities as delivery, quality and innovation (Longoni & Cagliano, 2015). Gong and Yan (2015), proposed a performance measurement system (PMS) to assess the performance of logistic service supply chain (LSSC). The proposed PMS has three different assessment area, which are listed as; “overall LSSC operation”, “customer service”, and “corporate management”. Each of these assessment areas have their own indices, and the object of the research was to measure the power of each of these indices for firm’s competitive advantages. The final ranking of the firms, elaborated the power of these indices, and also cleared the weakness points of firms, which of these indices should be improved. Their study results elaborated that, a strong relationship with customers, is a powerful indices to improve firm’s performance and bring competitiveness (Gong & Yan, 2015). Lieb and Lieb (2010), research on performance measurement systems in third-party logistics (3PL), confirmed that the commitment of organizations to implement sustainability practices, is a market-differentiation factor for them in the marketplace. A high level of sensitivity toward sustainability initiatives even during an undesirable economic condition by more than half of the customers of LSPs, indicated the importance level of sustainability initiative from market perspective (Lieb & Lieb, 2010). Another type of marketing differentiation as a competitive priority for freight transportation services is addressed by (Lammgård & Andersson,

2014). Table 2.4, presents the most recent literature about competitive strategies in the service industry. Considering the aforementioned discussions, differentiation strategies are classified into two group of social and environmental in our study. The social differentiation strategy is assessed from two perspectives, which are firm-oriented and market-oriented. Environmental differentiation strategy is also assessed from two perspective, which are market-oriented and firm-oriented.

Table 2.4: Competitive strategies.

Cost	Differentiation	Reference
Cost leadership	Marketing differentiation, Operations differentiation	(Laari et al., 2017)
Cost savings	Productivity Improvement; Improved efficiency Quality improvement	(Purba & Diane, 2005)
Low-cost	Specific CSR strategy: Ethical displacement strategy: Self-regulation Legal compliance Reputation protection	(Van de Ven and Jeurissen, 2005)
Low-cost	Differentiation Brand image Credibility Marketing Quality	(Hoejmose et al., 2013)
Price	Differentiation Market: Product-oriented Service-oriented	(Longoni & Cagliano, 2015)
Low-cost Operating efficiency Competitive pricing Control of partners in providing services	Differentiation Brand identification Innovation in marketing techniques and methods Advertising	(H. Salavou, 2010)
Price	Customer value Differentiated Marketing	(Lammgård & Andersson, 2014)
Cost savings	Market differentiation “Commitment to sustainability issues”	(Lieb & Lieb, 2010)
Pricing comparison	Overall LSSC operation: Service delivery time Customer query time Ability to flexibly deal with orders Customer service: Customer satisfaction/loyalty Customer relationship	(Gong & Yan, 2015)



3. METHODOLOGY

Making decisions is a common process in our daily life, and the process is repeated daily by everyone who are choosing their desired options. Evaluation of the options for decision makers could be confusing and time-consuming, specifically if they have to consider diverse alternatives regarding their pros and cons. The most important part of a decision-making process is addressed by Thomas L. Saaty (2012) to be the factor selection part. Considering the contributing factors to the defined problem, how these factors influence the problem and the participant community for solution finding, are all necessary actions for achievement of a desirable solution. The designated hierarchy for the problem should elaborate an overall precise view of the problem including alternatives, issues, stakeholders and the main objective. Different participators would evaluate the defined criteria variously and it is highly related to their professional field. So, the outcomes of decision-making process would be different for diverse participated associations (Thomas L. Saaty, 2012). The necessity of environmentally conscious practices from organizations, enforces them to consider a large number of attributes while making their decisions. Supply chain management is a complex process and the integration of sustainability pillars to it would enhance the level of complexity while making decisions (Banasik et al., 2016). Multi-criteria decision-making (MCDM) methods could be applied to assess the trade-off between sustainability pillars. MCDM approaches application in sustainable supply chain management are new but a growing research field (Banasik et al., 2016; Ilgin, Gupta, & Battaia, 2015; Seuring, 2013). MCDM techniques are applicable in both case of evaluation of different items (items are explicit) and also design problems (items are implicit). These techniques are also useful in case of decision maker's intervention, where a priori (weights for items) or a posteriori (ordering the given items) is required (Ilgin et al., 2015). Thus, in this research, A MCDM method is selected for methodology implementation.

3.1 Multi-criteria Decision Making Method

The studied literature on multi-criteria decision-making methods elaborates that these methods are mainly classified into two groups. MCDM approaches could be classified into two main groups;

- Multi-attribute decision-making (MADM): problems with a finite number of alternatives solutions
- Multi-objective decision making (MODM): problems with an infinite number of alternative solutions (Banasik et al., 2016)

To bridge the literature gap about the paucity of research on sustainable supply chain management using MCDM methods, which is addressed by Seuring (2013), one of the MCDM techniques is selected as the methodology approach of this research. There are much existing research which applied MCDM methods as their methodology approach. The highly cited of MCDM methods in the green supply chain assessment are ranked by Banasik et al. (2016) as; AHP (analytical hierarchy process), TOPSIS (a technique for an order of preference by similar to ideal solution), and ANP (analytical network process). These methods are applicable in case of assessing a limited number of criteria or alternatives, and they have been applied to evaluate the appropriate contracts of reverse logistics, assessing diverse suppliers and selecting the technology of production (Banasik et al., 2016).

The AHP method, designed Saaty (1995), evaluates a set of alternative options for a set of defined criterion, to provide the best option for the decision maker. The method provides a weight for any of the given evaluation criteria based on the pairwise comparisons which are made by the decision maker. The criteria are ranked regarding their achieved weighed, the higher the achieved eight, the more important the criterion is. Then AHP assigns scores for the defined alternatives per criteria, and the performance of each criteria considering its alternatives are generated. Although AHP is a popular MCDM method, it has drawbacks such as inconsistency and requirement of a large amount of data for comparisons.

3.2 Best Worst Method

The Best Worst Method which is proposed by Rezaei, (2015) uses pair-wise comparisons to solve multi-criteria decision-making problems. In comparison to

aforementioned MCDM methods, BWM has two main advantages; the results generated by BWM are more consistent than the results achieved with other MCDM methods, and BWM requires less pairwise comparison data. The generated results of BWM are not only better in terms of consistency, but they also show a lower violation and deviation, so the achieved results are more reliable (Rezaei, 2015).

Therefore, in our study, the Best-or-Worst method (BWM) is selected since it solves the inconsistency issue, which is the main drawback of AHP method. The BWM has been successfully used in research of multi-criteria decision-making problems, some of the most recent research with this method application are; “Quality assessment of airline baggage handling systems using SERVQUAL and BWM” (Rezaei, Kothadiya, Tavasszy, & Kroesen, 2018), “Evaluating firms’ R&D performance using best worst method” (Salimi & Rezaei, 2018), “Assessing the social sustainability of supply chains using Best Worst Method” (Badri Ahmadi, Kusi-Sarpong, et al., 2017), “Selection of biomass thermochemical conversion technology in the Netherlands: A best worst method approach” (van de Kaa, Kamp, & Rezaei, 2017) “Evaluation of the external forces affecting the sustainability of oil and gas supply chain using Best Worst Method” (Wan Ahmad, Rezaei, Sadaghiani, & Tavasszy, 2017), “A supplier selection life cycle approach integrating traditional and environmental criteria using the best worst method” (Rezaei, Nispeling, Sarkis, & Tavasszy, 2016), “Linking supplier development to supplier segmentation using Best Worst Method” (Rezaei, Wang, & Tavasszy, 2015)

Considering the aforementioned properties of BWM, the method is used in this research to extract the weights for collected data evaluation.

The steps of BWM are structured as follow by Rezaei (2015);

Step 1. A set of decision-making criteria should be determined. A set of criteria $\{c_1, c_2, c_3 \dots c_n\}$ are identified for making a decision. For instance, in this research, the set of criteria are including {stakeholder engagement c_1 , occupational health & safety c_2 , human rights c_3 , customer satisfaction $c_4 \dots$ }

Step2. Among the defined criteria, one option as the best (e.g. most important) and one option as the worst (e.g. least important) should be selected by the decision maker. No comparison is required in this step among the criteria, just the best and worst options are selected in general.

Step3. In this step, the preference for the best criteria over all other criteria should be determined using a number between 1 to 9. The resulting vector of this comparison; the best over others is presented as;

$$A_B = (a_{B1}, a_{B2}, a_{B3} \dots a_{Bn})$$

The a_{Bj} shows the preference of the best criterion over the criterion j, and $a_{BB} = 1$.

Step4. In this step, the preference of all other criteria over the worst criteria are determined, using a number between 1 to 9. The resulting vector of this comparison; all other criteria over the worst one is presented as;

$$A_w = (a_{1w}, a_{2w}, a_{3w} \dots a_{wn})$$

The a_{jw} shows the preference of option j over the worst criterion W, and $a_{ww} = 1$.

Step5. Optimal weights of $(w_1^*, w_2^*, w_3^*, \dots w_n^*)$, should be calculated in this step. The optimal weights should satisfy the following condition

For each pair of w_B/w_j and w_j/w_w , $w_B/w_j = a_{Bj}$, and $w_j/w_w = a_{jw}$.

In order to meet the defined conditions for j, the absolute maximum difference between $\{|w_B - a_{Bj} w_j|, |w_j - a_{jw} w_w|\}$, should be minimized.

$$\text{Min max}_j \{|w_B - a_{Bj} w_j|, |w_j - a_{jw} w_w|\} \quad (3.1)$$

Subject to;

$$\sum w_j = 1$$

$$w_j \geq 0, \text{ For all } j$$

The problem (3.1), can be transferred to:

$$\text{min } \xi \quad (3.2)$$

$$|w_B - a_{Bj} w_j| \leq \xi, \text{ For all } j$$

$$|w_j - a_{jw} w_w| \leq \xi, \text{ for all } j$$

$$\sum w_j = 1$$

$$w_j \geq 0, \text{ For all } j$$

By solving problem (3.2), the optimal weights for $(w_1^*, w_2^*, w_3^*, \dots, w_n^*)$, and ξ^* are reached.

3.3 Data Collection & Preliminary Preparation

3.3.1 Data collection

The process of gathering data in a rigorous and systematic way is called as data collection. Data collection process should be designed in a formal way to ensure that the collected information are accurate and precise, and the designed arguments based on the collected data are valid and reliable (Sapsford & Jupp, 2006). In general the data can be classified to two groups which are preliminary data and secondary data. Preliminary data defines the type of data which are gathered for the first time through diverse methods of data collection and the secondary data defines the type of data which are collected previously by researchers, thus secondary data are already existing (Sekaran & Bougie, 2010). The preliminary data could be collected via different ways including; questionnaires, structured and unstructured interviews (Sekaran & Bougie, 2010). In this research, since there is no current secondary data pertaining to our research, the preliminary data is collected via questionnaire. Data collection method of the research, is based on online and paper form of questionnaire. The questionnaire is prepared with a pre-formulated set of designed questions to collect data from respondents. Data collection through the questionnaire can be implemented in different ways such as; mail, phone call, face-to-face interview and web-based questionnaires. For this research the online questionnaire is designated using Google forms, in two languages, Turkish and English. The prepared email text for the questionnaire contains links of the both versions of questionnaire, which are Turkish and English. So, the respondents could choose their preferred language via clicking on the corresponding link. The emails including the questionnaire link have been sent to selected respondents, since this sharing method is appropriate for large amount of respondents' access. Other efficiency and advantage of this type of questionnaire distribution is that, respondents could fill in questionnaire at their desired time and location. Also, the web-based questionnaire protects the privacy of respondents, since the answers are kept anonymous. On the other hand, there are some drawbacks to this type of data collection method. For instance, the main drawback could be considered as the low response rate of respondents. Low response rate in web-based questionnaire is due to

the fact that, respondents are aware that their responses are anonymous, so there is no motivation or pressure on them to fill the questionnaire. Also, people are unwilling to spend their time on filling questionnaires.

3.3.2 Collection of respondents

Data should be collected from appropriate group of respondent and these group of respondents which will participate in data collection are selected considering their knowledge and experience in logistics and supply chain management. In this research two group of respondents are chosen as participants; scholars, industry experts. Before questionnaire distribution, a wide research toward finding the appropriate respondent is implemented. Different keywords are used in Google and LinkedIn search engine to find the people with the most related experience and knowledge. Keywords which used are including, logistics manager, logistic consultant, logistics executive, service provider and supply chain manager. Beside this, considering their expert field, knowledge, skills and experience in other areas as sustainability initiatives or competitive strategies are investigated as well. So, the respondents from industry sector should have a know-how about service industry and the pertaining sustainability actions and plans. The industry experts are from the active logistic and service provider companies in turkey and it has been tried to be in contact with people from different departments such as human resource management and quality standards control. The scholars are mostly chosen from, management department, logistic & transportation department and the environmental engineering department by investigating their publications and research interests. It has been tried to get into contact with academicians from different universities with the contact information which was provided on their profile pages from universities websites. Then the questionnaire were emailed to them. The email text was written including a brief information about the research and the contact information of researchers . In total 950 emails were sent to both group of scholars and industry experts. The Table 3.1, provides the number of participants from each group of respondents in data collection process. It is necessary to mention that questions about the gender, location of headquarters of the organization and annual turnover were not compulsory to respond, and we did not receive responses toward these questions from all respondents.

Table 3.1: Number of respondents per category.

Type of organization	Number of respondents
Shipper	12
Logistic Service Provider	9
Logistic consultant	9
University	12
Total	42

3.3.3 Questionnaires

The process of questionnaire design is implemented regarding the three defined principles by Serkan & bougie, (2010). These three principles could briefly be explained as follow; the first one is about the wording way of questionnaire, which must be simple and precise to deliver the exact meaning. The second one relates to formulation way of the question which entails the length of question, type of questions and the order of questions. The third principle refers to general format and appearance of the questionnaire. The questionnaire of this research is designed considering all these three principles, which enables the respondents to consider the sustainability metrics from two point of view, that are firm capabilities and market desires. The following section is about the structure of the questionnaire in both languages. It has been tried to deliver the same knowledge and information in both forms of questionnaire, Turkish and English format. The first page of questionnaire explains the main objective and goal of this research. It also presents a brief explanation toward the sequence of questions and the way that respondents will view the questionnaire. It is stated that, the collected information from respondents will be treated anonymous. At the last it entails the information of involved researchers. The second page informs respondents about the competitive strategies pertaining to sustainability initiatives and it involves three options. Three pillars of sustainability are classified considering two main competitive strategies. A brief but comprehensive explanation for each of the options is presented, so the respondents could clearly grasp the meaning and content of the option.

In third-page preference, questions are presented. There are five preference questions which are designed based on BWM requirements. First preference question is about cost leadership strategy which entails economic pillar's sub-dimensions, and the second one is about social dimensions from a market perspective. A short and precise explanation is provided per options of the questions. Firstly the respondents are asked to choose the best criteria for these options. For instance, Figure 3.1, Shows the

second question from preferences questions which are about social criteria's from a market perspective. Respondents are supposed to choose their best criteria from social pillar dimensions.

4. Social initiatives of firms could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which factor is the MOST important factor from 'FIRM' perspective? Please indicate one MOST important factor. *

- ☒ Employee training: "Programs for skill management to support the continued employability and career ending"
- ☐ Human rights: "Forced labour, child labour, Non-discrimination"
- ☐ Health & Safety: "High Incidence or high risk of disease related to occupation, Injury rate"
- ☐ Stakeholder engagement plan: "Concerns with the moral rights of society having stakes in the business"

Figure 3.1: Preference question for most important criterion.

Then they are immediately required to choose the least important criteria for social dimension. Which is presented in Figure 3.2.

4. Social initiatives of firms could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which is the LEAST important factor from 'FIRM' perspective? Please indicate one LEAST important factor. *

- ☐ Employee training
- ☒ Human rights
- ☐ Health & safety
- ☐ Stakeholder engagement plan

Figure 3.2: Preference question for least important criterion.

After they selected their most and least preferred criterion, the next question will show respondent 's most preferred criteria, and inquire them to compare this criterion over the all other criteria. The question is presented in Figure 3.3.

You have selected "Employee training" as your best option, please determine your preference ratio of "Employee training" over the other factors by using 1 to 9 measurement scale.(1 shows about equal importance to the factor at hand and 9 means the factor is extremely more important. Please check below for detailed explanation of 1 to 9 scales).For example, if you have selected 'Employee training' as the MOST important factor then please indicate how much more you prefer 'Employee training' over the other factors. *

	1	2	3	4	5	6	7	8	9
"Employee training" over Human rights	☐	☐	☐	☐	☒	☐	☐	☐	☐
"Employee training" over Health & safety	☐	☐	☒	☐	☐	☐	☐	☐	☐

Figure 3.3: Preference question to rank the most important criterion.

Then, the following question will show respondents, what they have selected as the least important criteria and inquire them to compare all other criteria over this criteria. The question is presented in Figure 3.4.

You have selected "Human rights" as your "Least" important option, please determine your preference ratio of the other factors over the least important factor by using 1 to 9 measurement scale.A score of 9 indicates that the score at hand is extremely more important than the least important factor, a score of 1 that it is about equally important.For example, if you have selected 'Human rights' as the LEAST important factor then please indicate how much more you prefer other factors over 'Human rights' . *

	1	2	3	4	5	6	7	8	9
Employee training over "Human rights"	☐	☐	☒	☐	☐	☐	☐	☐	☐
Health & safety over "Human rights"	☐	☐	☐	☐	☒	☐	☐	☐	☐

Figure 3.4: Preference question to rank the least important criterion.

This procedure is exactly same for the other four questions, which are designated based on BWM method. In general, there are five questions of BWM, which are in the following order, the first question is about preferences over the economic pillar, the second one is about firm-oriented social initiatives, the third question inquires market-oriented social initiatives. The fourth question inquires for environmental factors in two categories which are about firm-oriented and market-oriented factors. Answering to all these five questions is compulsory, while all the other demographical questions are optional. Due to applied methodology respondents are asked to choose a number between 1 to 9 to show their preference. Thus, a statement which could elaborate the meaning of each of these numbers is attached to each question. The statement is as follow;

Definition of 1 to 9-measurement scale:

- | | |
|------------------------------|---------------------------------|
| 1: Equal importance | 7: Very strongly more important |
| 3: Moderately more important | 9: Extremely more important |
| 5: Strongly more important | 2, 4, 6, 8: Intermediate values |

The final section of the questionnaire involves questions about the respondent's occupation position, gender and contact detail in case of their desire to achieve research results report. These questions are optional to be answered by respondents.

4. DATA ANALYSIS

The questionnaires is distributed to diverse groups of respondents, which are including industry and university experts in logistics and supply chain field. The data collection process took about two months. Totally 950 emails were sent, and 45 responses were received, where 42 of them were useful. Approximately, there was a 5 percent response rate for this research questionnaire. After data collection process finished, the links of questionnaire are closed. The first step of data analysis was to calculate the weights of factors using BWM structure. Considering the requirements of BWM and its equations, a linear programming code is written in Matlab software. The collected data are extracted in excel files from google forms and imported to Matlab program to calculate the weights. The Matlab code is used to extract the optimal weights of criteria, using the collected data from questionnaire. The results of these calculations are presented in this chapter and it is tried to compare the achieved results with previous studies. The collected data from questionnaires are analyzed in next section using BWM. The optimal weights of each criterion and the consistency are obtained. The criteria are ranked regarding their weights and the results are provided in different tables in next section.

4.1 Optimal Weights and Ranks

As it is mentioned in section 2.1, five different group of metrics are evaluated for sustainable supply chain management in logistic firms considering competitive strategies. These metrics are cost leadership strategy regarding economic pillar, differentiation strategy regarding social initiatives from market and firm perspective, differentiation strategy regarding environmental initiatives from market and firm perspective. The provided tables are including the general weights of these five metrics, and the optimal weights regarding two main different group of respondents. Table 4.1, is about the optimal weights of economic pillar regarding cost leadership strategy. The results indicates that profitability received the first rank, followed by

revenue maximization among other factors and greening expenses received the lowest rank.

Table 4.1: Economic factor weights.

Economic factors	Weight	Rank	CR
Profitability	0.295	1	0.192
Market share	0.167	4	
Greening expenses	0.131	5	
Marketing Investment	0.175	3	
Revenue Maximization	0.232	2	

The research results show that profitability is an important factor of the economic pillar, which is in line with Barbosa-Póvoa et al. (2017) study results. The study mentioned profitability as the second most cited factor of the economic pillar for sustainability initiatives. It is also in accordance with Purba & Diane, 2005 study, where profitability is considered as one of the main factors which can improve economic performance and bring competitiveness. Greening expenses received the lowest weight among factors. One reason could be that such expenses require a great amount of budget for investment, which might have advantages over a long period. In addition, cost leadership strategy is mainly about decreasing costs, which is in contrast with greening expenses. The costs of green implementations are considered as an internal barrier to sustainability initiatives implementation by (Walker et al., 2008), which is also indicated by this research results.

The results of social initiatives from firm perspective are presented in Table 4.2. These factors are mainly discussing what type of social initiatives could be implemented by firms as differentiation strategies based on firm's capabilities. The study results indicate that employee training has the first rank, which is followed by health & safety, human rights, and stakeholder engagement plan. It is obvious that the role of employee training is clear for firms and organizations since they know higher productivity from employees could save additional costs and time for organizations due to inefficiencies. This would lead to competitive advantage for firms, since Purba & Diane, 2005, call for improved efficiency a source of competitiveness. Stakeholder engagement plan received the lowest rank, which is in line with Badri Ahmadi, (2017a) work on assessing social sustainability using BWM. The study results of Badri Ahmadi, (2017a), ranked "work health & safety" as the second social factor while assessing SSCM, wherein our study also health & safety received the second rank.

Table 4.2: Social factor weights, firm-oriented.

Social factors	Weight	Rank	CR
Employee training	0.289	1	0.189
Human rights	0.251	3	
Health & safety	0.265	2	
Stakeholder engagement plan	0.195	4	

Social initiatives are also assessed regarding market desires. These factors are elaborating on what are the main social desires of customers while selecting their service provider. The study results will delineate which factor has the highest importance level from the market point of view. The study results about social initiatives of differentiation strategies from a market perspective are presented in Table 4.3.

Table 4.3: Social factor weights, market-oriented.

Social factors	Weight	Rank	CR
Brand image	0.271	2	0.205
Transparency & information disclosure	0.231	3	
Philanthropy	0.133	4	
Customer satisfaction	0.364	1	

Due to respondents, customer satisfaction is the most important factor while considering market social desires. Customer satisfaction is the result of firm's capability for on-time, safe delivery, and flexibility to deal with diverse orders.

Gong, (2015), highlights customer satisfaction as a key index for logistics service supply chain and declares that it leads to the competitive advantage of firms, which is in line with this study results. In relation to social initiatives of this study from the firm perspective, it was mentioned that employee training to increase efficiency is a source of competitive advantage. Higher efficiency will lead to delivery reliability, which would enhance customer satisfaction level, this elaborates the positive interaction between employee training and customer satisfaction as two social initiatives. Laari, (2017), declares that weak environmental performance could damage firm's image, which can be prevented by green supply chain initiatives, and this would lead to the competitive advantage of firms. This delineates the importance of brand image while considering competitive strategies which is supported by this research. Philanthropy received the lowest rank due to respondents. One reason could be that service provider firms are not that interested in donations for charities and investing in local communities. Based on discussions during our interviews with experts, they declared that philanthropy could enhance the firm's public image and result in new market

opportunities, which is also proved by Mani et al., 2016. However, the study results indicate that philanthropy did not receive a high-level importance in comparison to other factors.

The environmental differentiation strategies are also evaluated from firm and market perspective, and the results are presented in Table 4.4. By evaluating environmental differentiation strategies from firm point of view, it has been tried to investigate, which actions firms should take to improve their environmental performance. The assessed data from respondents indicates that legal compliance has the first rank, which is followed by trucks with lower fuel consumption and warehousing and green building. Walker, (2008), identifies legal compliance as a main external driver for environmental initiatives implementation. Ahi & Searcy, (2015), cited compliance as a key metric for SSCM evaluation. Our study results elaborates the importance of legal compliance as a driver for organizations to improve environmental performance. Trucks with lower fuel consumption and green building & warehouses are the two of firms capabilities to increase their productivity and improve their financial and environmental performance in long time (Oberhofer & Dieplinger, 2014). Our study result proves that the importance of such initiatives by service industry is clear enough for firms and organizations to invest and implement, which is also evidenced by Colicchia et al., (2013). Beside this, Laari et al., (2017) highlighted that improving environmental performance would enhance firm's reputation. As it is aforementioned, brand image is an important social desire from market perspective regarding our study results. It can be stated that there is a positive correlation between improving environmental performance and brand image, which proves the positive relation between social and environmental initiatives of sustainable development. Packaging management received a low rank from respondents. This means packaging management initiatives are neglected by firms, which is also declared by Colicchia et al., (2013). Diverse modes of transportation received the fifth rank in our study results. A possible reason could be that using diverse modes of transportation requires diverse infrastructures of transportation and cooperation with other service providers (Lammgård, 2012). This means that, if there is the only possibility of one transport type, the service provider would not have the other transportation modes for shipping. External collaboration received the lowest rank in our study, which is in line with Colicchia et al., (2013) study results. As it was mentioned in section 2.1.2.5, diverse

modes of transportation require close collaboration with other service providers. Our study results indicate that respondents evaluated these factors as the least important factors for their firms. The dearth of a strong collaboration in logistic service supply chain is also evidenced by Colicchia et al., (2013). This clarifies that, weak linkages between firms and diverse shipping modes are highly related to each other. Thus, not having a close collaboration with other service providers, is a main reason of not having accessibility to other transportation modes.

Table 4.4: Environmental factor weights, firm-oriented.

Environmental factors	Weight	Rank	CR
Trucks with lower fuel consumption	0.175	2	0.180
Packaging management	0.165	4	
Warehousing & Green building	0.168	3	
Legal compliance	0.195	1	
Diverse modes of transportation	0.150	5	
External collaboration	0.147	6	

Environmental initiatives are also assessed from market point of view. By this assessment, it has been tried to answer the question of what are the most important environmental factors for customers while selecting their supplier. The obtained weights by our study are provided in Table 4.5. Packing waste received the highest rank, which is followed by pollution level and environmental hazard. Experts highlighted the importance of packing material during the interviews, and they mentioned reusable pallets as one the applicable solutions for it. Arvidsson, (2013), highlighted type of packing as an important measure for performance improvement of service industry which needs to be competitive. Thus, it can be stated that, decreasing packing waste would result in competitive advantage for firms. As it was mentioned in section 2.1.2.7, pollution level is considered in 60% of the papers, which are related to sustainability measures. Our study results prove the importance of pollution amount by service industry from a market perspective. Reduction in pollutant amount would increase the environmental performance of firms, and this will lead to a competitive differentiation for firms as it is also evidenced by Laari., (2017). Environmental hazards, which covers every environmental aspect of firm actions received the lowest rank. Tacken et al. (2014), highlighted the importance of establishing environmental friendly logistic industry and declared that there is still need to improve green initiatives in logistic industry. The low level of importance by respondents to this factor could be due to the fact that their customers are not aware of the diverse impact

of logistics industry on the environment. Mostly the packing and CO2 emission are considered as the main environmental impacts. However, the type of fuel, energy consumption level and the kind of material which is used for pallets are other important aspects of logistics industry on the environment. Lammgård & Anderson, (2014), stated that environmental impacts are not considered while purchasing service provider, which is also declared by our study respondents.

Table 4.5: Environmental factor weights, market-oriented.

Environmental factors	Weight	Rank	CR
Pollution level	0.315	2	0.202
Packing waste	0.438	1	
Environmental hazard	0.247	3	

4.2 Comparison Analysis

The obtained weights for five different metrics are assessed and ranked as it was presented in section 4.2. In this section, we classified the respondents to two main group of industry and expert. The following tables are showing the information about the way how these two different group of respondents ranked the factors. Table 4.6, presents the obtained weights and order of factors from two different group of respondents. As it can be seen from the provided ranks by different respondents, there is not a significant difference in their preferred sequence of factors. Profitability is selected as the most important factor by both groups of respondents, however, the obtained weight for profitability by industry group is higher than experts. Second preference is given to revenue maximization by both groups of respondents, and the obtained weight slightly differs. Industry group selected market share as their third option, whereas experts preference was marketing investment in the third position and market share in the fourth place..

Table 4.6: Economic factor weights, Expert vs Industry.

Main factors	Industry Weight	Rank	CR	Expert Weight	Rank	CR
Profitability	0.307	1	0.195	0.276	1	0.187
Market share	0.171	3		0.156	4	
Greening expenses	0.124	5		0.140	5	
Marketing Investment	0.163	4		0.181	3	
Revenue maximization	0.235	2		0.247	2	

Table 4.7, provides the comparison between industry and export respondents while they ranked social factors, which firms are taking into account while trying to be

socially different. As it is clear from ranks, these two group of respondents ranked the social factors in the same order. However, industry group preferred employee training and health & safety almost with the same weight, which indicates the equal importance of this factor for them. Experts group assigned same importance to human rights and stakeholder engagement plan, while stakeholder engagement plan is the last preference of industry people with a lower weight. As it is indicated in table experts weights for social factors of firm capabilities are really close to each other and there is not a significant difference in their ranking.

Table 4.7: Social factors weight (firm-oriented), Expert vs Industry.

Social factors	Industry Weight	Rank	CR	Expert Weight	Rank	CR
Employee training	0.303	1	0.167	0.318	1	0.205
Human rights	0.247	3		0.214	3	
Health & safety	0.303	2		0.254	2	
Stakeholder engagement plan	0.147	4		0.214	4	

Table 4.8: Social factors weight (market-oriented), Expert vs Industry.

Social factors	Industry Weight	Rank	CR	Expert Weight	Rank	CR
Brand Image	0.277	0.191	2	0.266	2	0.218
Transparency & information disclosure	0.250		3	0.213	3	
Philanthropy	0.127		4	0.146	4	
Customer satisfaction	0.346		1	0.375	1	

There is not a significant difference in the given weights to different criteria by these two group of respondents and the obtained ranks are almost same.

In next section, a statistical test analysis with the null hypothesis of no difference among respondents will be implemented to figure out, the statistical distribution of data. As the last comparison in this section, the environmental differentiation strategies are compared between industry and experts. And the results are provided in Table 4.9 and Table 4.10. As it is clear from Table 4.9. there is a significant difference in the obtained ranks for environmental factors. The most important difference is about legal compliance which is selected by Industry as the first and last one with experts.

Table 4.9: Environmental factors weight (firm-oriented), Expert vs Industry.

Environmental factors	Industry Weight	Rank	CR	Expert Weight	Rank	CR
Trucks with lower fuel consumption	0.177	2	0.171	0.180	2	0.192
Packing management	0.173	3		0.163	4	
Warehousing & Green building	0.148	5		0.195	1	
Legal compliance	0.244	1		0.134	6	
Diverse modes of transportation	0.151	4		0.161	5	
External collaboration	0.108	6		0.166	3	

Table 4.10: Environmental factors weight (market-oriented), Expert vs Industry.

Environmental factors	Industry Weight	Rank	CR	Expert Weight	Rank	CR
Pollution level	0.287	2	0.203	0.341	2	0.212
Packing waste	0.436	1		0.416	1	
Environmental hazard	0.277	3		0.243	3	

The provided information in Table 4.9, clarifies that the given weights by experts to different environmental factors are not that different from each other. As it could be seen all weights are nearly close to each other, however, industry people ranked these options differently. Legal compliance as the first preference of industry received a higher rank in comparison to warehousing and green building as the first preference of experts. Also, external collaboration is selected as least important factor by industry with a lower weight than legal compliance as the least important factor of experts. In the following section, we tried to figure out whether these differences are statistically significant or not among the different group of respondents and also to see if there is a significant difference in one group of respondents while ranking subfactors of a metric.

4.3 Statistical Comparison Analysis

As it was mentioned in the previous chapter, two groups of respondents industry and experts are compared to each other, whether to see if there is a statistically significant difference between them while selecting their preference criterion. This analysis is implemented for all five defined metrics of SSCM regarding competitive strategies. In the first step, the data are checked to figure out about their normality. Normality test results are used to chose the type of parametric (Independent Samples t-Test), or non-parametric (U-Mann-Whitney test) statistical tests, to compare the results from two group of respondents. The independent sample t-test is a parametric test and is useful

in case of having two independent samples, to determine if there is a statistical proof that the associated group means are significantly different. The U-Mann-Whitney test is a non-parametric test to compare two independent group, while the data distribution is not normal.

In this section the economic metric analysis is discussed. As it is mentioned before, the economic metric has five sub-factors, which are profitability, market share, greening expenses, marketing investment and revenue maximization. The normality test is conducted for each of these five sub-factors, whether to see if there is a normal distribution or not. The market share is the only sub-factor which has a normal distribution, with statistical results which are presented in Table 4.11. The null hypothesis is that there is no difference between these two group of respondents, industry, and expert. The independent sample t-test is used for the market share, due to the normality of results. One of the default assumptions of t-test for independent samples is the equality of variances in two groups. This assumption is checked by the Levene's test. Based on the significance level obtained from the Levene's test (0.876) which is bigger than (0.05), it can be concluded that at the 95% confidence interval, the variance of the two group is equal. Independent sample t-test results show that there is no significant difference between the mean of industry and experts. In other words, considering the reference t value for the degree of freedom 34 (2.032), and the calculated value of t (0.445), also the sig (2-tailed) (0.652) in the confidence interval of 95%, there is no significant difference between the mean the two groups. Therefore, the null hypothesis is accepted that there is no statistically significant difference between two group. To compare the two group of respondent answers for four other sub-factors of profitability, greening expenses, marketing investment and revenue maximization, The U-Mann-Whitney test is conducted and the results are provided in Table 4.12. The significance values obtained from the U Mann-Whitney U test in the context of comparing each of the variables Profitability, Greening expenses, Marketing Investment, and Revenue max in the industry and expert groups, considering significance level of (0.05) at 95% confidence interval, indicates there is no significant difference between the means of these variables in two group of respondents. Therefore, the null hypothesis is accepted.

Table 4.11: Normality statistics.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Market share	Expert	20	.156	.091	.020
	Industry	16	.170	.095	.023

Table 4.12: Independent Samples Test (Market share).

	Levene's Test for Equality of Variances				t-test for Equality of Means (95%)				
	F	Sig.	t	df	Sig.(2-tailed)	Mean dif.	Std.E dif.	lower	upper
Equal.Variances assumed	.025	0.876	-.455	34	.652	-.0142	.0313	-.0779	.0494
Equal.Variances not assumed			-.453	31.638	.654	-.0142	.0315	-.0784	.0499

Table 4.13: Test Statistics (Economic factors).

	Profitability	Greening expenses	Marketing investment	Revenue max
Mann-Whitney U	156.500	138.500	134.000	144.500
Wilcoxon W	366.500	274.500	270.000	280.500
Z	-.111	-.685	-.828	-.494
Asymp. Sig. (2-tailed)	.911	.493	.407	.622
Exact Sig. [2*(1-tailed Sig.)]	.912 ^b	.498 ^b	.422 ^b	.626 ^b

In case of firm-oriented social factors, the only factor that is normally distributed in two samples is employee training. An independent t-test is used to compare the means of the two groups of industry and experts. This test compares the mean of the data of a variable belonging to the two independent groups and indicates the meaning or significance of their differences. In the Table 4.14, below, the independent t-test results are presented. The default assumption for independent samples t is the equality of variances in two groups. This assumption is checked by the Levene's test. Based on the significance level of the Levene test (0.915) and its magnitude of considering the significance level of (0.05) and the confidence interval of 95%, it can be concluded that the variance of the data of the two groups is equal to each other. Independent sample t-test results show that there is no significant difference between the mean's of two respondent groups while ranking the Employee training. In other words, based on the calculated t value (0.218), and the reference t value for the degree of freedom (34)

and the sig (two-tailed) (0.829), at 95% confidence level, there is no significant difference between the means of the two group of respondents.

U-Mann-Whitney test is used as the non-parametric test for other social factors including Human rights, Health & Safety, and Stakeholder engagement plan due to abnormal distribution of data in at least one of the groups. The results of this test are presented in the Table 4.15. The magnitude of the Sig values obtained from the U Mann-Whitney test in the context of comparing each of the variables Human rights, Health & Safety and Stakeholder engagement plan in the groups of industry and expert is bigger than the significance level (0.05). Which shows that there is no significant difference between respondents about their preferences of social factors.

Social factors related to market perspective includes Brand image, Transparency & Information disclosure, Philanthropy, and Customer Satisfaction. A review of the normal distribution of data related to these factors in the industry and expert group shows that the distribution of data in all of these categories for the comparative test is abnormal. Therefore, the non-parametric U Man-Whitney test is used to examine these variables. The results of this test are presented in Table 4.16. The significance values obtained from the U Mann-Whitney test in comparing each of the variables Brandimage, Transparency & Information disclosure, Philanthropy, and Customer Satisfaction in the industry and expert group. Considering the significance value of (0.05) at 95% confidence level, there is no significant difference between the means of these variables in the industry and expert groups.

Table 4.14: Independent Samples Test (Employee training).

	Levene's Test for Equality of Variances				t-test for Equality of Means (95% Confidence Interval of the Difference)				
	F	Sig.	t	df	Sig.(2-tailed)	Mean dif.	Std.E dif.	lower	upper
Equal variances assumed	.012	0.915	.218	31	.829	-.0148	.068	-.1239	.1535
Equal variances not assumed			.218	30.892	.829	-.0148	0.68	-.1240	.1536.

Table 4.15: Test Statistics (Social factors. Market-oriented)

	Brand Image	Transparency & Information	Philanthropy	Customer Satisfaction
Mann-Whitney U	127.500	114.000	150.000	143.500
Wilcoxon W	317.500	304.000	340.000	279.500
Z	-.812	-1.259	-.066	-.282
Asymp. Sig. (2-tailed)	.417	.208	.947	.778
Exact Sig. [2*(1-tailed Sig.)]	.422 ^b	.217 ^b	.961 ^b	.781 ^b

Table 4.16: Test Statistics (Social factors, Firm-oriented).

	Human Rights	Health & Safety	Stakeholder engagement plan
Mann-Whitney U	102.000	96.500	91.000
Wilcoxon W	255.000	249.500	227.000
Z	-1.225	-1.424	-1.622
Asymp. Sig. (2-tailed)	.220	.155	.105
Exact Sig. [2*(1-tailed Sig.)]	.231 ^b	.157 ^b	.110 ^b

Factors related to environmental capabilities of firms including Trucks with lower fuel consumption, Packing Management, Warehousing & GreenBuilding, Legal Compliance, Diverse mode of transportation and External collaboration are also deliberated to see if there is a difference among respondents. The Shapiro-Wilk test is implemented to assess the normality of the data, and the results show an abnormal distribution. Therefore, the non-parametric U Mann-Whitney test is used to examine these variables. The results of this test are presented in the Table 4.17. Factors related to environmental capabilities include. The magnitude of the obtained significance value from the U Mann-Whitney test in the context of comparing each of in the groups of industry and expert at (0.05), and 95% of confidence level, clarifies that there is no significant difference between the mean of these variables. Thus the null hypothesis regarding that there is no significant difference is accepted for five factors of, Trucks with lower fuel consumption, Packing Management, Warehousing & Green Building, Diverse mode of transportation and External collaboration. Regarding the legal compliance factor, because of the smaller value of significance obtained from the U Mann-Whitney test, it can be concluded that the differences between two groups of industry and experts are significant in legal compliance. So in this case, the null assumption that the legal compliance difference is not significant is rejected. Also,

based on the higher obtained weight of Legal Compliance with industry group of respondents, it can be concluded that the level of this variable has been evaluated higher among industry than expert.

Factors related to market desire in environmental issues including Pollution level, Environmental hazard, and Packingwaste are also assessed with normality test of Shapiro-Wilk. Test results show that the distribution of data in the comparative test is abnormal. Therefore, the non-parametric U Man-Whitney test is used to examine these variables. The results of this test are presented in the Table 4.18. The obtained significance value from the U Mann-Whitney U test in comparing each of the variables at (0.05) and 95% confidence level shows no difference. Therefore, the null assumption is accepted. The difference between two group of respondents while assessing Pollution level, Environmental hazard, and Packingwaste variables is insignificant.

To come to conclusion, the aforementioned statistical analysis presented the answer to our last research question. The analysis showed that the two groups of respondents assessed the values almost with the same importance. The only significant difference was achieved in legal compliance case, where the industry sector ranked it higher than experts.

Table 4.17: Test Statistics (Environmental factors, Firm-oriented).

	Trucks.	Packing M.	Warehouse.	Legal Compliance	Diverse.	External.
Mann-Whitney U	144.00	150.500	137.00	93.00	161.500	111.500
Wilcoxon W	297.00	340.500	290.00	283.00	314.500	264.500
Z	-.555	-.349	-.777	-2.171	.000	-1.585
Asymp. Sig. (2-tailed)	.579	.727	.437	.030	1.00	.113
Exact Sig. [2*(1-tailed Sig.)]	.594 ^b	.731 ^b	.452 ^b	.030 ^b	1.00	.114 ^b

Table 4.18: Test Statistics (Environmental factors, Market-oriented).

	Pollution level	Environmental hazard	Packing waste
Mann-Whitney U	114.000	117.500	118.500
Wilcoxon W	250.000	270.500	271.500
Z	-.794	-.669	-.633
Asymp. Sig. (2-tailed)	.427	.503	.527
Exact Sig. [2*(1-tailed Sig.)]	.444 ^b	.510 ^b	.533 ^b

Cluster analysis is discussed in this section. To evaluate the complete set of factors together and find out, whether there exists a homogeneous group of respondents with the same group of preferences over the defined factors, a cluster analysis is conducted. The first step was to conduct a two-step cluster analysis. The two-step cluster analysis implementation resulted in just one cluster, which was not appropriate to answer the research question. Thus, considering the most recent similar work from literature by Laari, (2017) a k-means cluster analysis is conducted over the collected data. The number of specified clusters for this test is considered as three clusters, considering the three type of competitive strategy which is considered in this research. The Table 4.19, presents the weight of factors in three different clusters. It should be highlighted that this table does not provide the information about all factors and their weights in the clusters, it just presents those factors which received a higher weight in one cluster comparing to two other clusters. The complete k-means analysis table which is based on SPSS results is presented in Appendix C, Table C.1. As it could be seen from the table, the respondents in cluster one ranked market share, revenue maximization and brand image higher than other two clusters, and the cases in this cluster mostly have selected cost leadership strategy as their competitive strategy. This suggests that respondents within this cluster, considering cost leadership strategy are giving a higher level of importance to economic factors rather than two other clusters in case of other sustainability pillars, which are social and environmental. The second cluster entails six cases, and it is hard to make interpretations based on this cluster data due to the very small number of respondents in this cluster. In the third cluster, profitability, greening expenses, and pollution level are relatively ranked higher than two other clusters. This could suggest that there is a group of respondents whose preference is to invest on greening expenses, and the high weight that they gave to pollution level, could be demonstrated that these are the respondents who care about improving their environmental performance.

Table 4.19: K-means cluster analysis.

Cluster	1	2	3
Number of cases in each cluster	21	6	15
Profitability	.068	.028	.158
Market share	.070	.049	.038
Greening Expenses	.031	.034	.064
Marketing Investment	.043	.196	.043
Revenue maximization	.122	.026	.031
Employee training	.041	.079	.050
Brand Image	.051	.029	.038
Customer satisfaction	.063	.071	.057
Legal compliance	.028	.026	.042
Pollution level	.049	.037	.051
Environmental hazard	.054	.088	.072



5. CONCLUSION

The fifth chapter presents the conclusions which are drawn from this study. The research questions are answered in chapter five and the limitations of this research are also mentioned in this chapter and finally, some recommendations are included based on this study findings.

The most important and contributing factors of sustainability pillars regarding differentiation and cost leadership competitive strategies of the logistic firm's supply chain management. To evaluate the final set of factors which are mentioned in section 2.1, the questionnaire is designed and distributed to respondents to collect data. The questionnaire is distributed to shippers, logistic service providers, logistics consultants, and professors. After the data collection process is finished, the collected data are used to obtain optimal weights for factors using the Best-Worst method. The answer to the main research question, regarding the most important factors is provided in section 4.1, based on the obtained weights. The results demonstrate that profitability is the most important factor of the economic pillar with the weight of 29.5%, and greening expenses (13%) is the least important factor from respondents perspective considering the implementation of cost leadership strategy. The low obtained weight for greening expenses could suggest the point that organizations are reluctant to make investments on green initiatives. As the most important factor of firm-oriented social factors, employee training obtained the highest weight (28.9%). And for market-oriented social factors, customer satisfaction obtained the highest rank with the weight of 36.4%. Based on the obtained weights for the environmental pillar of sustainability, legal compliance with the weight of 19.5% is the most important firm-oriented factor and packing waste (43.8%) is the most important market-oriented factor considering environmental differentiation strategy. The obtained rank of legal compliance as the most important firm-oriented factor demonstrates the importance of legal compliance as an external driver for sustainability initiatives implementations. The competitive strategies of the firm, and the category that they fall in (cost or differentiation strategy). The studied literature of this research, which is presented in chapter two clarified that

the cost leadership and differentiation strategy are the most cited type of competitive strategies in the current literature. In this research, differentiation strategy is considered from two perspectives, which is the social differentiation and environmental differentiation. The obtained results from respondents demonstrated that cost leadership strategy (47%) is the most applied type of strategy, following by the social differentiation (29%), and the environmental differentiation strategy (24%). The results deliberate that cost leadership is the most applied type of strategy and highlights the importance of lowering the cost of the provided service by the service industry. From another point of view, differentiation strategy is also as important as cost leadership strategy, since it has been selected by half percent of the respondents.

The existence of a homogeneous group of respondents' with the same group of preferences of criteria, considering the type of their competitive strategy

The results of the conducted k-means analysis are presented in section 4.3. Considering the three type of competitive strategy that is evaluated in this research, the assumptions of the k-means statistical test, the number of participated respondents in data collection, and the similar works in literature, a k-means analysis with three specified clusters are conducted. In the first cluster the, the respondents are those who ranked revenue maximization, market share and brand image with higher weights in comparison to two other clusters. The respondents who fall into this cluster are mostly selected cost leadership strategy as their main competitive strategy. This suggests that respondents who choose cost leadership strategy evaluated economic pillars importance higher than two other clusters. In the second cluster, the respondents have both types of cost leadership and differentiation strategies. The factors such as employee training, marketing investment, and environmental hazard are ranked higher in comparison to two other clusters but due to a small number of cases which fall into the second cluster, the second cluster does not specifically provides information about the existence of a homogeneous group of respondents. In the third cluster, most of the respondents selected social or environmental differentiation strategy, and greening expenses obtained the highest rank by this cluster in comparison to two other clusters. This result suggests that there is a group of respondents who are willing to provide more environmental-friendly services. The main objective of conducting a k-means cluster analysis was to figure out about the clusters of respondents with same preferences of criteria.

The difference in the rank of each pillar's criterion, by a different group of respondents

The respondents are divided into two main group of industry and experts to compare the ranks that they gave to different factors. The market-oriented and firm-oriented social factors received the same rank from two group of respondents. The market-oriented environmental factors are also ranked with the same order from two group of respondents who are industry and experts. The main difference between these two group of respondents while ranking factors is about the firm-oriented environmental factors, which the results are presented in chapter four. Legal compliance obtained the weight 24.4% from industry sector and 13.4% from expert's point of view, which suggests a relatively high importance of legal compliance among industry respondents. The weights that are given to firm-oriented environmental factors with experts are relatively close to each other, which points the same level of importance for factors from an expert perspective. Later the U-Mann-Whitney test is conducted for each of firm-oriented environmental factors to find out if the difference is statistically significant or not. Based on the U-Mann-Whitney test results, in case of legal compliance, the difference is statistically significant, since the achieved sig value is (0.03) which is lower than the p-value of (0.05). So the null hypothesis, that there is no difference between these two different group of respondents in case of legal compliance criterion is rejected. For all other firm-oriented environmental factors the null hypothesis is accepted, which confirms that there is no difference between industry and experts while ranking these factors.

5.1 Research Limitations

Although, the defined research questions of this research are answered, and the research has achieved its goal but there are unavoidable limitations. As it is mentioned the data is collected from the logistics firms in Turkey and mainly in Istanbul. This is a small size of the population, which entails 42 respondents. These respondents are divided into two main groups of industry and experts, and the small number of respondents in each of these two categories led us to use non-parametric tests for analysis. Considering that non-parametric tests are not as powerful as a parametric test, the results of this research are tentative. Another limitation from a literature perspective is that the considered factors, which are evaluated in this research, might not be the most comprehensive set of factors for each category. Though the final set

of factors in this research are selected after an extensive literature review and finalized with the help of experts from service industry, the pre-evaluation of such factors could be very helpful toward their completeness and applicability. This could provide a new research topic for interested researchers.

5.2 Recommendation

Based on the findings of this research and the limitations of the research which are mentioned before some recommendations are presented as follow;

Regarding the obtained weights for each criterion per social-oriented and market-oriented factors, the preference of the respondents over these criteria could be understood. Furthermore, the comparative analysis between the two main group of respondents clarified that legal compliance gains a higher weight from industry sector in comparison to experts. The statistical analysis over the different perception of these two group of respondents elaborates that there is a significant difference among these, two group of respondents while ranking legal compliance. These findings suggest that the implementation of sustainability initiatives in Turkey highly requires the existence of legal compliance from industry respondent's perspective. The existence of a set of pre-defined principles and rules could enforce the service provider companies for sustainability initiatives implementation. These results also suggest that service providers do not want to be penalized for being non-compliance and highlight the importance of legal compliance as an external driver for sustainable development.

Through the findings of this research over the market-oriented social factors, customer satisfaction obtained the highest weight in comparison to other factors. In a comparative analysis of the perceptions of two group of industry and experts, customer satisfaction received a relatively high weight from these two group. This suggests that customer satisfaction has a high level of importance from all type of respondent's perspective. The importance of customer's satisfaction with the type of service that they receive from the service provider highly affects the firm's reputation and market share and finally their profitability (Purba & Diane, 2005; Laari, 2017). This could suggest that it is highly important that customers should consider the environmental performance of the service provider firms. In other words, if there is a desire and request from market toward being more environmental-friendly, it could increase the motivation of service providers to implement green initiatives. Thus, customer's desire

to receive more environmental-friendly services could be considered as an external motivator for service providers to enhance their environmental performance.





REFERENCE

- Aguezzoul, A.** (2014). Third-party logistics selection problem: A literature review on criteria and methods. *Omega*, 49, 69-78.
- Ahi, P., Jaber, M. Y., & Searcy, C.** (2016). A comprehensive multidimensional framework for assessing the performance of sustainable supply chains. *Applied Mathematical Modelling*, 40(23-24), 10153-10166.
- Ahi, P., & Searcy, C.** (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production*, 52, 329-341. doi:10.1016/j.jclepro.2013.02.018
- Ahi, P., & Searcy, C.** (2015a). An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production*, 86, 360-377. doi:10.1016/j.jclepro.2014.08.005
- Ahi, P., & Searcy, C.** (2015b). Assessing sustainability in the supply chain: A triple bottom line approach. *Applied Mathematical Modelling*, 39(10-11), 2882-2896. doi:10.1016/j.apm.2014.10.055
- Åkerman, J., & Höjer, M.** (2006). How much transport can the climate stand?—Sweden on a sustainable path in 2050. *Energy Policy*, 34(14), 1944-1957. doi:<https://doi.org/10.1016/j.enpol.2005.02.009>
- Alison, A., Mike, L., & Melanie, H. S.** (2012). Making connections: a review of supply chain management and sustainability literature. *Supply Chain Management: An International Journal*, 17(5), 497-516. doi:10.1108/13598541211258573
- Amindoust, A., Ahmed, S., Saghafinia, A., & Bahreininejad, A.** (2012). Sustainable supplier selection: A ranking model based on fuzzy inference system. *Applied Soft Computing*, 12(6), 1668-1677. doi:<https://doi.org/10.1016/j.asoc.2012.01.023>
- Arvidsson, N., Woxenius, J., & Lamngård, C.** (2013). Review of Road Hauliers' Measures for Increasing Transport Efficiency and Sustainability in Urban Freight Distribution. *Transport Reviews*, 33(1), 107-127. doi:10.1080/01441647.2013.763866
- Azadnia, A. H., Saman, M. Z. M., & Wong, K. Y.** (2015). Sustainable supplier selection and order lot-sizing: an integrated multi-objective decision-making process. *International Journal of Production Research*, 53(2), 383-408. doi:10.1080/00207543.2014.935827
- Badri Ahmadi, H., Hashemi Petrudi, S. H., & Wang, X.** (2017a). Integrating sustainability into supplier selection with analytical hierarchy process and improved grey relational analysis: a case of telecom industry. *The International Journal of Advanced Manufacturing Technology*, 90(9), 2413-2427. doi:10.1007/s00170-016-9518-z
- Badri Ahmadi, H., Kusi-Sarpong, S., & Rezaei, J.** (2017b). Assessing the social sustainability of supply chains using Best Worst Method. *Resources, Conservation and Recycling*, 126, 99-106. doi:10.1016/j.resconrec.2017.07.020

- Banasik, A., Bloemhof-Ruwaard, J. M., Kanellopoulos, A., Claassen, G. D. H., & van der Vorst, J. G. A. J.** (2016). Multi-criteria decision making approaches for green supply chains: a review. *Flexible Services and Manufacturing Journal*. doi:10.1007/s10696-016-9263-5
- Barbosa-Póvoa, A. P., da Silva, C., & Carvalho, A.** (2017). Opportunities and Challenges in Sustainable Supply Chain: An Operations Research Perspective. *European Journal of Operational Research*. doi:10.1016/j.ejor.2017.10.036
- Brandenburg, M., & Rebs, T.** (2015). Sustainable supply chain management: a modeling perspective. *Annals of Operations Research*, 229(1), 213-252. doi:10.1007/s10479-015-1853-1
- Carter, C. R., & Rogers, D. S.** (2008). A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38(5), 360-387. doi:10.1108/09600030810882816
- Centobelli, P., Cerchione, R., & Esposito, E.** (2017). Environmental sustainability in the service industry of transportation and logistics service providers: Systematic literature review and research directions. *Transportation Research Part D: Transport and Environment*, 53, 454-470. doi:10.1016/j.trd.2017.04.032
- Chen, C.-C., Shih, H.-S., Shyur, H.-J., & Wu, K.-S.** (2012). A business strategy selection of green supply chain management via an analytic network process. *Computers & Mathematics with Applications*, 64(8), 2544-2557. doi:10.1016/j.camwa.2012.06.013
- Chunguang, B., & Joseph, S.** (2014). Determining and applying sustainable supplier key performance indicators. *Supply Chain Management: An International Journal*, 19(3), 275-291. doi:doi:10.1108/SCM-12-2013-0441
- Colicchia, C., Marchet, G., Melacini, M., & Perotti, S.** (2013). Building environmental sustainability: empirical evidence from Logistics Service Providers. *Journal of Cleaner Production*, 59(Supplement C), 197-209. doi:<https://doi.org/10.1016/j.jclepro.2013.06.057>
- Colicchia, C., Melacini, M., & Perotti, S.** (2011). Benchmarking supply chain sustainability: insights from a field study. *Benchmarking: An International Journal*, 18(5), 705-732. doi:10.1108/14635771111166839
- Cristina, G., & M., T. E.** (2012). Extending sustainability to suppliers: a systematic literature review. *Supply Chain Management: An International Journal*, 17(5), 531-543. doi:doi:10.1108/13598541211258591
- Cunha Callado, A. A., & Jack, L.** (2015). Balanced scorecard metrics and specific supply chain roles. *International Journal of Productivity and Performance Management*, 64(2), 288-300. doi:10.1108/ijppm-05-2014-0071
- Daugherty, P. J., Stank, T. P., & Ellinger, A. E.** (1998). Leveraging logistics/distribution capabilities: The effect of logistics service on market share. *Journal of Business Logistics*, 19(2), 35-51.
Retrieved from; <http://160.75.22.2/docview/212595606?accountid=11638>
- Dekker, R., Bloemhof, J., & Mallidis, I.** (2012). Operations Research for green logistics – An overview of aspects, issues, contributions and challenges. *European Journal of Operational Research*, 219(3), 671-679. doi:<https://doi.org/10.1016/j.ejor.2011.11.010>
- Dickinson, V., & Sommers, G. A.** (2012). Which Competitive Efforts Lead to Future Abnormal Economic Rents? Using Accounting Ratios to Assess Competitive

- Advantage. *Journal of Business Finance & Accounting*, 39(3-4), 360-398. doi:10.1111/j.1468-5957.2012.02283.x
- Dubey, R., Gunasekaran, A., Childe, S., Papadopoulos, T., & Fosso Wamba, S.** (2016). *World Class Sustainable Supply Chain Management: critical review and further research directions* (Vol. 28).
- Dubey, R., Gunasekaran, A., Papadopoulos, T., Childe, S. J., Shibin, K. T., & Wamba, S. F.** (2017). Sustainable supply chain management: framework and further research directions. *Journal of Cleaner Production*, 142, 1119-1130. doi:10.1016/j.jclepro.2016.03.117
- Dües, C. M., Tan, K. H., & Lim, M.** (2013). Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain. *Journal of Cleaner Production*, 40, 93-100. doi:<https://doi.org/10.1016/j.jclepro.2011.12.023>
- Dyllick, T., & Hockerts, K.** (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment*, 11(2), 130-141. doi:10.1002/bse.323
- Folke, C., Hahn, T., Olsson, P., & Norberg, J.** (2005). Adaptive Governance of Social-Ecological Systems. *Annual Review of Environment and Resources*, 30(1), 441-473. doi:10.1146/annurev.energy.30.050504.144511
- Forum, W. E.** (2009). *Supply chain decarbonization: The role of logistics and transportation in reducing supply chain carbon emissions*.
- Fraj-Andrés, E., Martínez-Salinas, E., & Matute-Vallejo, J.** (2009). Factors affecting corporate environmental strategy in Spanish industrial firms. *Business Strategy and the Environment*, 18(8), 500-514. doi:10.1002/bse.611
- Gimenez, C., Sierra, V., & Rodon, J.** (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, 140(1), 149-159. doi:10.1016/j.ijpe.2012.01.035
- Gold, S., & Schleper, M. C.** (2017). A pathway towards true sustainability: A recognition foundation of sustainable supply chain management. *European Management Journal*, 35(4), 425-429. doi:10.1016/j.emj.2017.06.008
- Gold, S., Seuring, S., & Beske, P.** (2009). Sustainable supply chain management and inter-organizational resources: a literature review. *Corporate Social Responsibility and Environmental Management*
- Golicic, S. L., & Smith, C. D.** (2013). A Meta-Analysis of Environmentally Sustainable Supply Chain Management Practices and Firm Performance. *Journal of Supply Chain Management*, 49(2), 78-95. doi:10.1111/jscm.12006
- Gong, K., & Yan, H.** (2015). Performance Measurement of Logistics Service Supply Chain Using Bijective Soft Set. *Journal of Advanced Manufacturing Systems*, 14(01), 23-40. doi:10.1142/s0219686715500031
- Harik, R., El Hachem, W., Medini, K., & Bernard, A.** (2015). Towards a holistic sustainability index for measuring sustainability of manufacturing companies. *International Journal of Production Research*, 53(13), 4117-4139. doi:10.1080/00207543.2014.993773
- Haw-Jan, W., & C., D. S.** (1995). Environmentally responsible logistics systems. *International Journal of Physical Distribution & Logistics Management*, 25(2), 20-38. doi:doi:10.1108/09600039510083925
- Hoejmose, S., Brammer, S., & Millington, A.** (2013). An empirical examination of the relationship between business strategy and socially responsible supply chain management. *International Journal of Operations & Production Management*, 33(5), 589-621. doi:10.1108/01443571311322733

- Hubbard, G.** (2009). Measuring organizational performance: beyond the triple bottom line. *Business Strategy and the Environment*, 18(3), 177-191. doi:10.1002/bse.564
- Hussain, M., Khan, M., & Al-Aomar, R.** (2016). A framework for supply chain sustainability in service industry with Confirmatory Factor Analysis. *Renewable and Sustainable Energy Reviews*, 55, 1301-1312. doi:10.1016/j.rser.2015.07.097
- Hutchins, M. J., & Sutherland, J. W.** (2008). An exploration of measures of social sustainability and their application to supply chain decisions. *Journal of Cleaner Production*, 16(15), 1688-1698. doi:<https://doi.org/10.1016/j.jclepro.2008.06.001>
- Ilgin, M. A., Gupta, S. M., & Battaia, O.** (2015). Use of MCDM techniques in environmentally conscious manufacturing and product recovery: State of the art. *Journal of Manufacturing Systems*, 37, 746-758. doi:10.1016/j.jmsy.2015.04.010
- Jang, Y. J., Kim, W. G., & Bonn, M. A.** (2011). Generation Y consumers' selection attributes and behavioral intentions concerning green restaurants. *International Journal of Hospitality Management*, 30(4), 803-811. doi:10.1016/j.ijhm.2010.12.012
- Jung, H.** (2017). Evaluation of Third Party Logistics Providers Considering Social Sustainability. *Sustainability*, 9(5), 777. doi:10.3390/su9050777
- Kolk, A.** (2004). *A decade of sustainability reporting: Developments and significance* (Vol. 3).
- Kuo, R. J., Wang, Y. C., & Tien, F. C.** (2010). Integration of artificial neural network and MADA methods for green supplier selection. *Journal of Cleaner Production*, 18(12), 1161-1170. doi:<https://doi.org/10.1016/j.jclepro.2010.03.020>
- Laari, S., Töyli, J., & Ojala, L.** (2017). Supply chain perspective on competitive strategies and green supply chain management strategies. *Journal of Cleaner Production*, 141, 1303-1315. doi:10.1016/j.jclepro.2016.09.114
- Laari, S., Töyli, J., Solakivi, T., & Ojala, L.** (2016). Firm performance and customer-driven green supply chain management. *Journal of Cleaner Production*, 112, 1960-1970. doi:10.1016/j.jclepro.2015.06.150
- Lammgård, C.** (2012). Intermodal train services: A business challenge and a measure for decarbonisation for logistics service providers. *Research in Transportation Business&Management*, 5, 48-56. doi:<https://doi.org/10.1016/j.rtbm.2012.11.001>
- Lammgård, C., & Andersson, D.** (2014). Environmental considerations and trade-offs in purchasing of transportation services. *Research in Transportation Business&Management*, 10(SupplementC), 45-52. doi:<https://doi.org/10.1016/j.rtbm.2014.04.003>
- Lieb, K. J., & Lieb, R. C.** (2010). Environmental sustainability in the third-party logistics (3PL) industry. *International Journal of Physical Distribution & Logistics Management*, 40(7), 524-533. doi:10.1108/09600031011071984
- Lin, C.-Y., & Ho, Y.-H.** (2008). An Empirical Study on Logistics Service Providers' Intention to Adopt Green Innovations. 2008, 3(1), 10.
- Lin, C.-Y., & Ho, Y.-H.** (2011). Determinants of Green Practice Adoption for Logistics Companies in China. *Journal of Business Ethics*, 98(1), 67-83. doi:10.1007/s10551-010-0535-9

- Longoni, A., & Cagliano, R.** (2015). Environmental and social sustainability priorities. *International Journal of Operations & Production Management*, 35(2), 216-245. doi:10.1108/ijopm-04-2013-0182
- Longoni, A., Golini, R., & Cagliano, R.** (2014). The role of New Forms of Work Organization in developing sustainability strategies in operations. *International Journal of Production Economics*, 147, 147-160. doi:10.1016/j.ijpe.2013.09.009
- Lovrić, M., Li, T., & Vervest, P.** (2013). Sustainable revenue management: A smart card enabled agent-based modeling approach. *Decision support systems*, 54(4), 1587-1601. doi:<https://doi.org/10.1016/j.dss.2012.05.061>
- Luthra, S., Govindan, K., Kannan, D., Mangla, S. K., & Garg, C. P.** (2017). An integrated framework for sustainable supplier selection and evaluation in supply chains. *Journal of Cleaner Production*, 140(Part 3), 1686-1698. doi:<https://doi.org/10.1016/j.jclepro.2016.09.078>
- Maisam, A., & Fredrik, N.** (2012). Themes and challenges in making supply chains environmentally sustainable. *Supply Chain Management: An International Journal*, 17(5), 517-530. doi:doi:10.1108/13598541211258582
- Mani, V., Agarwal, R., Gunasekaran, A., Papadopoulos, T., Dubey, R., & Childe, S. J.** (2016a). Social sustainability in the supply chain: Construct development and measurement validation. *Ecological Indicators*, 71, 270-279. doi:10.1016/j.ecolind.2016.07.007
- Mani, V., Agarwal, R., Gunasekaran, A., Papadopoulos, T., Dubey, R., & Childe, S. J.** (2016b). Social sustainability in the supply chain: Construct development and measurement validation. *Ecological Indicators*, 71(Supplement C), 270-279. doi:<https://doi.org/10.1016/j.ecolind.2016.07.007>
- Mani, V., Gunasekaran, A., & Delgado, C.** (2018). Enhancing supply chain performance through supplier social sustainability: An emerging economy perspective. *International Journal of Production Economics*, 195, 259-272. doi:10.1016/j.ijpe.2017.10.025
- Marchet, G., Melacini, M., & Perotti, S.** (2014). Environmental sustainability in logistics and freight transportation. *Journal of Manufacturing Technology Management*, 25(6), 775-811. doi:10.1108/jmtm-06-2012-0065
- Markley, M. J., & Davis, L.** (2007). Exploring future competitive advantage through sustainable supply chains. *International Journal of Physical Distribution & Logistics Management*, 37(9), 763-774. doi:10.1108/09600030710840859
- Maury, B.** (2018). Sustainable competitive advantage and profitability persistence: Sources versus outcomes for assessing advantage. *Journal of Business Research*, 84, 100-113. doi:<https://doi.org/10.1016/j.jbusres.2017.10.051>
- Milne, M. J.** (1996). On sustainability; the environment and management accounting. *Management Accounting Research*, 7(1), 135-161. doi:<https://doi.org/10.1006/mare.1996.0007>
- Min, H., & Galle, W. P.** (1997). Green Purchasing Strategies: Trends and Implications. *International Journal of Purchasing and Materials Management*, 33(2), 10-17. doi:10.1111/j.1745-493X.1997.tb00026.x
- Min, H., & Galle, W. P.** (2001). Green purchasing practices of US firms. *International Journal of Operations & Production Management*, 21(9), 1222-1238.
- Oberhofer, P., & Dieplinger, M.** (2014). Sustainability in the Transport and Logistics Sector: Lacking Environmental Measures. *Business Strategy and the Environment*, 23(4), 236-253. doi:10.1002/bse.1769

- Oberhofer, P., & Fürst, E.** (2013). Sustainable Development in the Transport Sector: Influencing Environmental Behaviour and Performance. *Business Strategy and the Environment*, 22(6), 374-389. doi:10.1002/bse.1750
- Orsato, R. J.** (2006). Competitive Environmental Strategies: When Does it Pay to Be Green? *California Management Review*, 48(2), 127-143. doi:10.2307/41166341
- Papadas, K.-K., Avlonitis, G. J., & Carrigan, M.** (2017). Green marketing orientation: Conceptualization, scale development and validation. *Journal of Business Research*, 80, 236-246. doi:10.1016/j.jbusres.2017.05.024
- Porter, M. E.** (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. The Free Press, New York, NY.
- Purba, R., & Diane, H.** (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, 25(9), 898-916. doi:10.1108/01443570510613956
- Rahdari, A. H., & Anvary Rostamy, A. A.** (2015). Designing a general set of sustainability indicators at the corporate level. *Journal of Cleaner Production*, 108, 757-771. doi:10.1016/j.jclepro.2015.05.108
- Rajeev, A., Pati, R. K., Padhi, S. S., & Govindan, K.** (2017). Evolution of sustainability in supply chain management: A literature review. *Journal of Cleaner Production*, 162, 299-314. doi:10.1016/j.jclepro.2017.05.026
- Rezaei, J.** (2015). Best-worst multi-criteria decision-making method. *Omega*, 53, 49-57. doi:10.1016/j.omega.2014.11.009
- Rezaei, J., Kothadiya, O., Tavasszy, L., & Kroesen, M.** (2018). Quality assessment of airline baggage handling systems using SERVQUAL and BWM. *Tourism Management*, 66, 85-93. doi:<https://doi.org/10.1016/j.tourman.2017.11.009>
- Rezaei, J., Nispeling, T., Sarkis, J., & Tavasszy, L.** (2016). A supplier selection life cycle approach integrating traditional and environmental criteria using the best worst method. *Journal of Cleaner Production*, 135, 577-588. doi:<https://doi.org/10.1016/j.jclepro.2016.06.125>
- Rezaei, J., Wang, J., & Tavasszy, L.** (2015). Linking supplier development to supplier segmentation using Best Worst Method. *Expert Systems with Applications*, 42(23), 9152-9164. doi:<https://doi.org/10.1016/j.eswa.2015.07.073>
- Saaty, T. L.** (1995). Transport planning with multiple criteria: The analytic hierarchy process applications and progress review. *Journal of Advanced Transportation*, 29(1), 81-126. doi:doi:10.1002/atr.5670290109
- Salavou, H.** (2010). Strategy types of service firms: evidence from Greece. *Management Decision*, 48(7), 1033-1047. doi:10.1108/00251741011068752
- Salavou, H. E.** (2015). Competitive strategies and their shift to the future. *European Business Review*, 27(1), 80-99. doi:10.1108/eb-04-2013-0073
- Salimi, N., & Rezaei, J.** (2018). Evaluating firms' R&D performance using best worst method. *Evaluation and Program Planning*, 66, 147-155. doi:<https://doi.org/10.1016/j.evalprogplan.2017.10.002>
- Sapsford, R., & Jupp, V.** (2006). *Data Collection and Analysis*. London: SAGE publisher.
- Sara, P., Marta, Z., Enrico, C., & J.L., M. G.** (2012). Green supply chain practices and company performance: the case of 3PLs in Italy. *International Journal of Physical Distribution & Logistics Management*, 42(7), 640-672. doi:doi:10.1108/09600031211258138

- Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B.** (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28(2), 163-176. doi:<https://doi.org/10.1016/j.jom.2009.10.001>
- Sarkis, J., Zhu, Q., & Lai, K.-h.** (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, 130(1), 1-15. doi:10.1016/j.ijpe.2010.11.010
- Sekaran, U., & Bougie, R.** (2010). *Research Methods for Business: A Skill Building Approach* (Vol. 05): Willey.
- Seuring, S.** (2013). A review of modeling approaches for sustainable supply chain management. *Decision support systems*, 54(4), 1513-1520.
- Seuring, S., & Müller, M.** (2008a). Core issues in sustainable supply chain management - a Delphi study. *Business Strategy and the Environment*, 17(8), 455-466. doi:10.1002/bse.607
- Seuring, S., & Müller, M.** (2008b). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699-1710. doi:<https://doi.org/10.1016/j.jclepro.2008.04.020>
- Shibin, K. T., Gunasekaran, A., & Dubey, R.** (2017). Explaining sustainable supply chain performance using a total interpretive structural modeling approach. *Sustainable Production and Consumption*, 12, 104-118. doi:10.1016/j.spc.2017.06.003
- Srivastava, S. K.** (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, 9(1), 53-80. doi:10.1111/j.1468-2370.2007.00202.x
- Stank, T. P., Goldsby, T. J., Vickery, S. K., & Savitskie, K.** (2003). LOGISTICS SERVICE PERFORMANCE: ESTIMATING ITS INFLUENCE ON MARKET SHARE. *Journal of Business Logistics*, 24(1), 27-55. doi:10.1002/j.2158-1592.2003.tb00031.x
- Stephan, V., & D., K. R.** (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, 26(7), 795-821. doi:doi:10.1108/01443570610672248
- Stindt, D.** (2017). A generic planning approach for sustainable supply chain management - How to integrate concepts and methods to address the issues of sustainability? *Journal of Cleaner Production*, 153, 146-163. doi:10.1016/j.jclepro.2017.03.126
- Tacken, J., Sanchez Rodrigues, V., & Mason, R.** (2014). Examining CO₂e reduction within the German logistics sector. *The International Journal of Logistics Management*, 25(1), 54-84. doi:10.1108/ijlm-09-2011-0073
- Taticchi, P., Garengo, P., Nudurupati, S. S., Tonelli, F., & Pasqualino, R.** (2014). A review of decision-support tools and performance measurement and sustainable supply chain management. *International Journal of Production Research*, 53(21), 6473-6494. doi:10.1080/00207543.2014.939239
- Thomas L. Saaty, L. G. V.** (2012). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process*.
- van de Kaa, G., Kamp, L., & Rezaei, J.** (2017). Selection of biomass thermochemical conversion technology in the Netherlands: A best worst method approach. *Journal of Cleaner Production*, 166, 32-39. doi:<https://doi.org/10.1016/j.jclepro.2017.07.052>

- Walker, H., Di Sisto, L., & McBain, D.** (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, 14(1), 69-85. doi:10.1016/j.pursup.2008.01.007
- Wan Ahmad, W. N. K., Rezaei, J., Sadaghiani, S., & Tavasszy, L. A.** (2017). Evaluation of the external forces affecting the sustainability of oil and gas supply chain using Best Worst Method. *Journal of Cleaner Production*, 153, 242-252. doi:<https://doi.org/10.1016/j.jclepro.2017.03.166>
- Yakovleva, N., Sarkis, J., & Sloan, T.** (2012). Sustainable benchmarking of supply chains: the case of the food industry. *International Journal of Production Research*, 50(5), 1297-1317. doi:10.1080/00207543.2011.571926
- Yingli, W., Vasco, S. R., & Leighton, E.** (2015). The use of ICT in road freight transport for CO2 reduction – an exploratory study of UK's grocery retail industry. *The International Journal of Logistics Management*, 26(1), 2-29. doi:doi:10.1108/IJLM-02-2013-0021
- Zhu, Q., Sarkis, J., & Lai, K.-h.** (2007). Green supply chain management: pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, 15(11), 1041-1052. doi:<https://doi.org/10.1016/j.jclepro.2006.05.021>

APPENDICES

APPENDIX A : Questionnaire

APPENDIX B : Tables



APPENDIX A

Determining the Importance of Social, Economical and Environmental factors of Logistic Firms Supply Chain Management and their contribution to the competitive advantage of the firms

Dear Sir/ Madam,

We are conducting research at the *Istanbul Technical University* to identify the importance of social and environmental factors of supply chain management in logistic companies and how these factors grant competitiveness for the companies. Based on studied literature and the conducted information from interviews with experts in this field, two main categories of competitiveness strategies, namely Cost and differentiation has been selected. The sustainability initiatives including; Social, environmental and economic factors, are classified based on competitive strategies (cost and differentiation) from two perspective, firm and market. Questions are designed as follow:

First, we ask you to choose the Most important type of competency strategy (Cost or Differentiation) for your firms. Then for each of these strategies, there are a couple of investigated sub-dimensions, which we ask you to choose the Most and Least important one of these sub-dimensions and then rank the other dimensions based on your selected Most & Least option. Our ambition is to gain insights into the most important factors through this survey.

Given your expertise in the field, your participation in this survey would be of great value to our study. The survey takes approximately 15 minutes to complete; it is anonymous and we will treat all personal information confidentially. In case of questions, I can be contacted at the below mail address.

Thank you for taking part in this survey!

Mehrnaz Ektesaby (ektesabi15@itu.edu.tr)

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Hatice Camgoz Akdag, PhD

Associate professor of Management engineering department, Istanbul Technical University

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1. Which one of the following options is the most important competitive strategy of your firm's sustainability initiatives?

1.1 Cost Leadership strategy

“Firms show tremendous effort to lower costs in an industry. This usually involves the construction of efficient facilities, rigorous pursuit of cost reductions from experience, tight cost and overhead control, avoidance of marginal customer accounts, and cost minimization in areas like R & D, service, sales force, advertising.”(Porter, 1980) The sub-dimensions of this strategy includes; Profitability, Market share, Greening expenses, Marketing Investment and Revenue Maximization.

1.2 Differentiation strategy

“The strategy of differentiation aims at creating a product or service that is somehow unique. This can be done through design or brand image, technology, customer service, or other attractive features”. (Porter, 1980) Through this research differentiations, strategies are considered regarding sustainability pillars namely social and environmental initiatives.

Differentiation strategy based on Social initiatives

The sub-dimensions of this strategy includes; Brand Image, Customer satisfaction, Health & Safety and Human rights.

Differentiation strategy based on Environmental initiatives

The sub-dimensions of this strategy includes; Pollution level control, Packing waste, Greening facilities Legal compliance and Reduction in environmental hazards.

In the following questions, we ask your opinion on the MOST and LEAST important factor influencing your supply chain management decisions. Also, we ask your preference of the MOST important factor over the other factors, as well as your preference of the other factors over the LEAST important factor.

Preference Questions

1. Several factors could affect Cost leadership strategies of firms (Greening expenses, Marketing investment) as listed below. In your opinion, which is the MOST and the LEAST important factor? Please indicate one MOST important factor and one LEAST important factor below.

Table A.1: Main economic factors.

Main factors	Explanation	Most important factor	Least important factor
Profitability	“Exploit new market opportunities to lead to greater profit Margins”		
Market share	“Aggressive pricing to maximize economies of scale”		
Greening expenses	“Cost Increase due to implementing green initiatives, such as efficient facilities”		
Marketing Investment	Amount of allocated budget for marketing		
Revenue maximization	Above average returns		

2. Based on the MOST important factor you have selected, please determine your preference of this factor over the other factors by using 1 to 9 measurement scale (1 shows about equal importance to the factor at hand and 9 means the factor is extremely more important. Please check below for detailed explanation of 1 to 9 scales¹). For example, if you have selected ‘Market share’ as the MOST important factor then please indicate how much more you prefer ‘Market share’ over the other factors.

Table A.2: Best economic factor.

Factors	Profitability	Market share	Greening Expenses	Marketing Investment	Revenue maximization
Most important factor:					

3. Based on the LEAST important factor you have selected, please determine your preference for the other factors over the least important factor by using 1 to 9 measurement scale. A score of 9 indicates that the score at hand is extremely more important than the least important factor, a score of 1 that it is about equally important

1 Definition of 1 to 9 measurement scale:

1: Equal importance

3: Moderately more important

5: Strongly more important

7: Very strongly more important

9: Extremely more important

2, 4, 6, 8: Intermediate values

Table A.3: Worst economic factor.

Main factors	Least important factor: ...
Profitability	
Market share	
Greening expenses	
Marketing investment	
Revenue maximization	

Differentiation factors

Differentiation strategies are classified from two perspectives, which is market and firm oriented. The following questions are about market and firm's social and environmental initiatives to achieve their competency goals.

Differentiation Factors from Firm Perspective (Social & Environmental)

4. Social initiatives of Firms could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which factor is the MOST and the LEAST important? Please indicate one MOST important factor and one LEAST important factor.

Table A.4: Firm-oriented social factors.

Factors	Explanation	MOST important	LEAST important
Employee training	"Programs for skill management to support the continued employability and career-ending"		
Human rights	"Forced labour, child labour, Non-discrimination"		
Health & safety	"High Incidence or high risk of disease related to occupation" "Injury rate"		
Stakeholder engagement plan	"Concerns with the moral rights of society having stakes in the business"		

5. Based on the MOST important factor you have selected, please determine your preference of this factor over the other factors by using 1 to 9 measurement scale (1 shows the equal importance and 9 means the factor is extremely more important).

Table A.5: Best Firm-oriented social factor.

Factors	Employee training	Human rights	Health & safety	Stakeholder engagement plan
Most important factor:				
...				

6. Based on the LEAST important factor you have selected, please determine your preference for the other factors over the least important factor by using 1 to 9 measurement scale. A score of 9 indicates that the score at hand is extremely more important than the least important factor, a score of 1 that it is about equally important.

Table A.6: Worst Firm-oriented social factor.

Factors	Least important factor: ...
Employee training	
Human rights	
Health & safety	
Stakeholder engagement plan	

7. Environmental initiatives of Firms could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which factor is the MOST and the LEAST important?

Table A.7: Firm-oriented environmental factors.

Factors	Explanation	MOST important	LEAST important
Tracks with lower fuel consumption			
Packing management	“Ecological materials for primary packaging, Reduction of packaging waste”		
Warehousing & Green building	“Investment in green building & on efficient warehousing”		
Legal compliance	Laws & Legislation		
Diverse modes of transportation			
External Collaboration	“Partnerships with other companies/3PLs”		

8. Based on the MOST important factor you have selected, please determine your preference of this factor over the other factors by using 1 to 9 measurement scale (1 shows the equal importance and 9 means the factor is extremely more important).

Table A.8: Best firm-oriented environmental factors.

Factors	Tracks with lower fuel consumption	Packing management	Legal compliance	Diverse modes of transportation	External Collaboration
Most important factor:					

9. Based on the LEAST important factor you have selected, please determine your preference for the other factors over the least important factor by using 1 to 9 measurement scale.

Table A.9: Worst firm-oriented environmental factors.

Factors	Least important factor: ...
Tracks with lower fuel consumption	
Packing management	
Warehousing & Green building	
Legal compliance	
Diverse modes of transportation	
External Collaboration	

Differentiation factors from the Market perspective (Social & Environmental)

10. Social expectations of Market could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which factor is the MOST and the LEAST important? Please indicate one MOST important factor and one LEAST important factor.

Table A.10: Firm-oriented social factors.

Factors	Explanation	MOST important	LEAST important
Brand Image	"The impression in consumer's mind of brand reputation"		
Transparency & Information disclosure	"Providing information to their customers and stakeholders regarding material used, carbon emissions and toxins released during production, etc."		
Philanthropy	"The extent to which the provider actively participates in aiding the society through donations and commercial initiatives (the ratio of the philanthropy budget to sales)"		
Customer satisfaction	Delivery time, Delivery reliability		

11. Based on the MOST important factor you have selected, please determine your preference of this factor over the other factors by using 1 to 9 measurement scale (1 shows the equal importance and 9 means the factor is extremely more important).

Table A.11: Best firm-oriented social factors.

Factors	Brand Image	Transparency & Information disclosure	Philanthropy	Customer satisfaction
Most important factor: ...				

12. Based on the LEAST important factor you have selected, please determine your preference for the other factors over the least important factor by using 1 to 9 measurement scale.

Table A.12: Worst firm-oriented social factors.

Factors	Least important factor: ...
Brand Image	
Transparency & Information disclosure	
Philanthropy	
Customer satisfaction	

13. Environmental concerns of Market could affect supply chain management strategies and how they contribute to the competitive advantage of firms. Within this category, in your opinion, which factor is the MOST and the LEAST important? Please indicate one MOST important factor and one LEAST important factor.

Table A.13: Market-oriented social factors.

Factors	Explanation	MOST important	LEAST important
Pollution level			
Environmental hazard			
Packing waste			

14. Based on the MOST important factor you have selected, please determine your preference of this factor over the other factors by using 1 to 9 measurement scale (1 shows the equal importance and 9 means the factor is extremely more important).

Table A.14: Best market-oriented social factor.

Factors	Pollution level	Environmental hazard	Packing waste
Most important factor: ...			

15. Based on the LEAST important factor you have selected, please determine your preference for the other factors over the least important factor by using 1 to 9 measurement scale.

Table A.15:Worst market-oriented social factor.

Factors	Least important factor: ...
Pollution level	
Environmental hazard	
Packing waste	

III. Final questions

1. The headquarters of my company/university is located in:
City:
Country:
2. For industry: The annual turnover of my company is (rounded number). *The results are anonymous*:
..... Million euro
3. For industry: The number of employees working for my company is....
..... Employees
4. Gender:
 - a) Male
 - b) Female

If there are any **other important factors** that influenced sustainable supply chain management and competitive strategies, you can mention them in the following textbox:

--

Thank you very much for filling out this survey. If you have any questions considering the survey or if you would like to receive a summary of the main findings of our research project ‘Determining the Importance of Social and Environmental Factors of Supply chain Management’, please fill out your contact details (contact details will be treated confidentially):

Your name (optional):

Email address:

Do you have any other comments on the survey? You can place them here:

--

END.

APPENDIX B

Table B.1: Final Cluster Centers, K-means analysis.

	Cluster		
	1	2	3
Profitability	.068	.028	.158
Market share	.070	.049	.038
Greening expenses	.031	.034	.064
Marketing investment	.043	.196	.043
Revenue maximization	.122	.026	.031
Employee training	.041	.079	.050
Human rights	.042	.035	.044
Health & safety	.047	.043	.041
Stakeholder engagement plan	.037	.010	.032
Brand Image	.051	.029	.038
Transparency & information disclosure	.029	.045	.048
Philanthropy	.024	.022	.024
Customer satisfaction	.063	.071	.057
Trucks with lower fuel consumption	.032	.032	.024
Packing management	.021	.047	.029
Warehousing & green building	.033	.022	.023
Legal compliance	.028	.026	.042
Diverse mode of transportation	.029	.014	.024
External collaboration	.023	.025	.026
Pollution level	.049	.037	.051
Environmental hazard	.054	.088	.072
Packing waste	.040	.014	.043

Table B.2: Number of Cases in each Cluster

Cluster	1	21.000
	2	6.000
	3	15.000
Valid		42.000
Missing		.000

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