

PRODUCT DIFFERENTIATION AS A TOOL OF SUSTAINABILITY AND FINANCIAL PERFORMANCE

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*To my brother and Can,
with respect, thanks and honour...*



ABSTRACT

Sustainable product differentiation has been distinguished essential factors to assist environmental balance of ecosystem, gain growth to sustainable future. Defining sustainable product differentiation is initiated with ecological and environmental innovations and sustaining on market. This paper focus on environmental product differentiation aspect on sustainability. Analysis examines the relationship between sustainable product differentiation and financial performance employing the companies in WRDS as sample. Within this frame, ESG (Environmental, Social and Governance) Rating and Environment Score and WRDS Global Financial Statement dataset are obtained. The analysis which is made with 7 years samples on 43 companies which is from different sectors put some essential points: Which dimension of ESG rating does initiated with companies' financial performance? Is environment score sufficient to explain increase in financial performance in companies?

ÖZET

Sürdürülebilir ürün farklılaşması, ekosistemin çevresel dengesini sağlamaya, sürdürülebilir geleceğe büyüme elde etmesine yardımcı olan temel faktörleri ayırt etmekte kullanılmaktadır. Sürdürülebilir ürün farklılaşmasının tanımlanması ekolojik ve çevresel yeniliklerle ve pazarda sürdürülebilirlikle ilişkilendirilir. Bu çalışma, sürdürülebilirliğin çevresel ürün farklılaşması alanına odaklanmaktadır. Analiz, sürdürülebilir ürün farklılaşmasının finansal performans ile olan ilişkisini WRDS'den alınan örnekler üzerinde inceler. Bu çerçevede sürdürülebilir ürün farklılaşması ile ilgili olarak ESG (Çevre, Sosyal ve Yönetişim) Derecelendirmesi ve Çevre Puanı, örnek şirketlere ilişkin finansal göstergelere erişebilmek için de WRDS Global Finansal Tablo veri seti kullanılmıştır. Farklı sektörlerden rastgele seçilen 43 şirket için 7 yıllık (2009-2015) yapılan örneklemler bazı önemli noktaları ortaya koyuyor: Hangi sektörler sürdürülebilir değişimleri finansal oranlarına yansıtıyor? ESG puanının hangi alt başlığı şirketlerin finansal performansını etkiliyor? Tek başına çevre puanı şirketlerde finansal performans için yeterli midir?

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CHAPTER I

INTRODUCTION

Sustainability has possessed desirability for many years. However, most of organization did not achieve it in beginning. Staric and Rand were associated with some factors. Firstly, understanding was very insufficient about environment and nature. Secondly, society was unaware of advantage of eco-friendly product or energy. Limited public awareness and policies was third possible reason in their article (1). Presently; green economy as a concept come into the life and it tried to integrate for each side of society with fourth industrial revolution. Many reports, articles and researches emphasize that companies try to launch green products, make sustainable design for existing products and/or rebuild business cycle based on sustainable and environmental points. The scarcity of natural resources, changing demand on market and restrictions or directives which is given by policy makers are key reasons for this concept because “environment is a public good” (Reinhardt, 1998) (2). However, government should go beyond the legislation such as imposition of penalty (Marcus & Fremeth,2009) (3). On the other hand, voluntary programs, subsidies and tax reforms in this field might be appropriate for improvement (Fiorino, 2006) (4).

1.1 Background on Sustainability

According to Church, Hecox, Dresner and Edwards (2008), International Union for Conservation of Nature and Natural Resources published a report called World Conservation Strategy Report and this “sustainable development” took part as a term

firstly in this report (5). This report indicates that sustainable employment and ecological processes and life- support systems are three of priority requirements. National and international actions is presented with a checklist in the report (6). Since this report is published in 1980s, most of companies have not implemented as a core strategy until now. However, this report played an important role to hear sustainable development as a term based on social and environmental issues.

After hearing as a term in World Conservation Strategy Report, Brundtland's definition with the ideas indicated in the report named Our Common Future. In the Brundtland Report, sustainable development is described as the requirements of the present lack of conciliatory the ability of future generations to encounter their demands (WCED, 1987) (7).

1.2 Trend in Sustainability

Environmental Performance Index (EPI) which is index making with 180 countries and 24 performance indicators in 2018 shows us how close countries close to implement environmental policies. Countries from Europe and North America is early in the least, on the other hand Asian and African countries have very low rate based on environmental policies.

After this economic transformation, companies are planning carbon-intensive technologies, using renewable resources, sustainable business models etc. Each industry will affect differently from this wave. There might be winner or loser but reports and researches give some signal the possible future of sustainable differentiation.

Automotive sector has tried some eco-innovations since 1990's. This process will be analysed in this paper the integration of sustainability part. "Regarding with changing customer demand, Ford Mustang used environmentally-friendly foam material which is made from soybeans in its seats. As Ford reported, approximately 230 million pounds CO₂ is kept, which is the amount of consuming 4 million trees in a year (cited from Ford Authority)" (8). Moreover, hybrid car of Toyota was launched with the lowest CO₂ emission. Other automotive brands are also prepared to launch their own models which is appropriate for green innovation. Although these designs might be expensive than standard model, consumers can prefer hybrid and full function electric vehicle to avoid higher oil prices. The automotive sector might be learning how know and set a competitive price with standard models in terms of economy of scale. This trend is attracted some research groups; RethinkX's last report which is released 2017 suggests that autonomous electric vehicles will be two to four times cheaper for consumers by 2021. Same report indicates that deep peak in oil demand until 2020 and increase in productivity for a country which is directly related with GDP (RethinkX,2017) (9).

Mc Kinsey & Company's 2019 research in Global Energy Perspective Reference Case affirm RethinkX's idea about changing consumer demand in automotive sector. The case shows us expected electric vehicles sales will be 100 million by 2035 due to decreasing oil demand. While non-green powers such as oil and coal play less part in our lives, new players come such as solar and wind power (Mc Kinsey & Company,2019) (10).

The green and sustainable trend in an industry directly affect other industries which have an interaction or create new industries. For instance; Covestro, international manufacturer and supplier of sustainable polymers to the electronics, automotive and

construction sectors since 2015, get into the market as a new player to get a slice of the developing cake (Covestro, 2018) (11).



CHAPTER II

LITERATURE REVIEW

The significance of the green innovation and using this concerns as a tool for product differentiation are growing. With a focus on sustainable product differentiation this thesis aims to clarify three notions: specifying greener differentiation on product and associating it with financial performance.

Different approaches are presented in the first part of literature review to define what sustainable product differentiation is and on second part will be identified the needs behind sustainable product differentiation; and final part provides literature to observe implementation of this concept.

2.1 Definition of Sustainable Product Differentiation

Before analysis the literature a simplifying Sustainable Product Differentiation as a concept was required to comprehend which literature must be involved. Product differentiation is defined as many aspects. The definition for product differentiation basically as the process of separating a product or service from others (12) . When we look at the literature, Sharp and Dawes (2001) shared the result of their survey among their colleagues about differentiation. According to this survey, some examples of differentiation definition are as:

- is a tool of higher sales and profit as a result of desirability of differentiation,
- is a way of settle a higher price due to uniqueness and consumer surplus on highly qualified products (13).

Same article reaches a simple definition for literature as “Differentiation happens when a firm's product or service is favoured on target group - over its competitors’ offerings” (13) In addition to this, Caves and Williamson (1985) describes product differentiation with two conditions: First one involves that “consumers’ view about brands within a product market are close substitutes, but poor substitutes for brands in other product markets” (14). On the other hand, second condition suggests that “the brands within the product market are sufficiently imperfect substitutes that firms face downwardly sloping demand curves for their brand” (14). Although differentiation was considered mostly with making profit at past, current phenomime has started to associate with corporate responsibility and brand loyalty. Boehe and Cruz (2010) asserted that there is a positive link between product differentiation and product quality so, it creates brand loyalty (15).

Before the combine sustainability and product differentiation, this term is also noticed separately: Sustainability generally is used as the quality of being able to use over a period a time. It also refers the quality of ecologically almost safe. Therefore, ecological or environmental differentiations on product and services of companies define sustainability. Sustainable development is such a result of social and environmental issues.

When sustainable differentiation is defined, eco- innovation is also another term within this frame. Fussler and James (1996) define this concept as eco-innovation. They argue that companies can only survive if they develop radical and breakthrough innovations that exhibit a substantially reduced environmental impact and deliver more customer value (16). Kemp and Pearson (2007) also used similar term in the final report of MEI Project as “Eco-innovation is the production of a product, process, service or management or business strategy that is adapted to the organisation and which results,

throughout its cycle, in a decreasing of environmental risk, pollution and other negative effects of resources use compared to substitutes” (17). Similarly, Renning (2000) defined sustainable innovation as eco innovation and is initiated with environmental targets (18).

Some definitions for this term involve social dimensions. For instance; ecological innovations must be supported socially and institutionally (Freeman,1996) (19). Furthermore; Haughton (1999) explained ideas of sustainability five principle: futurity, social justice, transfortier responsibility, procedural equity, inter-species equity. These principles contribute a beneficial essence to assess sustainable development (20).

To summarize below definitions, sustainable differentiations can be used for product, service or business method to aim environmentally or socially sustainability. This concept is linked with sustainable development and ecological and green innovation.

When identifying various approaches of some conceptions such as green, ecological and environmental and social innovation; combine of two concepts also, sustainability and product differentiation, has defined in literature without social part. Therefore, sustainable product differentiation might be defined as basically two aspects:

- able to continue this differentiation over a period, long-lusting achievement, functionality, uniqueness.
- environmental, green and/or ecological changes and innovations in product design

Porter (1980) explains first aspect in under the competition strategy: Differentiation affects positively credibility, brand loyalty, bargaining power of suppliers and buyers, excess profit, having market authority (meaning of market maker, not monopolistic power). All of these create a threat on potential rivals, therefore, companies make differentiation for sustaining advantage. Porter’s competitive approach draws an inference that differentiation is necessarily selection for sustainable development (21).

On the other hand, Reinhardt (1998) considers that companies differentiate product to gain environmental benefits or continue with same product with an imposed smaller environmental cost. Furthermore, Reinhardt emphasizes environmental product differentiation for sustaining at the end of the day (2).

2.2 The Needs for Sustainable Product Differentiation

Today, large of companies develop green products to differentiate and lead. Some of reasons push firms to greener differentiation and some of them is such a requirement for taking huge portion from industry based on profitability, market share and/or reputation. Although this concept embodies different definitions, the common points for most definitions are the needs for sustainable product differentiation which is as follows:

- Scarcity of resources
- Increased prices of and regulatory limits to the use of resources
- Trade off cost/benefit requirement for managerial decision about product designing and manufacturing process
- Gaining market share with creating comparative advantage
- Social responsibility and corporate social performance
- Increasing firm value based on brand performance and financial response.

We know that “many resources will be in short supply in the future” (Meadows, Randers, & Meadows, 2004; Manahan, 1999) (22) ; (23). This will create finding substitute ways on production phase or using different material within production. Foregone conclusion about natural resources faces companies to differentiate product with a sustainable way. Furthermore, expected shortage in resources for near future and

unequally distributed structure of it's in the moment affect regulations of boundaries and prices of resources. A sustainable product design with a key variable affect use of resources and proactive choice for company.

Besides these, green innovation has been detected as one of indicators to aim of growth same time with the firms' environmental, social and financial results (Dangelico & Pujari, 2010) (24).

Sustainable product differentiation might create proactive solution for companies considering trade off cost/benefit requirement. Sanjay Sharma (2000) made a research among 99 firms in the Canadian oil and gas industry. The result shows us implementations of environmental strategies reduce operation costs (25).

Companies prefer not only cost minimizing but also gaining more or same benefit with almost same cost with sustainable way. Since, some firms consider that green innovation has huge cost and requires high-priced investment. It might not be an absolute approach. When an industry is available for green product differentiation, knowledge gap about it will decrease progressively and know-how may decrease cost of investment. The positive relationship among financial performance and sustainability is suggested in literature. Hart and Ahuja (1996) confirmed that emissions decrease enriches the operating and financial performance more (26). Furthermore; Klassen and McLaughlin (1996) indicated that changes in market value of the firm are initiated with low emissions, better resource efficiency (27).

Competitive advantage is also important both differentiation and sustainability. If this concept is considered without sustainability Bradley (1991) suggests that one of the ways for gain competitive advantage is product differentiation (low cost strategy is other way) (28). Furthermore; some articles also are involved sustainability. To illustrate;

Henriques & Sadorsky (1996) argued the link between creating competitive advantage and product design which is useful for environment on the research (29).

Another point to consider in a business cycle is productivity. As sustainable development makes common in each industry, management team use environmental changes to increase in productivity. King's analysis which is made in 1999 showed indications that non-environmental innovations had not progress based productivity (30). In contrast to King, Porter states that some economic assumptions suggest green innovation and sustainable management challenges increasing cost and production inefficiency while others argue positive relationship between productivity and green innovation (Porter,1991) (31).

Porter's analysis which is made in 1995 created another aspect to be considered: positive relationship between environmental regulation and competitiveness. Competitive sectors implement successful sustainable development strategies after environmental policies (Porter and van der Linde,1995) (32). Reinhardt (1998) clarified environmental effects as externalities for a company and asserted that costs are charged as pollution for the community by companies due to lack of environmental regulation (2).

Making profit may not be direct reason to choose an environmental strategy in product/service design. Most corporate firms implement sustainable differentiation for social responsibility. It affects their corporate social performance and has an indirect impact on gaining profit. As company becomes prominent with sustainably and environmentally strategies, it is known as its consumers and stakeholders. The study in 2005, made by Bansal indicates corporate sustainable development and examines its organizational determinants. According to the study; larger firms delegates sustainable

development than larger firms and they get benefit from better social approval (33). This strategy has an important role increase in sales and price sensitivity.

After companies notice the relationship between firm level of green design and industry availability level, they are disposed to make profit more. Gaining competitive advantage in sector which is low uncertainty level affect portion which is taken from sector profit. On the other hand, relationship between environmental performance and financial performance of companies creates a tendency doing green product differentiation. If an industry is entirely available for green innovation, some activist groups and media side against companies which do not focus environmental performance of their businesses. Therefore, availability level of industry affects companies profit ratio and forces them to act about greener differentiation.

2.3 Integration of Sustainability with Example

In the beginning of integration was not successful and Staric & Rand's view is mentioned before. On the other hand, Hart suggested that achievement for firm could be possible if they would establish long term business plan (Hart,1995) (26). Considering the conditions at that time such as firms' and consumer priorities, two point of views has reasonable premises. Therefore, firms' tendencies and strategies about environmental sustainability create other questions in our mind: How companies integrate environmental sustainability? The definition of Dangelico & Pujari and also give some clue about the way of green innovation. According to their illustration (Figure 1); minimizing in energy, reducing in materials and pollution prevention are basis method for environmental sustainability (24).

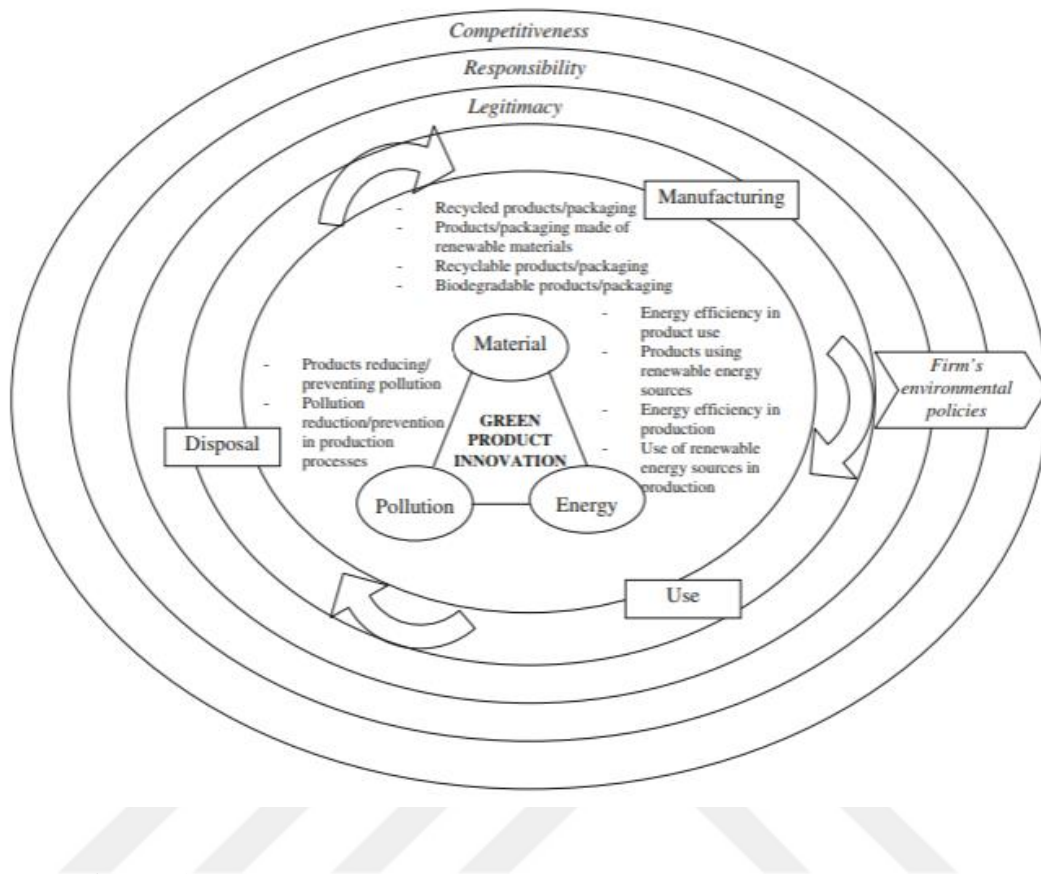


Figure 1: Dangelico & Pujari Green Product Innovation Definition (Source: Dangelico & Pujari,2010)

On the other hand, each product has not same characteristic in terms of green changings. As mentioned below, each industry might not same response against sustainable differentiations. Dangelico & Pujari also mentioned this concern in their article as “For example, environmental effect of a furniture company might be mainly on material base (because of using forest) whereas washing machine manufacturer primarily creates environmental consequences during product process (owing to energy, water usage). Other industries which creates environmental effect such as automobile and oil whose environmental step might be larger as it guards all physical life cycle stages (production process, usage, and destroying stage)” (24). Therefore; industry and

product/service should be appropriate for sustainable differentiation. If these circumstances are not available for a radical innovation, incremental changes should be considered. Same article gives us the content of radical and incremental solutions with cases. These are also ways to integrate sustainable differentiation. Within this frame radical innovations are considered as “using of different technology (e.g., hybrid or hydrogen vehicles), alternation of one crucial component with an entirely new one that importantly decrease the whole environmental effect of the product” (24). According to Dangelico & Pujari ‘s case results as, “considerable green innovations include the raising use of substantial key component of green product such as eco-efficiency (e.g., significant growth of fuel efficiency in vehicles), the substitution of traditional materials with materials with an environmentally safe (e.g., using recycled ones instead of virgin materials), or the design of recyclable products (e.g., designed for disassembly)” (24). Some incremental innovations are defined by Hellström in 2007 as “New resources of supply primarily include removal of replacement components for production processes. This was sometimes unified with a new process innovation, where the new process surrendered, except from higher levels of efficiency, a new environmentally safe product or component that could enter another production process, alternatively one that could be internally recycled” (34)

According to State of Green Business Report, 2018; the Figure 2 shows as “While these indicators illustrate that natural capital costs and exposure to business risk continue to be significant for companies, measuring and valuing the key types and sources of impacts could help businesses to prioritize ongoing improvement in their environmental performance.” Natural capital is defined in same report as “Natural capital adverts to the limited stock of the Earth’s natural resources upon which people and businesses depend

for success, security and well-being. It involves things such as clean air and water, land, soil, biodiversity and geological resources” (35).

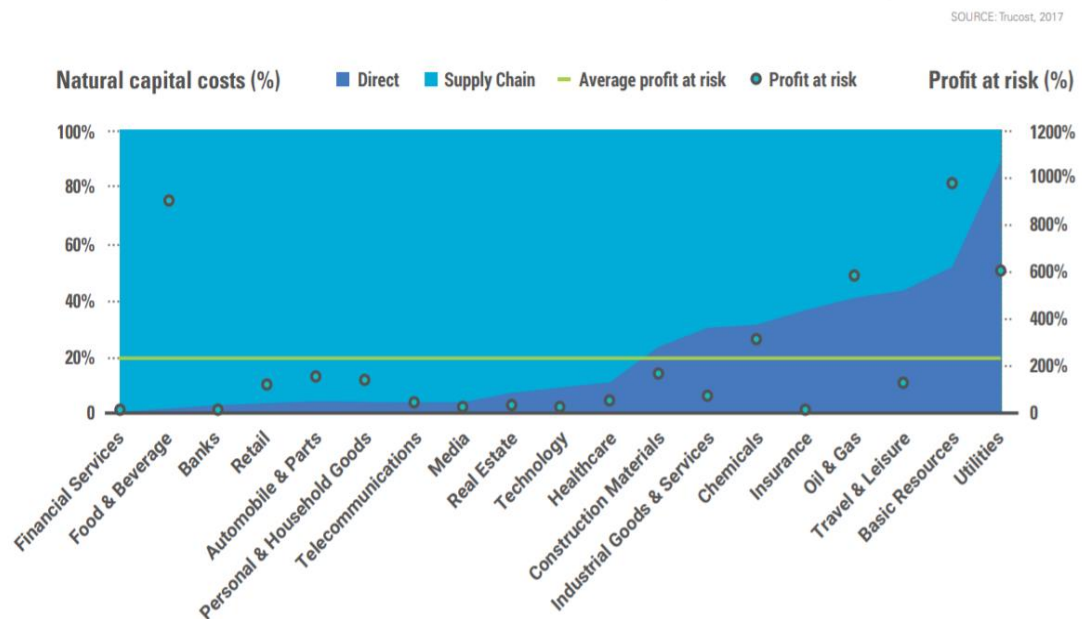


Figure 2: Natural Capital Costs Sector Based (Source: Greenbiz, State of Green Business Report 2018)

The higher natural capital costs are simply initiated with countries natural and environmental structure. Therefore, policies with sector and country-oriented helps companies to integrate sustainable differentiation. For instance; Kyoto Protocol and European Community policies have restricted the usage of some natural resources and companies trying to adapt these sustainable changings into their business model. Porter summarizes aims of environmental policies with 6 points in 1995 as “Regulations should

- signal companies about likely resource inefficiencies and potential technological growth,
- concentrated on information assembly can succeed main gains by increasing corporate awareness,

- decrease the uncertainty that investments to target the environment will be valuable,
- create pressure that inspires innovation and advancement,
- level the transitional playing field. During the transition period to innovation-based solutions, regulation guarantees that one company cannot opportunistically gain position by preventing environmental investments. Regulations contribute a buffer until new technologies enhance proven and learning impacts decrease their costs,
- be required in the case of imperfect return. Innovation cannot always fully offset the cost of compliance, mainly in the short term before learning can decrease the cost of innovation-based solutions. In some cases, regulation will be needed for environmental quality.” (Porter & van der Linde, 1995) (32).

Integration of sustainability might be made with categorizing innovation easily. Some green products or processes require technological innovation and implementation will be new green product design.

Automotive sector has experienced it in early stage of sustainability and technology relation. General Motors, is one of pioneer in sector about electric automobiles, had a pilot program electric car but they discontinued. In terms of electric vehicle, they concentrated on hydrogen fuel-cell technology. The new motor design was not successful Hybrids (both electric and conventional). Environmental product design should be involve wider searching because electric car has much efficient motor power and needs less maintenance (Marcus & Fremeth, 2009) (3).

3M, Minnesota mining and manufacturing company, is an early example for maintaining successful environmentally sustainable program. Main points of 3M were

creating solution for own environmental issues, environmentally appropriate product design, developing programs to protect natural resources, collaboration with policy makers for reformative environment regulation. Marcus, 2009 suggested as “3M committed to source decrease through product redesign process replacement, equipment remodelling, recycling, and reuse” (3). Some companies such as Novartis, General Dynamics, and IBM made similar program with process and product design and gain success like 3M (Marcus, 2005) (36). Marcus’s another example from an acquisition: General Electrics bought a filtration device manufacturer: Osmonics which implemented a successful sustainability product design (36).

There were losers as well as winners at this integration: Ringer which is natural lawn material producer. They launched sustainable products, but their prices were so high for customers. The company did not gain profitable market share and it faced with bankruptcy (Marcus,2009) (3). Another example from a printing company named as Deluxe Printing. They announced new eco printing system called PrintWise, but they faced with same problem as Ringer: high priced products. The failure of PrintWise affected their core business negatively (Marcus, 2009) (3).

All in all, new business model or new product/process design is a tough issue for green management. Each sector and target group might give different response so trade-offs might be evaluated. The requirements which is pointed by Reinhardt (1998) summarizes the successful strategy for environmental product differentiation as “willingness to pay, credible information, and defensive actions against imitations in market” (2).

CHAPTER III

DATA AND METHODOLOGY

3.1. Data

All the data used in this analysis have been obtained from Warton Research Data Services which is a research and data analytics platform.

The analysis is based on data variables which are related to sustainability and financial performance. Financial indicators are attained from WRDS Global Financial Statement. Sustainability variables of data has been obtained from Sustainalytics' ESG (Environmental, Social and Governance) Rating. *Total ESG Score* and *Environment Score* will play role on sustainability side of this analysis.

Financial part of dataset includes these indicators: *Tangibility*, *Return on Asset (ROA)*, *Return on Equity (ROE)*, and *Size* for 7 years historical amounts.

Total ESG Score

“ESG is a set of standards for a company’s operations that socially conscious investors use to screen prospect investments. Environmental criteria deal with response in environmental issues. Social criteria express management facilities about company relationship with its staff, supplies, target group. Governance deals with a company’s leadership, executive pay, audits, internal controls and shareholder rights (Bloomberg Definition)” (37).

Some companies have no score and not disclose anything so is showed as N/A due to not covered by ESG group. The score ranges from 0.1 to 100. Minimum score means that company disclose a minimum amount of ESG data point collected by Sustainalytics. The components of this metric are shown as Figure 3.

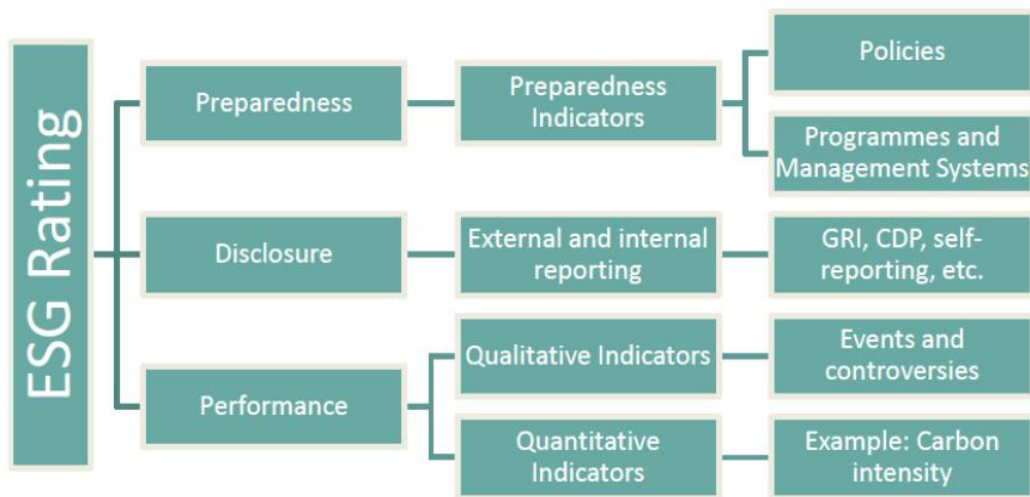


Figure 2- ESG Rating Dimensions (Source: Sustainalytics)

Environment Score

It based on extent of a company's environmental score as part of Environmental, Social and Governance (ESG) data. This score initiated with environmental sustainability efforts by the company. The score ranges from 0.1 to 100, too. Metrics are industry specific based. For instance, the companies in energy sector are measured with the variables of carbon reserves, NOx (nitrogen oxides), SOx (sulphur oxides)

Social Score

Social score investigates how a company handle relationships with its stakeholders. For instance; “Does it work with suppliers with the same values? Does the company donate to the community or being active some volunteer events? Does the

company make some improvement about employees' working condition to make it safer? Does the company consider the stakeholders' priorities?" (37).

Governance Score

Governance Score regards to transparent to shareholders based on accounting and allow them rights to vote significant issues. Avoiding the conflicts among board members, looking after their rights, and uninvolved to illegal and political contribution are also included this score. (Bloomberg Definition) (37).

Tangibility

Tangibility's numerator varies by company. Net PPE for a real estate company or stocks or machines for a manufacturing company are a numerator to reach tangibility value. Each asset has tangibility to use for collateral in case of any loan. "Tangibility increases the value that can be captured by creditors in default states (Almeida) (38)."

$$Tangibility = \frac{Cash, commodities, PPE \text{ etc.}}{Total Assets} \quad (1)$$

Return on Asset (ROA)

ROA is generally expressed as a common variable in financial performance in environmental differentiation literature (Russo & Fouts, 1997) (39). Also, Jacobson (1987) argues that ROI is the "most beneficial ratio and finalized 'bottom line' test of business performance" (40). If a company get some assets to contribute product or process differentiation, ROA will show whether efficient management exist or not.

$$Return \ on \ Assets = \frac{Operating \ Income}{Total \ Assets} \quad (2)$$

Return on Equity (ROE)

ROE is defined Bloomberg Terminal as “a measurement of how well a company used reinvested earnings to make profit”. Differentiation will probably require new investment and this figure measure the performing of this earning. Also, it refers net income divided by shareholders’ equity. so, the possible effect of sustainable innovation on ROE present the investability.

$$\text{Return on Equity} = \frac{\text{Average Shareholder's Equity}}{\text{Operating Income}} \quad (3)$$

3.2. Methodology

In this thesis, the aim is to measure relationship between ESG Score, and some financial indicators. The methodology is set as suitable for two hypotheses:

- *H1. Environmental Product Differentiation will be associated with financial performance.*
- *H2. The companies which cannot implement environmentally differentiation on their product will use other tool of sustainability for higher financial performance.*

Depending variable and independent variables is defined as: ROA and/or ROE is dependent variable for each model. Environment Score, Governance Sector and Social Score are included as independent variables with different combinations as suitable for model. Tangibility and Size are also included equations as control variables. Due to existence of more than one independent variable, VIF (Variance Inflation Factor) is checked to avoid multicollinearity through establishment of each model. Higher

correlation problem is prevented with consideration of $VIF < 5$. Finally, linear regression analysis is used to observe how sustainable activities related to financial performance are.

***Hypothesis 1** Environmental Product Differentiation will be associated with profitability.*

Product differentiation might be on material based or process based as mentioned in literature review part. A product can differentiate environmentally on some sectors such as automotive component, material and equipment-based sectors etc. (24). So, these kinds of differentiations create a new product or new design for same product which means these sectors have physical business cycle. This analysis assume that environmental product differentiation can be observed mostly the sectors which has physical product cycle and 'Environment Score' will probably demonstrate the effects of environmental product differentiation. Two models will set for this analysis: **Model 1** measure whether impact on ROA or not. On the other hand, **Model 2** quantifies the results on ROE after sustainable differentiation.

CHAPTER IV

RESULTS

Methodology was set based on three ESG variables (environment score, social score, and government score) and control variables (tangibility and size) on previous chapter. Before analysis ROA and ROE values truncated at %2.5 due to unrealistic values in outliers. Technical problems in data collection and sources creates unrealistic values which is far from real life. Hypothesis is modelled as:

***Hypothesis 1** Environmental Product Differentiation will be associated with profitability.*

According to VIF analysis, independent variables of model do not cause any multicollinearity (Table 1) so all variables might be used in regression.

Table 1: VIF Analysis for H1

Environment Score	Tangibility	Size
1.010900	1.028226	1.018313

After VIF Analysis model 1 and model 2 are set as follows and visualized in Table 2 and Table 3.

Model 1: ROA= Environment Score + Tangibility+ Size

Table 2: OLS Regression Result of Model 1 for H1 (with control variables)

OLS Regression Results						
Dep. Variable:	ROA	R-squared (uncentered):	0.169			
Model:	OLS	Adj. R-squared (uncentered):	0.163			
Method:	Least Squares	F-statistic:	29.21			
Date:	Thu, 12 Dec 2019	Prob (F-statistic):	3.27e-17			
Time:	16:39:12	Log-Likelihood:	-1448.4			
No. Observations:	435	AIC:	2903.			
Df Residuals:	432	BIC:	2915.			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Environment_Score	0.0194	0.011	1.810	0.071	-0.002	0.041
Tangibility	-0.0638	0.071	-0.894	0.372	-0.204	0.076
Size_1	0.5269	0.103	5.105	0.000	0.324	0.730

The regression results for Model 1 present that the companies which has highest environment score are profitable in unit asset with a statistically significant way.

In the literature; Orlitzky, Schmidt and Rynes (2003) suggested that environmental performance is linked with financial performance, especially in accounting based financial ratios instead of market ratios (41).

In addition to these, tangibility has no significant effect on ROA while company size is positively related with return on asset. When size and tangibility excluded in linear regression model, environment score is still related positively with ROA (Table 3).

Model 2 describe effect on ROE but return on equity is marginally insignificant with environment score (Table 4).

Table 3: OLS Regression Result of Model 1 for H1 (without control variables)

OLS Regression Results						
Dep. Variable:	ROA	R-squared (uncentered):	0.118			
Model:	OLS	Adj. R-squared (uncentered):	0.116			
Method:	Least Squares	F-statistic:	58.27			
Date:	Thu, 12 Dec 2019	Prob (F-statistic):	1.47e-13			
Time:	17:58:16	Log-Likelihood:	-1461.1			
No. Observations:	435	AIC:	2924.			
Df Residuals:	434	BIC:	2928.			
Df Model:	1					
Covariance Type:	nonrobust					
	coef	std err	t	P> t 	[0.025	0.975]
Environment_Score	0.0576	0.008	7.633	0.000	0.043	0.072

Model 2: ROE= Environment Score + Tangibility+ Size

Table 4: OLS Regression Result of Model 2 for H1

OLS Regression Results						
Dep. Variable:	ROE	R-squared (uncentered):	0.007			
Model:	OLS	Adj. R-squared (uncentered):	-0.000			
Method:	Least Squares	F-statistic:	0.9881			
Date:	Thu, 12 Dec 2019	Prob (F-statistic):	0.398			
Time:	18:03:40	Log-Likelihood:	-3043.7			
No. Observations:	411	AIC:	6093.			
Df Residuals:	408	BIC:	6105.			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t 	[0.025	0.975]
Environment_Score	0.9860	0.644	1.531	0.127	-0.280	2.252
Tangibility	-1.1963	4.373	-0.274	0.785	-9.793	7.400
Size_1	-3.0862	6.179	-0.499	0.618	-15.232	9.060

Hypothesis 2 *The companies which cannot implement environmentally differentiation on their product will use other tool of sustainability for higher financial performance.*

Each company gives different response to differentiation, sustainability or any innovation. This was mostly related to main activities of a company. Some sectors almost never be able to make environmental differentiations such as banks. Although their product/service do not allow to make environmental modifications, they use sustainability as a tool of make profit. Environment is not only component of sustainability, Social and Governance is also used for a good financial performance. Furthermore, some companies do not prefer sustainable changings on their current product even if their business model are suitable for modifications. They are several reasons behind this such as cost, market demand, target group’s strict preferences etc.

Independent variables’ multicollinearity is checked with VIF and independent variables are suitable for model as follows:

Table 5: VIF Analyses for H2

Social Score	Tangibility	Size
1.006528	1.022362	1.019907

Governance Score	Tangibility	Size
1.017566	1.022025	1.032550

Table 6: OLS Regression Result for H2 (with social score)

OLS Regression Results						
Dep. Variable:	ROA	R-squared (uncentered):	0.180			
Model:	OLS	Adj. R-squared (uncentered):	0.175			
Method:	Least Squares	F-statistic:	31.70			
Date:	Thu, 12 Dec 2019	Prob (F-statistic):	1.55e-18			
Time:	23:46:14	Log-Likelihood:	-1445.3			
No. Observations:	435	AIC:	2897.			
Df Residuals:	432	BIC:	2909.			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Social_Score	0.0275	0.009	3.088	0.002	0.010	0.045
Tangibility	-0.0654	0.071	-0.925	0.355	-0.204	0.074
Size_1	0.4625	0.096	4.793	0.000	0.273	0.652

Table 7: OLS Regression Result for H2 (with governance score)

OLS Regression Results						
Dep. Variable:	ROA	R-squared (uncentered):	0.195			
Model:	OLS	Adj. R-squared (uncentered):	0.189			
Method:	Least Squares	F-statistic:	34.83			
Date:	Thu, 12 Dec 2019	Prob (F-statistic):	3.54e-20			
Time:	23:52:45	Log-Likelihood:	-1441.4			
No. Observations:	435	AIC:	2889.			
Df Residuals:	432	BIC:	2901.			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Governance_Score	0.0337	0.008	4.171	0.000	0.018	0.050
Tangibility	-0.0694	0.070	-0.992	0.322	-0.207	0.068
Size_1	0.3917	0.096	4.067	0.000	0.202	0.581

Test result gives a statistically significant result with Social and Governance Score separately. The important point is that the companies which implement environmentally sustainable differentiation might also make social sustainability actions. With an

expanded data range has excluded physical product cycled companies create more obvious result. Some findings take part in literature by (2019): The analysis among European Bank Industry suggested that the positive relationship between Corporate Social Responsibility and Financial Performance (42).



CHAPTER V

CONCLUSION

In this thesis, the connection between sustainable product differentiation and financial performance has been analysed with ESG Criteria. The data is obtained from WRDS includes ESG Scores and Financial. H1 and H2 are investigated with the sample and both are supported with test result.

The companies which have physical business cycle experienced product differentiation deeply and environmentally changings might be accepted as product differentiation for these sectors. Environment part of ESG Score is positively linked with profitability for these companies.

Some companies which physical product cycle do not have are not favourable to analyse with environment score. These companies implemented sustainable initiatives mostly related with social responsibility. H2 was supported with a highly correlated value.

Two output of this thesis are not the only results. Environmental sustainability has been a focus area since 1970s, but each sector is trying to adapt sustainability with other ways because all business division need to survive on a sustainable economy. Within this thesis' examples, companies also make social responsibility initiatives to contribute their corporate identity. For instance; financial sector is trying to launch new service which creates positive environment impact such as green bond.

Although sustainability is not a new concept practise have increased recently. The loss scenarios' reasons or successful integrations' road-map did not analysed well

due to lack of sample and knowledge. ESG score is measured for 2009 and 2015 and this was barrier not to be a proxy for most of financial ratios. Therefore, this might be implications for future research.



APPENDIX

- Variance inflation factor analysis is gathered as a result of code with written in R Studio in below.

```
master=as.data.frame(master_data_2)

library(stargazer)

library(DescTools)

# Model 1 for H1

model1=lm(ROA ~

Environment_Score +

Tangibility+

Size_1, data=master)

summary(model1)

# Variance inflation factor analysis for Model 1 and Model 2 for H1

VIF(model1)

# Model 2 for H1

model2=lm(ROE ~

Environment_Score +

Size_1 +

Tangibility, data=master)

summary(model2)
```

- Regression models are written in Python. Code is made for regression analysis and is rerun for each model.

```
y = data.ROA()
x = data[['Environment_Score', 'Tangibility', 'Size_1']]. copy()
```

```
y1.dropna()
```

```
x1.dropna()
```

```
model = sm.OLS(y1, x1).fit()
```

```
#to exclude other control variables
```

```
model = sm.OLS(y1, x1['Environment_Score']).fit()
```

```
model. summary()
```


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