

Sustainable Constructions and Economic Yield in Northern Cyprus: An Empirical and Qualitative Analysis

Korhan Yolcu

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Approval of the Institute of Graduate Studies and Research

Prof. Dr. Ali Hakan Ulusoy
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Vedat Yorucu
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Hasan Güngör
Supervisor

Examining Committee

1. Prof. Dr. Hasan Güngör

2. Assoc. Prof. Dr. Demet Beton Kalmaz

3. Asst. Prof. Dr. Yenal Süreç

ABSTRACT

Sustainable development is a crucial aspect for developing construction economy and not only for specified sectors but it is an ideology for optimum usage for such highly developed infrastructures. This study will explore the potential solutions and challenges that are seen and forecasted in sustainable construction practices. Northern Cyprus is the part of the island that lags behind the infrastructure developments in comparison to other developed countries. In regards of world-wide technological advancements & developments, implication of this future – proof regime is being followed by very slow pace due socio-political and economic barriers which includes political, economic and some other issues.

By using proper qualitative research applications, this study will investigate the current conditions for adoption of sustainable practices in construction sector and explain some brief developments regarding to this matter by using some qualitative analysis, tabulated data displays & comparison of various cases.

Keywords: GDP, Sustainability, Qualitative Analysis, Economic Yield

ÖZ

Sürdürülebilir kalkınma, sadece belirli sektörler için değil, aynı zamanda yüksek gelişmiş altyapıların en uygun şekilde kullanılması için bir ideolojidir ve inşaat ekonomisinin gelişimi için önemli bir unsurdur. Bu çalışma, sürdürülebilir inşaat uygulamalarında görülen ve öngörülen potansiyel çözümleri ve zorlukları araştıracaktır. Kuzey Kıbrıs, diğer gelişmiş ülkelerle karşılaştırıldığında altyapı geliştirmelerinde geride kalan adanın bir parçasıdır. Dünya çapındaki teknolojik ilerlemeler ve gelişmeler doğrultusunda, bu geleceğe yönelik rejimin uygulanması, siyasi, ekonomik ve döviz kuru gibi sosyo-politik ve ekonomik engeller nedeniyle çok yavaş ilerlemektedir.

Bu çalışma, uygun nitel araştırma yöntemlerini kullanarak, inşaat ekonomisinde sürdürülebilir uygulamaların benimsenmesi için mevcut koşulları inceleyecek ve bu konuda grafik analizleri, tablolar halinde veri sunumları ve karşılaştırma analizleri ile bazı kısa açıklamalar sunacaktır.

Anahtar Kelimeler: Gayri Safi Milli Hasıla, Sürdürülebilirlik, Nitel Analiz, Ekonomik Verim

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LIST OF ABBREVIATIONS

BIM	Building Information Modelling
CE	Circular Economy
CICA	Confederation of International Contractors
CIP	Cyprus Investment Programme
CO ₂	Carbon Dioxide
CPI	Consumer Price Index
CVA	Construction Value Added
DI	Domestic Investment
EPBD	Energy Performance of Building Directives
FCT	Foreign Capital Transfer
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GDP _{cons}	Gross Domestic Production of Construction Sector
GPI	Government Policy Index
ISG	Occupational Health and Safety Departments
KIBTEK	Northern Cyprus Electricity Corporation
kW	Kilowatt
LEED	Leadership in Energy and Environmental Design
LR	Long Run
M3	Money Supply
PV	Photovoltaic
R&D	Research & Developments
SDGs	Sustainable Development Goals

SP_Adoprate	Sustainable Practice Adoption Rate
SR	Short Run
TL	Turkish Lira
TO	Trade Openness
TPI	Total Private Investment
TR	Total Revenue
U.S.A	United States of America
UN	United Nations
USD	United States Dollar
WCED	World Commission on Environmental and Development
YTL	New Turkish Lira
Δ	Change in

Chapter 1

INTRODUCTION

1.1 Background of the Study

In recent years, there has been a growing emphasis on sustainable construction practices and their economic impact. The construction industry plays a significant role in the economy of Northern Cyprus, and there is a need to examine how sustainable construction techniques can contribute to economic yield in the region.

This analysis aims to investigate the potential benefits of sustainable construction methods and their impact on the economic development of Northern Cyprus. By analyzing data and conducting a thorough qualitative assessment, this study seeks to provide valuable insights into the relationship between sustainable construction practices and economic yield, and contribute to the ongoing discourse on sustainable development in the construction industry. The industry plays a leading role in enhancing living standards by delivering essential infrastructure that supports social and economic growth. However, on Global level, these infrastructural advancements come with significant environmental costs [1]. Traditional construction methods often involve unsustainable production processes that deplete vital natural resources like freshwater and timber. For example, building projects continue to rely heavily on freshwater during both construction and usage phases, despite the increasing strain on global freshwater supplies (Hughes, 2019; Cole et al., 2018; UN Water, 2018).[2,3]. Additionally, the ongoing unchecked deforestation in tropical and boreal forests for

construction and other purposes disrupts the Earth's carbon balance [4], contributing to global warming. In many countries, particularly those that are developing like Northern Cyprus, there is an over-reliance on fossil fuels as energy source for buildings. The burning of fossil fuels remains one of the major contributors to greenhouse gas emissions [5]. Although the construction industry has been criticized for its slow adoption of innovations like sustainable construction adoption, in highly developed countries this rate of adoption is increasing lot faster compared to Northern Cyprus's pace even compared to Southern Cyprus.[6]

To effectively evaluate the benefits of sustainable construction methods firstly, stakeholders and contractors must understand the policies necessary for successful implementation and it is essential to consider not only the direct cost implications but also the long-term advantages in terms of resource efficiency and overall economic resilience.

Furthermore, the influence of sustainable construction practices on the economic development of Northern Cyprus extends beyond immediate cost savings but with proper implications. By delving into these complexities, this analysis aims to provide a clear understanding of the relationship between sustainable construction practices and economic yield, shedding light on the broader implications for the region's development trajectory.

1.2 Statement of The Problem

Despite growing global advancements in sustainable construction, Northern Cyprus remains significantly behind Northern Cyprus lags behind developed countries in terms of infrastructure development, progressing at a slower pace due to a range of socio-political and economic challenges. The region faces significant limitations, including political constraints and hard currency exchange rate fluctuations, which complicate efforts to integrate sustainable practices into the construction sector. These challenges exacerbate the difficulties in accessing resources and adopting sustainable infrastructure, further widening the gap between Northern Cyprus and more developed regions.

We aim to address the critical problem of the limited implementation of sustainable construction practices in Northern Cyprus. By conducting a qualitative analysis, the research will explore the specific barriers posed by the region's unique political and economic context, examine the availability and feasibility of sustainable methods, and identify strategies that could overcome these obstacles to promote more sustainable infrastructure development in Northern Cyprus. While Southern Cyprus has made notable strides in adopting sustainable construction practices, Northern Cyprus continues to lag due to unique political and economic challenges

1.3 ‘Sustainability’ & Applications of Sustainable Constructions in Northern Cyprus

The concept of sustainability has been first seen in 1980's where the world was in intense decade with full contradictions. Cold war ended with the imminent fall of Berlin Wall. This action had its consequences and the major recession like in mid-1970's was triggered by oil crisis.[7] Soon after the Iranian Revolution, second crisis appeared however, the decade carried on to the brutal economic recovery period of Italy's from 1984 to 1990 which was the longest period of prolonged growth in the country's history and this was carried for 26 consecutive financial quarters with overall gross domestic product (GDP) increment of 21.4%. This was the era where the sustainability term was first met the world. In 1987, 'sustainable development' was first introduced in the report of 'Our Common Future' by the World Commission on Environmental and Development (WCED) also known as the 'Bundt land Report' where as this report defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.[8]

This initial ideology of sustainability in construction began between 1960s – 1970s where the environmental movement and the ideology of 'environmentalism' appeared which highlighted the human activities on nature where there were studies conducted by Rachel Carson's Silent Spring (1962) raised awareness about degradation.[9] Then influenced by the general environmental movement of that time. The concept was further enhanced in the 1980's and 1990's with the rise of green building standards such as Leadership in Energy and Environmental Design (LEED) certification by the United States (U.S) Green Building Council in 1998 and this was the significant shift maker regarding to integration period of sustainability practices in construction economy.

[10] As initiation period of ‘Sustainable practices application in construction economy’ was first stated in 1990’s in high developed countries and the proper initiation was delayed in Northern Cyprus. Through the 20-year span of the country’s developments were not highly promising. In early 2000’s, the concept was not widely recognized and there was limited awareness and very low regulations and applications emphasizing green building practices which clearly states the infrastructures with sustainable composition and behaviors among environment. The major concern was focusing on completion of the task rather than eco-behaviors of the infrastructure.

Awareness and initiatives started globally and this was yet taking part effectively in Northern Cyprus with the developing application of sustainable practices yet these applications were not majorly in construction based areas but the general terminology was implemented and to create a background image on the people and here is an example of a newspaper that was published in 2011 relative to sustainable practices; There was relative progression regarding to green building practices then the initial step was to worldwide known ‘Photovoltaic Panel’ applications which was just implication of solar based energy for domestic and industrial usage and how the geological positioning of Cyprus was very beneficial for this and these applications were actually the initial step for sustainable practice for Northern Cyprus. For construction perspective, not all the same could be said but still this had its own effects on how sustainable materials are important and the future proof of the raw materials are important but since the availability of these raw goods are limited and access via transportation were expensive, adoption of sustainability was restricted due price and various reasons.

In 2020, as the transportation costs boomed due worldwide pandemic with Covid-19, as for less developed countries like Northern Cyprus. Implications for such extra properties (materials with lower carbon foot print and ecofriendly compositions) were a second priority.

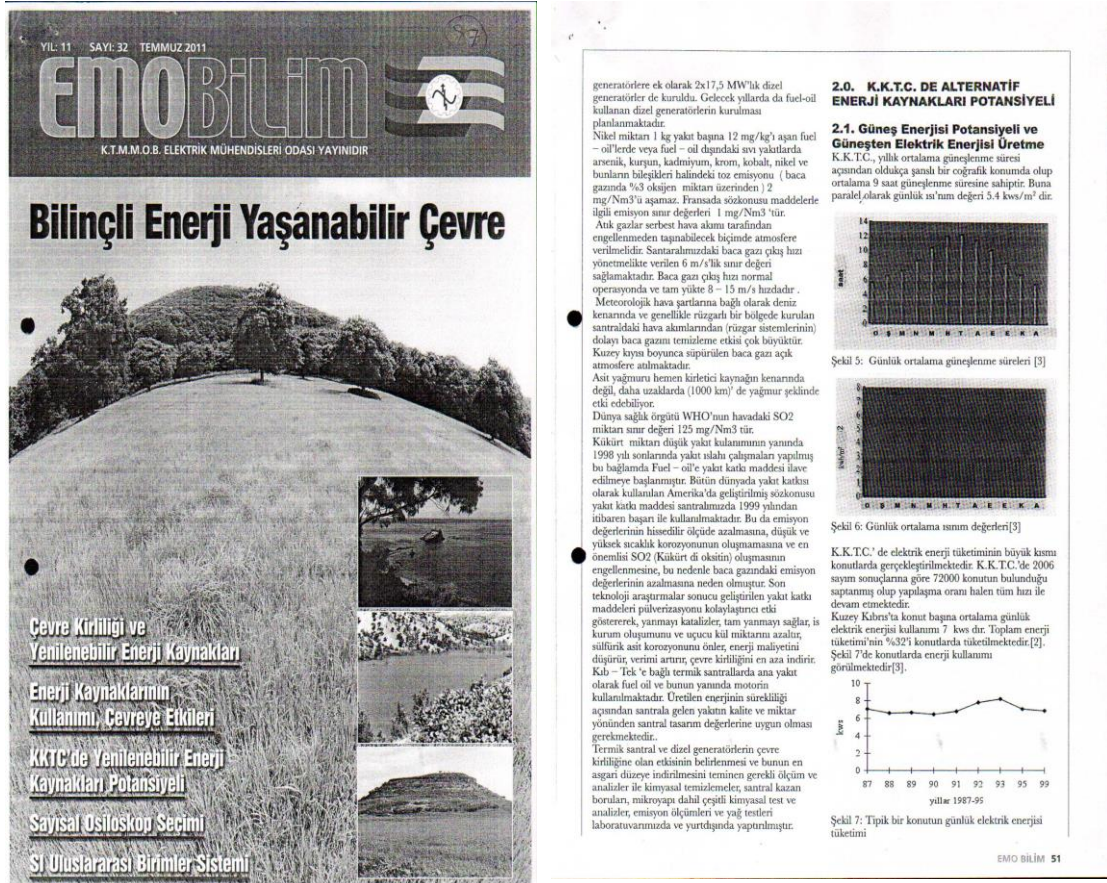


Figure 1: First News for Renewable Energy Production

Chapter 2

AN EMPIRICAL STUDY

2.1 Literature Review

Sustainable development can be defined as improving the quality of life, enabling people to live in a healthy environment while enhancing social, economic, and environmental conditions for both current and future generations. Since the World Commission on Environment and Development (WCED) published "Our Common Future" in 1987, sustainable development has gained widespread attention across nations. This report advocated for a strategy that integrates development and environmental protection and described sustainable development as meeting the needs of the present without compromising the ability of future generations to meet theirs [11]. [12] predicted that sustainable development would be the major challenge of the 21st century, while [13] emphasized that it involves balancing available technologies, innovation strategies, and government policies.

The World Business Council for Sustainable Development defines sustainability reporting as “public reports by companies that offer internal and external stakeholders a view of the company’s stance and activities across economic, environmental, and social dimensions”[14]. Emphasized that the core purpose of sustainability reporting is to reveal the company’s commitments and accomplishments in all areas of sustainability, considering the perspectives of both internal and external stakeholders [15].

The growing focus on sustainable development's social, economic, and environmental indicators has brought attention to the construction industry, which is an increasingly prominent sector globally and a key industry in both developed and developing nations (Industry and environment, vol. 26. N 2–3., The building and construction sector., Agenda 21 for Sustainable Construction in developing countries[16,17,18]

Socially and economically, the European Commission in 2006 reported that the construction sector directly employs 11.8 million workers and is Europe's largest industrial employer, representing 7% of total employment and 28% of industrial employment in the EU-15. In 2003, around 910 billion euros were invested in construction, accounting for 10% of the gross domestic product (GDP) and 51.2% of the Gross Fixed Capital Formation of the EU-15 [19]. However, environmentally, the sector is also responsible for significant energy consumption, solid waste generation, greenhouse gas emissions, pollution, environmental degradation, and resource depletion (CICA – Confederation of International Contractors' Associations., 2002, [20,21,22]

The rise of sustainable construction has been accelerating globally in recent years due to the need for resource conservation. However, this growth has also brought various challenges from managerial, strategic, and operational perspectives. The construction industry plays a crucial role in enhancing the quality of life by meeting societal needs [23,24,25]. Despite this, the sector is responsible for 35% of global CO₂ emissions and contributes 45-65% of the waste in landfills. Additionally, construction activities are significant sources of harmful emissions, with 30% of the planet's greenhouse gases generated during construction processes, and 18% of these emissions stem from transporting and processing construction materials [26].

Given this context, the importance of studying sustainability in the construction sector is clear. Organizations are increasingly recognizing that maintaining a competitive edge requires more than just low costs or high-quality products and services. Customers now expect companies to be environmentally conscious, ethical, and socially responsible [27].

Then, the need of exploring sustainability practices in construction sector begins. Being conducted in this study, a qualitative method is approached. Several studies have found consecutive relationship between sustainable adoption practices with various econometric factors. A study from Qatar [28] dictated an econometric model to describe the relationship between the level of sustainable construction experience (an indicator of sustainability adoption) and characteristically behaviors of firms which has more effects on sustainable practices. Another study from [29] studied a quantitative bibliometric research among other qualitative methods in content of sustainability in civil constructions and concluded that sustainable practices are a chain member for developing construction industry.[30] stated that with correct policy term applications, it is possible to achieve economic growth and development as in the same way for developmental status of the country has potential relationship with the role and size of the construction economy. Furthermore [31], made study regarding to role & ability of sustainable development-based requirements in United Kingdom whereas the practice of sustainability has gradually adopted in construction industry of the country and concluded that there is a positive effect of government regulations on sustainable construction practices in which it was the most vital determinant for sustainable practices.[32] conducted a study in Japan which is a highly concentrated in people, stated that urban built environments is the key region for appropriate sustainable

policies and actions could yield significant human and ecological benefits and they concluded in that green & sustainably renovated buildings could yield in terms of cost savings and improved health situation for building users. [33] investigated the long run equilibrium of construction sector in an open macro economy, whereas the money supply (M3), Foreign Capital Transfers (FCT) has direct relationship on Gross Domestic Product (GDP) reflecting openness and indirectly onto Construction Value added (CVA). He concluded on M3 and GDP are prior determinants for long run equilibrium and with a magnitude on positive indirect relationship to CVA during 1977-2008 of Northern Cyprus. As Cyprus has two individual but politically interconnected sides,[34] made a research regarding to adoption of mandatory building insulation regulations for zero energy dwellings in Cyprus by 2020 after adoption of all provisions of the EPBD (Energy Performance of Building Directives) and yet after the implication of the governmental regulation, energy consumption of dwellings decreased by 40% and they have conducted in the importance of European directives regarding to sustainable matters. Lastly, due to the importance of constructional characteristic behaviors reflecting sustainable practices,[35] made a detailed research scoping in the problems in mass housing and policy interventions for estates in Famagusta, Northern Cyprus. The study discussed ongoing, uncontrolled constructions trying to change the contemporary urban environment based on housing and urbanism. They concluded that the lack of building control mechanism as many construction systems were changed without considering energy efficiency and similar materiality to protect the standards of the housing units. The methodology they followed is literature based combination of descriptive and explanatory research methods. Finally, they have concluded in that the future period of infrastructure quality is challenging and lack of green urbanism approaches has to be more lot more in play prior to construction initiation.

From all above research methods and concepts, a detailed sustainability practice adoption on construction economy could be conducted. On the recent studies,[36] claimed that the construction industry has a significant role in developing economic growth and the construction industry itself is generating high volumes of waste whilst obstructing sustainable development goals (SDGs). They stated that circular economy (CE) utilizes on waste minimization by holding all materials in a closed loop status. They highlighted the importance of CE to be the major discourse of United Nations (UN) SDGs Scheme towards 2030. By using Scopus, ScienceDirect and Web of Science data pools, they concluded that in CE should be used in pre, mid and post stages of infrastructures in order to maintain SDGs.

[37] examined the integration of sustainability into project management practices aimed at achieving both economic and environmental goals. They emphasized that despite the pressures to meet sustainability targets, maintaining project efficiency and profitability was essential. Their review showcased innovative project management strategies that allowed companies to adhere to higher environmental standards while staying within budget constraints.

[38] conducted a critical review of the literature on 'green building,' identifying key themes such as the definition and scope of green buildings, the benefits of green buildings compared to traditional ones, and various methods for achieving green buildings [38]. They also pointed out a notable imbalance in the literature, with significantly fewer studies addressing social sustainability compared to environmental sustainability.

More recently, scholars have utilized bibliometric methods similar to those in the current review [39,40]. Santos and colleagues[39] applied bibliometric analysis to research on building information modeling (BIM), a technology used to promote more sustainable construction. Their review revealed a growing global use of BIM from 2005 to 2015 but also highlighted a lack of academic research on how BIM contributes to achieving sustainability goals.

[40] updated the review by [38] with a bibliometric analysis of 'green building research,' identifying current research clusters and trending topics. Their review also noted a persistent gap in the literature regarding social sustainability.

Unlike several of these earlier reviews, the current review does not focus on a specific sustainable construction method (e.g., LCA, BIM). Instead, it takes a broad view of 'sustainable construction,' using a bibliometric approach that parallels the methods of Santos et al.[39] and Zhao et al.[40] but aims to address and fill in the gaps identified in their studies.

As after Covid-19, the world wide spread disease. Lot of environmental based future decision priorities were set back and ideal plans like [41]'s paper related to 'Green New Deal' policy which was South Korea Policy related to sustainability transition strategy that was proposed as post-Covid-19 stimulus plan aiming to build under three strategic sections, green urban development, innovative green industry and low 0 carbon decentralized energy. This was yet a pure upgraded version of 'Green Growth' national policy but yet [41] concluded that there is a greater dilemma around the world about implications but powerful policy makings with the right vision, we could steer this momentum into the right direction.

2.2 Methodology

The study embarks a qualitative analysis methodology which will represent the adoption of sustainable construction practices in the construction economy of Northern Cyprus. Analysis will grant us a better understanding of the current state, the obstacles and the economic impacts.

To develop the research background and justify the research context, a combination of descriptive and explanatory research methods was employed in the literature review. The descriptive approach was utilized to clearly define the problem, while the explanatory method systematically underpinned the study's approach. Consequently, the research was carried out through a literature review that focused on the interrelationships between key variables, supporting the theoretical framework and providing insights into the construction industry and its effects on sustainable construction practices within the construction economy of Northern Cyprus.

Building on the initial literature review, the second phase of the methodology centers on a qualitative examination of key variables that influence sustainable construction practices in Northern Cyprus. These variables include Gross Domestic Product (GDP), Government Policy Index (a direct indicator of sustainable regulations), Total Private Investment, Domestic Investment, Trade Openness, and Total Revenue (the sum of Imports and Exports). A brief explanation for each selected variable as follows;

- Gross Domestic Product (GDP): To account for economic growth, GDP can be included as an economic indicator that might influence the sustainability of construction practices.

- Government Policy Index: A composite measure of the presence and stringency of government policies supporting sustainable construction.
- Total Private Investment and Domestic Investment: The amount of domestic and foreign investment in the construction sector or overall economy.
- Trade Openness: Measures the degree to which a country's economy participates in international trade. It's usually calculated as the ratio of total trade (exports plus imports) to the country's Real Gross Domestic Product
- Total Revenue (Import + Export): It is the net summation of total imports and exports of the economy.

Due to limitations of data, not exactly same methodology being carried but it carried the same purpose. Since the data sets collected carries some data from interviews including face to face conversations, this method had to be validated. A study conducted by [42] concluded in a matter where the participant can use the incentive in which if the required data are not available to them, they can proceed to face to face collection of data from the expert requested in the area of study. He concluded in a point where the importance of raising 'methodological awareness' among qualitative inquirers of any research field, especially those who are in position as stated above can directly use the relevant observations acquired from specialist without the need for attending conferences or reading published papers with only under one condition that the participants that conducted must have solid knowledge so that the interaction becomes of a validated value.

A very recent study dictated that Sustainable Development Growth 8, out of 18 (“Decent Work and Economic Growth”) challenges the evidence that limitless economic growth is unsustainable on a planet with finite resources in which The United Nations Sustainable Development Goals (SDGs) were aimed to. Hence, they found that GDP alone requires significant policy incoherence and concluded that GDP cannot be alone as prime indicator for sustainable economic growth and needs to be considered further with other macro-economic indicators like Government Policy Index (GPI) towards SDG 8 investigation [43]

[44] checked the environmental degradation in the MENA (Middle East and North African) region, they conducted a panel model to represent the aim of the study and found out that there is cointegration between trade openness, industrial development and political stability in the short run (SR) and in the long run analysis (LR).

As for the prior factors spoken before and the crucial one that was chosen as sustainable policy driver GPI, which also is an example of sustainable policy which is a statement of sustainability action or principle proposed or adopted by a government, organization or individual. It can be viewed from three point of views which are priorities, instruments and institutional arrangements.[45]. Priorities refer to clear statements of policy objectives to be done, Policy instruments are the set of techniques in which governments and institutions forces policies for better good of society [46].

To highlight the importance of Total Private Investment (TPI),[47] conducted an analysis of impacts of public investments, especially in construction and R&D on economic growth and of crowding-pit effects on private investment. They offered to

address the importance of policy issue to magnify in spillover contribution of public investment to the enlarged scope of economic activity.

In the recent years,[48] made a study to investigate the relationship between GDP and Government Revenues of Republic of Croatia from 2000 to 2010 and concluded that GDP has significant play on the Government Revenue trends which they sought to demonstrate empirically how fiscal policy reforms in the EU impact economic growth.

2.3 Relationship between Sustainability Adoption Rate in Constructions vs. Selected Variables

Gross Domestic Product (GDP) as defined above usually factors affecting the sustainability concept of this thesis but it also measures the overall performance of the country including the total value of goods and services produced over a specific period (usually a year or a quarter). It is the most crucial indicator to demonstrate a country's economic growth. It is usually **visualized as % gains or losses**. Some reasons for negative GDP are;

- 1) Recessions
- 2) Economic Shocks
- 3) Decreased Consumer Spending
- 4) Reduced Investment

Then these factors can sum up to negative GDP growth to result in ; [49]

- Job losses which may lay offworkers to reduce cost of running company during economic shut downs. [50]
- Business Closures which straight away defines whereas upon GDP shrinkages, companies shut off if they can't float.[51]
- Reduced Government Revenue, often means lower economic activity which translates into lower Tax Revenue so impacting public services then to general public directly which shortens the money circulation and finalizing a negative growth pattern on the economy.

Gains are positive increments to the prior year/quarter which in this thesis, the data sets are yearly and each set shows that there is either a positive inclination or declination to the prior year. It usually emphasizes a basic way of formulation;

$$\text{GDP}=\text{C}+\text{I}+\text{G}+\text{NX} \quad (4)$$

$\text{GDP}=\text{Consumption}+\text{Investment}+\text{Government Spending}+(\text{Net Exports}-\text{Net Import})$

- Consumption: Private consumption expenditures by households and nonprofit organizations to construction economy
- Investment: Business expenditures by business and home purchases by households but in the concept of this thesis, this relates to investments to construction economy via rural or urban constructions including not also private or governmental, governmental investments as well.
- Government Spending: It denotes expenditures on goods and services on the construction economy
- Net Exports: Summation of all Net exports subtracted by summation of all net imports on the construction economy like exporting of constructional goods and importing of construction materials.[52]

Occupational Health and Safety Departs (ISG) was chosen the most crucial aspect of GPI-provider as its sole aspect relies on the Sustainability concept. Occupational Health and Regulation was 1st submitted on 2008 but the improved concept and updated sustainability-based regulations were implemented in 2017. In the below chart, the major reason of why ISG was chosen to be the lead actor of the thesis will be explained.

30/1993 25/2000 51/2002 15/2004 50/2010 23/2015	(2)	Sağlık ve güvenlik şartlarının devamlarının sağlanması için bu Tüzüğün 5'inci maddesinin (3)'üncü fıkrası kuralları uygulanırken, bu Tüzüğe ekli EK-IV'de düzenlenen inşaat alanlarındaki işyerleri için asgari sağlık ve güvenlik gerekliliklerini dikkate alarak uygun tedbirler almak,
21.4.2009 R.G. 74 EK III A.E. 337	(4)	Ana işveren, inşaat işlerinde sağlık ve güvenlik şartlarının devamlılığını sağlarken, alt işverenin kullanacağı iş ekipmanları da dahil olmak üzere gerçekleştireceği faaliyetlerde, bu Tüzüğe ekli EK-IV'de uyarınca asgari sağlık ve güvenlik tedbirlerinin alınmasını sağlar.
09.11.2010 R.G. 191 EK III A.E. 680	(6)	Ana işveren, inşaat alanı kurulmadan önce sağlık ve güvenlik planı ile iş sağlığı ve güvenliği dosyasının hazırlanmasını sağlar.
	(7)	Ana işveren, inşaat alanlarında, güvenlik ve sağlık konuları için İnşaat Sertifikalı İş Sağlığı ve Güvenliği Uzmanının ve sağlık ve güvenlik koordinatörünün uyarı, tespit ve talimatlarını uygular.
09.11.2010 R.G. 191 EK III A.E. 680	(10)	Bir işyerinde bir veya birden fazla alt işveren veya bağımsız çalışan aynı anda veya ard arda faaliyet gösteriyorsa ana işveren, işyerinde yürütülen faaliyetleri dikkate alarak işyerinde faaliyet gösteren diğer alt işveren ve çalışanların işyerinde yürütülen işle ilgili mevcut tehlike ve risk faktörleri ile bunların önlenmesiyle ilgili önlemler hakkında gerekli bilgi ve talimatların alınmasını sağlar.

Figure 2: Validation of TPI Explanations

The explanations above are implemented from Northern Cyprus Statistical Department and since there is no direct English version of the documentation, the translation is as follow;

(2): To ensure the continuity of health and safety conditions, when applying the rules of Article 5, Paragraph 3 of this regulation, appropriate measures should be taken by considering the minimum health and safety requirements outlined in Annex IV for workplaces on construction sites.

(3): Take into account the warnings, findings, and instructions of the health and safety coordinator on the construction sit

(4): The main contractor ensures the continuity of health and safety conditions in construction work, including the equipment used by subcontractors, and ensures that the minimum health and safety measures outlined in Annex IV of this Regulation are implemented in their activities.

(6): The main contractor ensures that a health and safety plan and file are prepared before the construction site is established.

(7): The main contractor implements the warnings, findings, and instructions of the certified occupational health and safety expert and the health and safety coordinator on construction sites regarding security and health issues.

(10): If one or more subcontractors or independent workers operate simultaneously or consecutively at a workplace, the main contractor ensures that the necessary information and instructions are obtained regarding existing hazards and risk factors related to the activities carried out at the workplace and the measures to prevent them, considering the activities of other subcontractors and employees.

Speaking of policy applications and sustainable development based policy implications. A study conducted in China by [53] did a research about facing the primary challenges related to balance in future urbanization processes and resource conservation which is a sole priority and description of sustainability terminology itself that they concluded through their studies to current sustainable policy adoptions should interfere with social factors and more investigation related to impact of implementing sustainability practices on the economic competitiveness of construction industry in China. Yet another highly developed country of Germany had its interest in such manner, they had a different approach of teaching sustainable policy rather than on a specific sub sector into a more of a generalized elementary state of initiation.[54] managed to do a study relative to this concept on ‘Education for Sustainable Development’, indicating the ambition to move (reflexively within) structures in the direction of scaling of Education for Sustainable Development. Meanwhile [55] initiated a research along with the Sustainable future concept relative to economic impacts and dictated that the existing

literature on the correlation between policy uncertainty and the environment indicates favorable and reverse consequence within an open economy. They concluded in a point, implementing policy measures to promote a cleaner, more sustainable energy future. Primarily the paper is related to Economic Policy Uncertainty exerts an asymmetric impact on renewable energy consumption.

To summarize the general knowledge about the statements above that these regulations carry the sole purpose of sustainability and optimum performance applications with regard of protecting the contractor and the consumer. Few statistical approaches have been identified in order to how Sustainability in construction economy might be displayed and throughout the searching period, 1st concern was what to display and how to prove that the indicator chosen was relative to the scope of thesis. In more developed countries that where sustainability in any matter covering the major aspect of the business, companies usually start of from;

1. Environmental Impacts which involves eco-friendliness factor and regulation checks
2. Economic Viability as it defines if it is profitable approach in which it leads it into a 'good investment' stat
3. Innovative and adaptable considering innovation and flexibility to adapt changes
4. Policy and support intensives to local regulations [56]

Within the scope of this study, the approach of ISG regulations statistical data sets are used in essence for GPI. To understand the main aspect even better a chart has been developed showing the relationship of ISG departments total inspection on total sectors

in comparative to total accidents. This will show the implementation of ISG's sustainability regulation in real life scenarios. First of all, an individual data set was crafted from Year 2009 till 2021 which was the most recent data to be collected showing the ISG's regulation implementation on 2017 and how did this affect the expected results. The collected data involved;

- Total Company inspections conducted by the labor department
- Accidents in Construction sector which involved was summation of 'Construction Injuries' and 'Construction Death counts'
- Total Accidents, Total Injuries and Total deaths

There were few question marks about the dataset regarding to accident and death toll count details whereas if a person was sick and found deceased, was this accounted as death toll in sector. Even more if a person was fine during job hours but was confined ill at night, was this involved in the data set. After further inspection of the data sets that all these factors were considered and none of the conspiracies above were accounted in the tabulation and the data sets are only received and issued by governmental or private hospitals official papers then was listed into tabulation. Three charts have been developed from the datasets acquired in order to commentate and confirm that these tabulations are useful for the scope of thesis and can be considered as vital variable for the rest of the research.

2.4 Qualitative Analysis

A qualitative analysis method was chosen to allow for a deeper exploration of the complex and interconnected nature of these variables. In contrast to quantitative methods that simplify variables into numerical data, qualitative analysis offers a more detailed and comprehensive view of how these factors interact within the unique socio-economic and political landscape of Northern Cyprus. Data will be gathered through in-depth oral methods with industry professionals, policymakers, and experts in sustainable development. These data gatherings will be complemented by a comprehensive review of policy documents, government reports, and case studies relevant to the construction industry and sustainability initiatives in the region. Further charts & tabulations will be done in order to describe the interconnection between variables and how they dictate the direction of sustainable construction practices of Northern Cyprus.

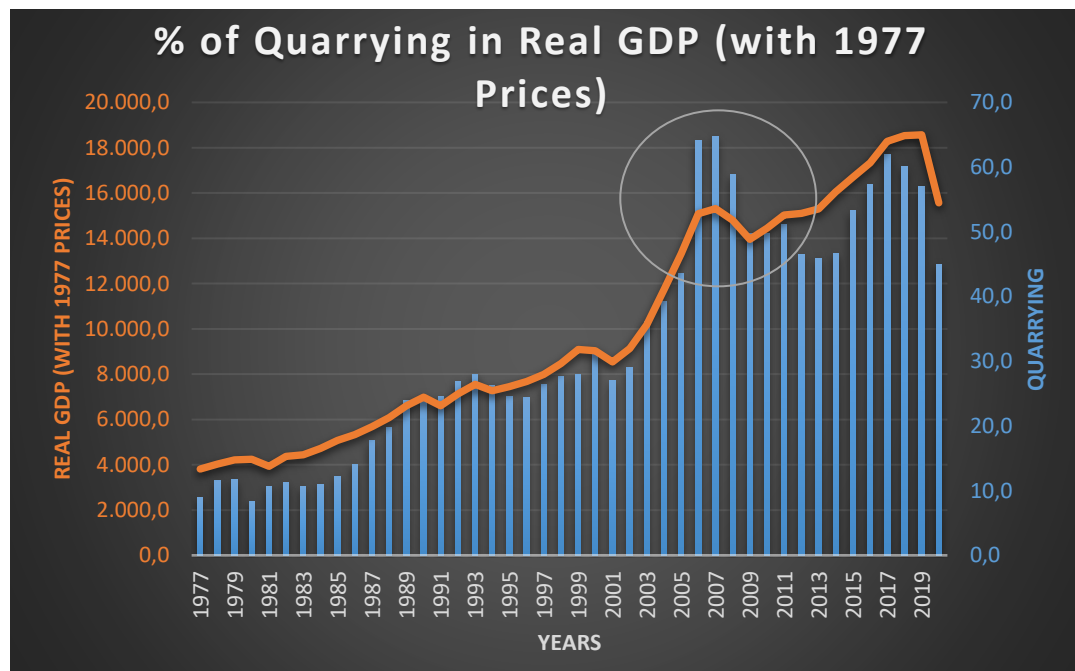


Figure 3: % of Quarrying in Real GDP (with 1977 Prices)

Here the first chart of the analysis is the ‘Quarrying participation as % on Real GDP’ from 1977 until 2020. Hence, the first eye catching point of the chart is the years between 2006 and 2009 which showed an un-natural rate of quarrying displaying the rate of depletion of natural forestation with a higher speed. This was due extensive construction deployment rate of increment and other relative mining reasons. Quarrying itself basically is an open-pit mining method, to extract massive and deep natural depositions for mainly construction purposes like Aggregates, Sand, Clay, Slate and Gypsum. It has huge negative effects including aesthetic value of area decreases, deforestation occurs and without a correct policy of recovery is substantially low which in this case biodiversity occurs. These lands and areas in prior to excavation are categorized as quarry land which can benefit as wildfire habitat or recreational area but in the case of North Cyprus, this is quite an extraordinary outcome to be fulfilled.

GPI (Government Policy Index) is another crucial variable that directly relates to sustainability concept in the most generalized point of view. ‘Occupational Health and Safety’ department in North Cyprus was established in 2008. Through the years, the importance of sustainability rises very quickly. However, due to North Cyprus’s economic and political situation, the world improvements regarding regulations and legislations are delayed by years. An appropriate index of representation for sustainability aspect of construction economy in Northern Cyprus would be various ways. For instance;

- Waste Management: A proper application of disposal of construction waste, Recycling and Re-usage.
- Pollution Control: Examination of regulations regarding to minimization of air & water pollution from construction activities

- Photovoltaic Energy Usage: PV panels are the most widely used aspect of renewable energy for sourcing constructions and domestic uses which is the foremost leader of the sustainable energy concept regarding to creation. Due lack of datasets and reliable data, the sources that are based in Northern Cyprus are limited to PV-based energy creation but a reliable source was found from KIBTEK (Kibris Turk Elektrik Kurumu / Northern Cyprus Electricity Corporation) which shows the usage of domestic PV-Panels also will create an ideology of sustainability concept.

As referring to prior stages of the thesis study that renewable energy based sourcing is one the major subject to sustainable based development but due insufficient technological advancements and developments on this specific PV sector, relativity of this matter has been limited and information delivered will be respectfully fully proportional to this subject.

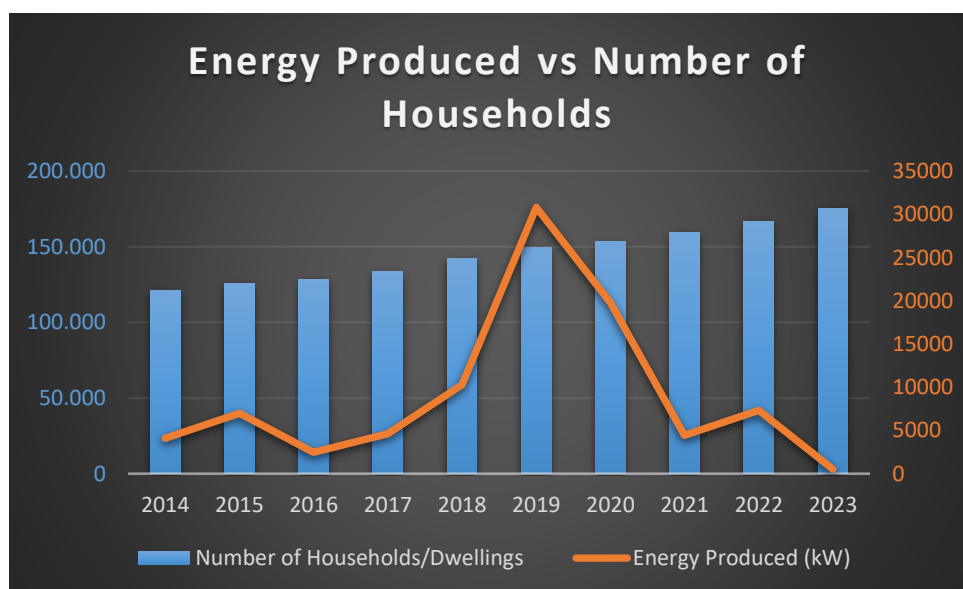


Figure 4: Energy Production vs. Number of Households

Here on the displayed data, the number of households/dwellings are marked as blue to indicate the positive growth of construction regarding to domestic units in regards to total kW (kilowatt) production of those units with photovoltaic panels. It can be clearly seen that from 2022 till up to date that there is a huge decrement which shows the deployment of PV based renewable energy is reduced.

It can be clearly seen that the datasets that were acquired are from a short span range of 2014 to 2023 (up to date), and there has been a significant up rise through 2017 till 2019. This was due allocation of domestic solar house implications were high and from the consumer perspective, installing a PV grid was benefit able including the installation cost and pay over timing was desirable. Without further Deeping down into statistical costs and detailed inspection of PV systems, the allocation that was given to consumers were higher than their domestic total KW and whilst this had a significant benefit for consumers but huge impact on the government due consumers were on positive turnovers which means after a yearly consumption, they ended up in debt from government to consumers and huge load on the local grid system. In mid-2019, the allocation for installing PV plants up to 5 KWh were given (From 9 KWh) which was almost halving the systems output. Furthermore, the local electricity lines are from 1970's in which the local load that they can carry is not suitable for increasing sustainable energy basis. To explain this matter in a daily reference, imagine in using a general 240 V based fridge and the supplied electricity is 270V. This will cause in high Voltage shock on electronic devices and guarantee void on appliances. So till now, government implemented a law in which they require your yearly consumption to be able to allocate you the required PV system that consumer can install but the ones that

had it before 2019 are above average and usually on positive turn over in yearly statistics.

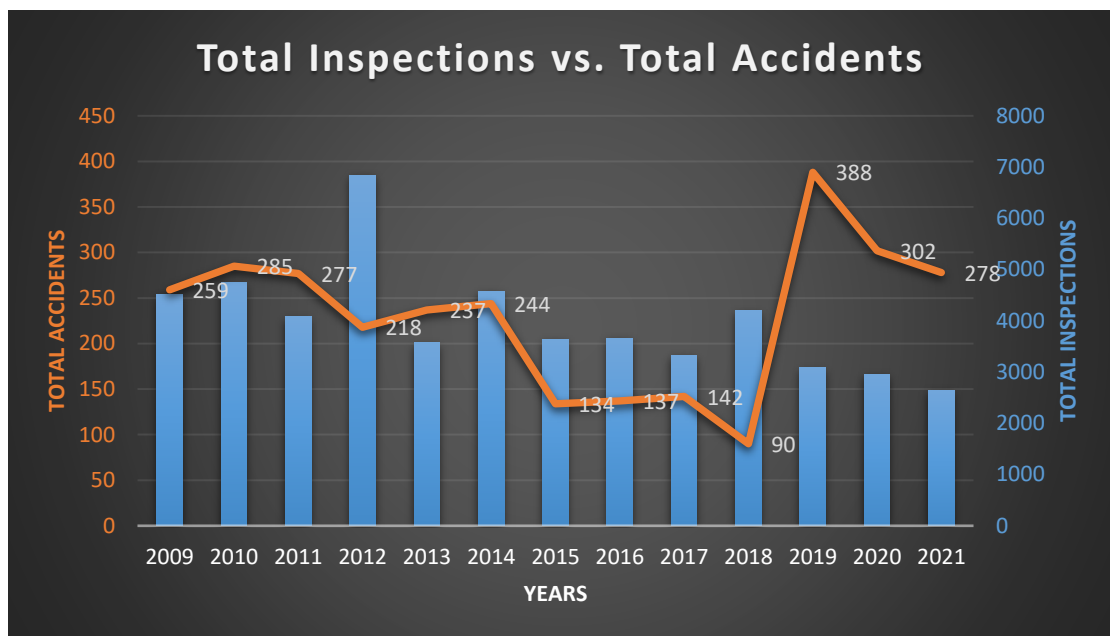


Figure 5: Total Inspections vs. Total Accidents

The chart simplifies into the total number of inspected sectors which includes many economical main sectors like;

- Fishing
- Mining and Quarrying
- Manufacturing
- Electricity, Gas, Steam and Water Production & Distribution
- Construction
- Wholesale and Retail trades
- Hotels and Restaurants
- Transportation, storage and communication sectors
- Activities of financial intermediaries

- Real estate, renting and business activities
- Public administration, defense and social security
- Education
- Health and social services
- Household employers
- First time job seekers

As this was covering all the sectors in Northern Cyprus in general. To compare this into total accidents that occurred in summation of all these sub sectors. It is evident that from the initial state of the data set in which from 2009 till 2017 mid, there has been constant fluctuation on total number of inspections regarding to number of increasing sector quantities as well which also showed a reduction in total accident count among these years. In 2018, the legal implementation of ISG's updated regulation which also was add over into the current regulation and legislations that has been used since the beginning of 2009, had drastic effects. As the supervisors specially educated for this concern had too many reported mistakes in each sector. As a director and also civil engineer myself, I have witnessed in a construction site whereas the worker was not tight from belt to two-story construction scaffold, the inspector stopped the construction work that this was not adequate to standards of ISG's construction regulation and can cause severe damages. As this inspection became more detailed, more companies were warned & fined. Due to lack of data, we cannot determine the total number of exact companies which were fined and warned to show that the success rate of this updated regulation but in which from dataset that we can noticeably see that from 2018, where detailed real incident documentation started and this showed more realistic results. IMO / Chamber of Civil Engineers were appointed to educate their members about

occupational health and safety and the members who lacked the required documentation will not be allowed to do specified constructions either to monitor the cite engineer nor the statistical drawing of the required task.

From 2018 till today, the number of total accidents were skyrocketed and the number of total inspections in all of the listed sectors above decreased drastically. This clearly shows that the ISG or Occupational Health & Safety regulations were not taken seriously and showing weak performance on the overall grow scale of sectors in essence of sustainability.

As it was listed above that the accidents were involved as an indicator for the TPI's reliability whereas 'the lesser the accidents, the better application of regulations' were accounted but whilst all these sectors were there, the construction sector carried the highest individual part in total death tolls vs. sectors (in this case, its construction sector) & also in comparison to total accidents vs. total construction accidents.

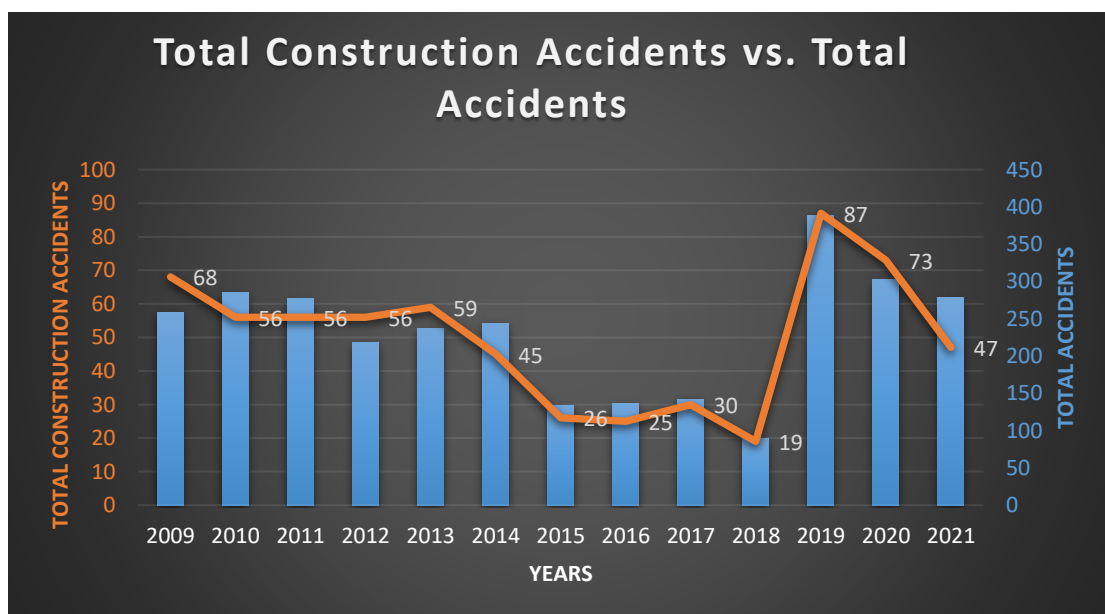


Figure 6: Total Construction Accidents vs. Total Accidents

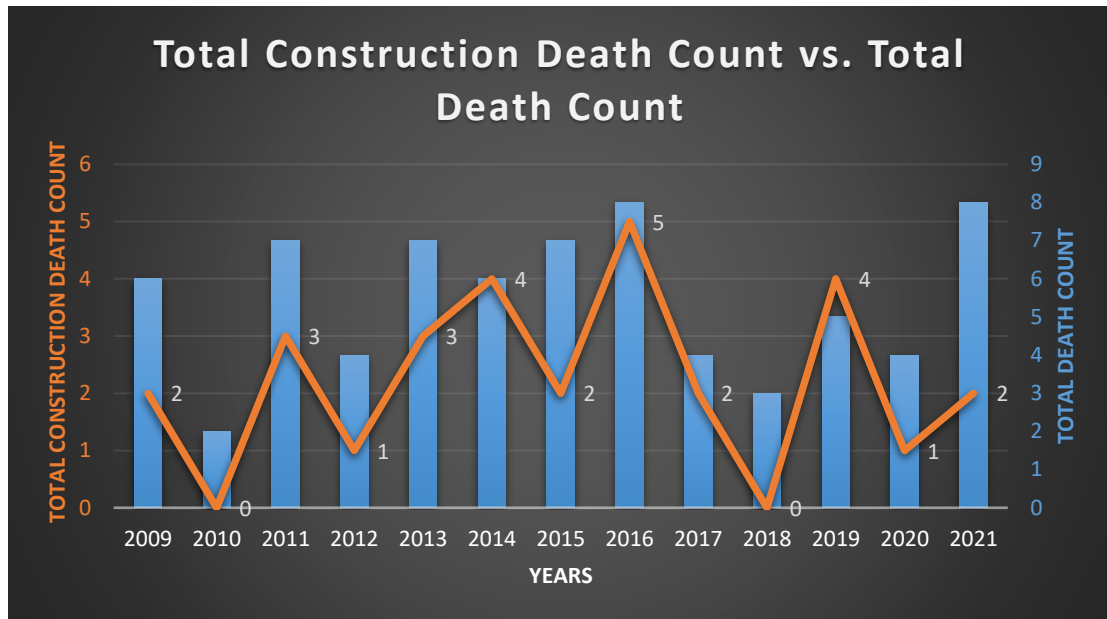


Figure 7: Total Construction Death Count vs. Total Death Count

The chart above identifies the total death toll in blue bar from 2009 till 2021 and the linear line describes the constructional death counts for that year. The most eye catching data in first glance is on year 2008, death count from constructions were reported as zero in 2018 which this was chivied 8 years ago prior to that year. In overall performance, construction sector always carried out half of the total death count recorded in every year but after 2019 there has been decrease in this ratio which was due developing of construction sector in Northern Cyprus. To able to support what was meant in this sentence. A TPI (Total Private Investment) qualitative analysis will be used which will describe how the construction sector is evolving due high demand and foreign direct investments appeared. To support this sentence even more, FDI was planned to use and described accordingly but due to insufficient data and the regulation of Northern Cyprus Foreigner company regulations that they cannot withhold a 100% equity of the company unless they have a national id card or maximum up to 49% equity. Which was very difficult to trace and analyze the data so FDI was removed. However, TPI will partially include foreign investment as well due this reason in

analysis and it will guide why the construction sector is getting more attention since 2019 where first Corona virus appeared in December in Wuhan. In which, till that year, the construction economy showed significant rise in performance and total number of outputs. Since this was a world-wide affecting disease and caused tremendous amount of effects on the economy in every scale, the backlash of this started to appear in 2020 but from 2017 till 2020, there was an increase in performance in construction sector. Another variable that play a vital role is TPI (Total Private Investment), which has been a crucial indicator of the construction industry's performance in Northern Cyprus. The relationship between TPI and connected GDP growth has been also the subject of several studies.[57]

As the industry provides employment, supports the supply chain of the construction materials and is a crucial part of the banking industry due to high amounts of investments & household credits. Several studies show a one-way causality relationship between economic growth and the construction sector.[58]

Speaking of Total Private Investment of Construction sector and relatively to Domestic Investment of construction sector. They both carry vital role in development of GDP of a nation, in other words due to scope of this thesis, to construction sector itself. As explained on definitions of variables part of the work, usually TPI refers to all investments made by private entities within the construction sector including both domestic and foreign investment while DI specifically refers to investments made within the country by domestic entities in the construction sector [59]

Usually DI is a component of TPI in which a higher TPI compared to DI indicates that there is a higher foreign investment with good investor confidence with good sector's attractiveness.

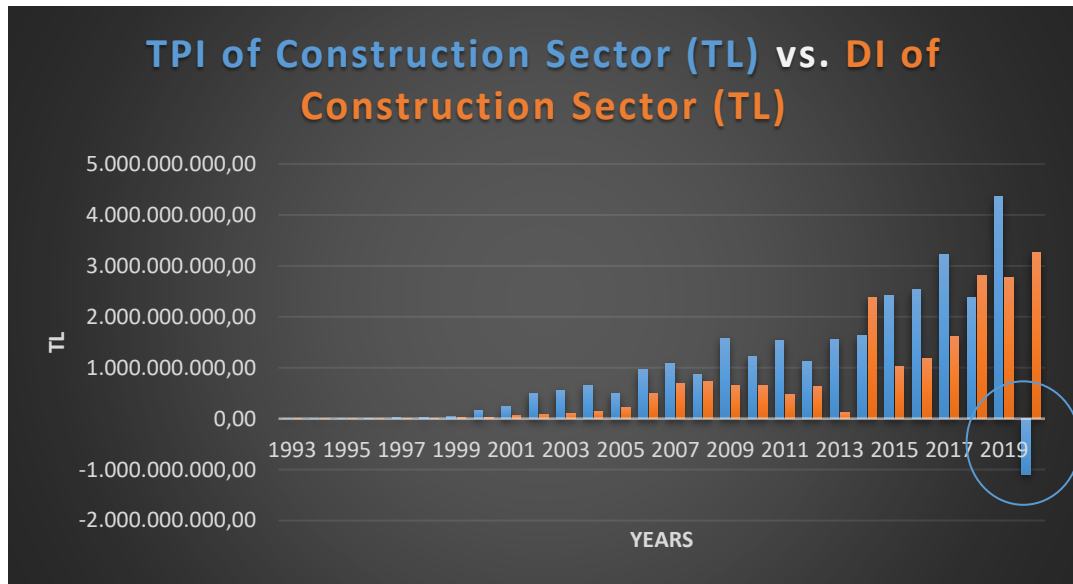


Figure 8: 'TPI vs. DI' of Construction Sector

Here the chart above showing investment in construction economy being growing since 2012 and the corresponding investment ratios according to it. From the statistical data, there has been 2998 permits to constructions were granted in 2023 compared to 3272 permits in 2022. Since there was a small declination of 8.4% but the overall value of permits increased in average of 17% with a steady rate rise of 3.9% in total construction area. [60]. This shows that there is an increased rate of interest in construction sector even in domestic investment and total private investment which includes both domestic and foreign direct investment. By looking at the chart, we can clearly see that there is a significant rise in TPI up until 2019 in which by looking at the moving trend line, it's an upscale growth but a significant event appeared in 2020 whereas TPI ended up in - 1.097x10⁶ TL which was due world wide spread corona disease caused lot of

companies to go shutoff and even sell of properties under production price or floor price. There is also another significant reason why the negative TPI appeared is that end of Cyprus Investment Programme (CIP) in November 2020. There are several conspiracies behind the shut off of the Programme which includes about ‘Corruption’ and ‘Misuse’ which directly relates to passports being given in order to own more units with lower payment taxes which is also called tax evasion.[61] As Cyprus is divided country but for a foreigner who is an entity willing to multiply his/her asset value, the international news work accordingly to them and with the excessive negative growth rate of Covid-19 some aspects appeared;

- Supply chains distrusted which caused in difficulties in sourcing materials and labor, delaying construction projects
- Economic Uncertainty for investors faced downslope willingness for upcoming new projects or investment opportunities
- Travel Restrictions for foreigners to visit sites or manage projects
- Financial Strain which resulted in increased in costs and reduced in revenues during the pandemic[62].

On the contra verse, domestic investment in construction economy had an increase of 17.33% from 2019 to 2020. This showed that domestic construction units were sold off with lower prices for the economy to sustain and for long term investment perspective of buying units were reasonable due sellers needed cash to circulate the needs of their firms. Local investors shifted their priorities with the expectation of selling the unit way higher than what they bought it for. These opportunities appeared not only in construction sector but relatively the corresponding sectors like healthcare facilities, well balanced infrastructures with viable future. Since the foreign transaction fees and

difficulties of sending money internationally was hard, local investment and rolling cash into assets became more reasonable. Local banks offered lower interest rate domestic currency options for people who willing to use this an opportunity but further after that these options became even harder to control, interest rates rose up, inflation became exponential in growth and caused in massive economical unsustainability. Another reason for such investment in construction sector in such harsh times is that due sector specific resilience. Construction sector have been known as resilient or durable sector compared to other options leading to increased investment in regards to wider declination of private investments.

Another way of showing the contribution of domestic investment in total private investment follow on 'Table 2: TPI & DI Datasets – Ratio of DI to TPI' in Appendix We can clearly see that since 1993 till 2019, domestic investment carried out minimum 7.5% up to 145.2% of the total private investment of construction sector but in 2019 due to the reasons explain before, there was a significant negative reduction in TPI while almost quadruple of its value in domestic investment appeared. It can be clearly seen that this was an eye catching situation of investment for locals and it was well covered. This has negative and positive effects on the economic growth which will be furthermore explained in the GDP variations with also in consideration of Trade Openness (TO).

Till now, most of the variables are taken into consideration for Sustainable Practice Adoption Rate (SP_Adoprate). Speaking of variables as the most crucial econometric variable points out to Gross Domestic Product (GDP). In this thesis, GDP of Construction sector and GDP itself was taken into consideration to magnify the

economic aspects in particular year span. Throughout the data searching and facing conflicts over the preparation of the data's few particular considerations were taken into account that since the data set that being used is not Deflated, in other terms that inflation ratio that is affecting each year is not being eliminated and therefore an equation will be used on GDP. To explain the difference of nominal and real GDP;

- Nominal GDP: Represents the value of the finished goods and services that an economy has produced (Unadjusted for inflation) in other words GDP (Current Prices)
- Real GDP: Represents the value of the finished goods and services that an economy has produced for inflation. Which is GDP (with 1977 Prices).

A basic equation has been used to confirmed that the values are being de-inflated.

$$\text{GDP Deflation (\%)} = \frac{\text{GDP (Current Prices)}}{\text{Real GDP (with 1977 Prices)}} \times 100 \quad (6)$$

On Table 3: GDP de-inflation method will be shown and therefore, this calculates the effects of the inflation on the finished goods and products by changing an economy's output into current prices showing the impact of inflation on the GDP change. One of the main reason that using deflator is that it allows pinpointing the real reason for increase in GDP, whether inflation or increased output also vice versa. Several comparisons have been conducted among data and few were taken into consideration like;

- Real GDP vs. Real GDP of Construction Sector
- Real GDP vs. Real Trade Openness
- Real GDP Deflation vs. Real Currency Exchange Rate of USD/TL
- Real GDP Deflation vs. Change in (Δ) Deflation

By eliminating of inflation in GDP, it helps us to reflect the real economic output which benefits also in monetary and fiscal policy decision making processes by banks due helps out in setting interest rates and designing economic measurements. By Adjusting historical GDP figures, it is also possible to compare economic outcomes over time without the distortion caused by change in price levels. Here a clear chart for ‘Real GDP vs. Real GDP of Construction Sector’ will be shown.[63]

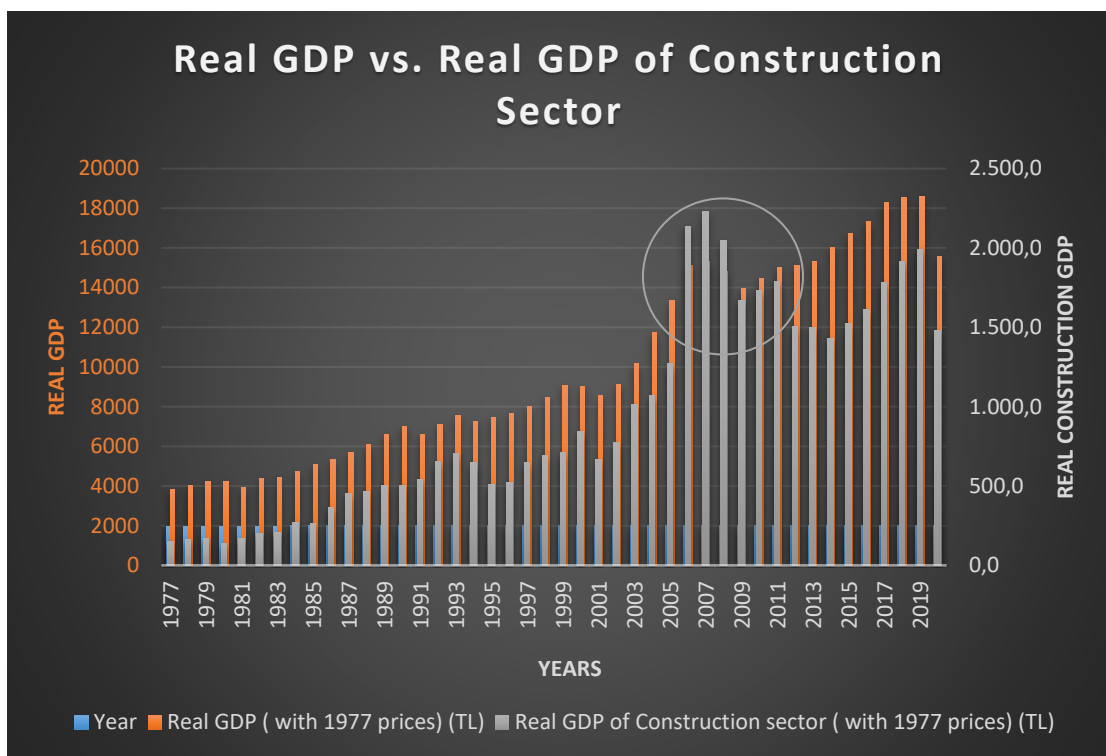


Figure 9: Economic Yield Display for Real GDP vs. Real GDP of Construction Sector

There is a very important point on the graph where between 2005 and 2008, Real GDP of Construction sector surpasses the Real GDP which is impossible on basic math equation whereas the Real GDP is combination of all of these sectors specific Equation (5) variation. The reason that this error happened in here is because on 2005, due to currency depreciation of Turkish lira was too high and government created a new

currency of YTL (Yeni Turk Lirasi) and this was in equivalent of 1M YTL = 1 TL, due this conversion that the specific sector's GDP was misused and appeared to be over of total economies GDP. It can be clearly seen that the sudden explosion of real construction sector GDP started in late 2007 till late 2009 which then all the confusion was settled and carried its upscale performance in real GDP till now. The error margin in the chart could be grouped as 'Economic Anomaly' where extraordinary events could impact the reliability of data which is sector specific and will be gradually fixed which that phenomenon was seen in the chart just after 2010.

Another chart to talk about is the 'Real GDP vs. Real Trade Openness' and the importance of Trade Openness in an economy. As the basic terminology of trade openness was explained prior to variable description of this thesis, I will dive into why it's an important aspect and what is the relationship of it to sustainability concept. First of all, RTO carries vital role in perspective for the investor which can be domestic or foreigner. On Table 3 in Appendix, a tabulation of data is available and it is an equation derived output which is;

$$RTO = \frac{RTR}{RGDP} \quad (7)$$

Whereas RTR (Real Total Revenue) is calculated from;

$$RTR = \frac{TR \times TI/\$}{GDP \text{ Deflation}} \times 100 \quad (8)$$

There is an also a different approach but due lack of Consumer Price Index (CPI) of USA starts from 2015 and our data starts from 1977, another way of correct conversion would be carried. The basic equation as follow;

$$X(\$), M(\$), GDP(\$) \quad (9)$$

Whereas X: Total Imports (\$)

M: Total Exports (\$)

GDP: Gross Domestic Product (\$)

$$X^* = \frac{X}{CPI(\$)} \times 100, \quad M^* = \frac{M}{CPI(\$)} \times 100, \quad GDP^* = \frac{GDP}{CPI(\$)} \times 100 \quad (10)$$

$$RTO = \frac{(X^*) + (M^*)}{(GDP^*)} \quad (11)$$

But due missing CPI (\$) data, conversion done with Eq (7) & Eq (8)

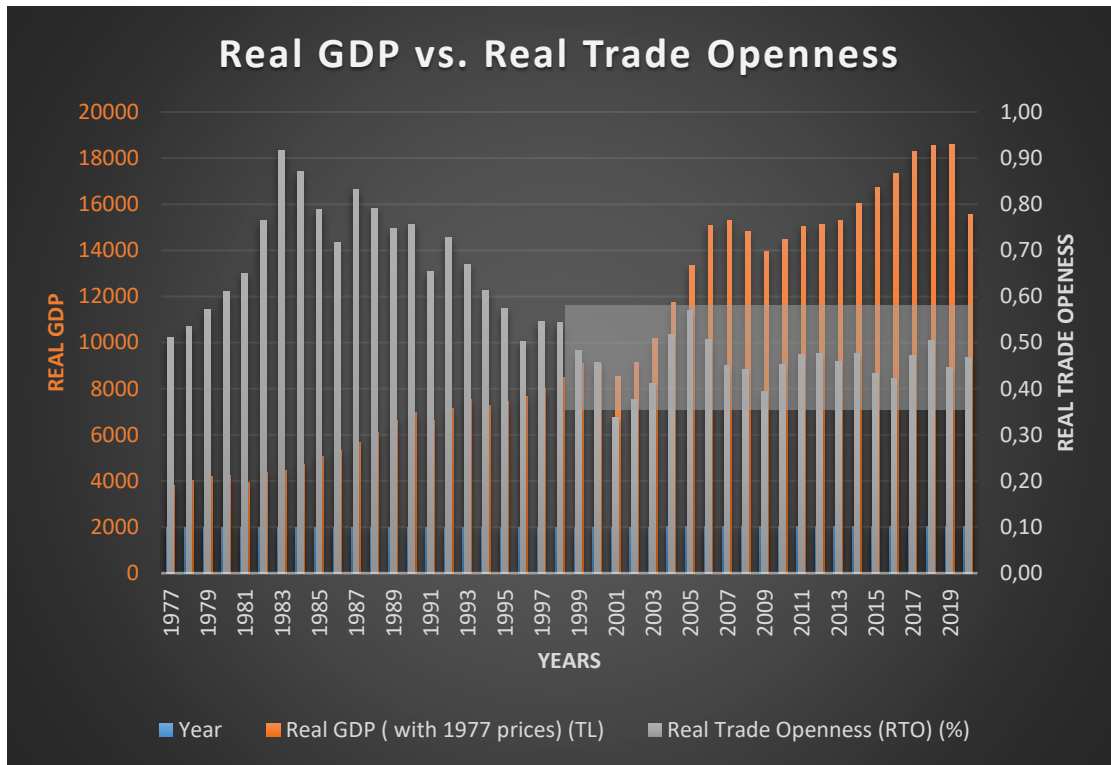


Figure 10: Real GDP vs. RTO

Here the chart showing the range of RTO from $0 < n < 1$ throughout the 43-year span. On theory, the value of RTO indicates the total revenue from trade which is a portion of country's GDP. The more it closes to 1 indicates a higher level of trade relative to

economy dictating in greater trade openness. It is such a crucial variable allowing us to understand the international trade in relation to GDP.[64].

On the contra verse, having values closer to zero meaning that the trade constitutes a slight portion of the country's GDP which can be resulted from less engagements to international trades. This has various reasons which can be due to protectionist policies or strong internal market where production of country is valid enough to maintain the needs of the sector which in this chart is a generalized version rather than construction sector only. On the other hand, construction sector carries a significant play in total GDP which was shown on Chart 6 so that we can say the TO variations are having major effects on the construction sector. Throughout the initial years up till 2000, the economy had a relatively strong TO value ranging between $0.4 < n < 0.9$ while RGDP was very low compared to rest of the time span. From 2000 till 2020, RTO values are low compared to prior years and this can be issued that country is more dependent on imports rather than exports. This statement could be verified by checking sector specific import and export comparisons to understand which carries a higher role so that the effect of this ratio could be a source for lower RTO value. In construction sector, this value creates opportunities like international market advantages, reducing local dependence which in other terms that the owner will not only rely on domestic customers but will have a 'contingency plan' of that the product or unit will be sold off to international buyer creating a confidence barrier. For a higher RTO to appear, there should be a transparent policy that its investor friendly and confidence enhancer with proper policy makings and offer creations. On the aspect for sustainability matter which is the sole purpose of this thesis, accessing to international markets will enable sourcing ecofriendly and more advanced materials promoting green construction practices. [65].

Which also ends up in diversified markets and global partnerships with more advanced knowledge about construction performance in sustainable matter resulting in ecofriendly infrastructures.

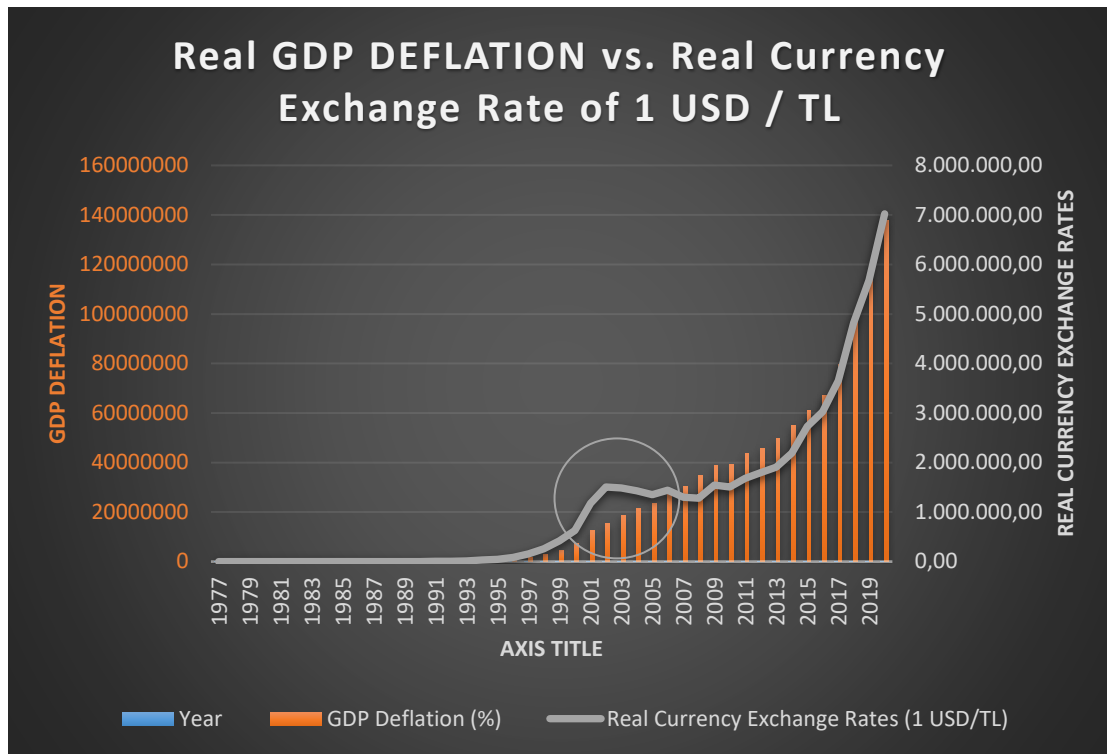


Figure 11: RGDP Deflation vs. Real Currency Exchange Rate of USD/TL

Speaking of RTO, the international hard currency (USD / \$) had its influence on the domestic market involving deflation perspective. Among year 2001 and 2008 where explained above that domestic currency swap to YTL was unexpectedly caused depreciation increments and major sell offs. Right after 2008, GDP deflation started to rise higher than real currency exchange rates which usually happens from decrease in purchasing power where as domestic prices are rising faster than the currency is depreciating, leading to reduced purchasing power.[66]

An example to this condition can be referred as, while Northern Cyprus experienced high inflation, the Turkish lira depreciated at slower rate. As domestic prices increased rapidly, the cost of imported goods like consumables, electronics, fuel... etc rising higher which was confirmed by RTO ratio spoken above with values fluctuating around 0.4 during those times. This was because, despite the currency exchange rate plummeting unevenly, the inflation within the country meant consumers had to spend more Turkish lira for the same imported items, consequently making imports more expensive in reality.

As deflation was playing key role on all analysis above, a further investigation regarding to inflation itself will be useful by analyzing the Change in Deflation % among each year corresponding to the other.

From the 'Table 4: Real GDP Deflation vs. Change in (Δ) GDP Deflation' in Appendix, the initial Δ GDP Deflection was considered as 1 and the maximum achieved is 2.48 but this sudden movement of Δ Deflection will just partially describe the stability of the economy as this implies on whole governing GDP sectors but in overall performance, it can be clearly seen that prior to every year, deflation increased. Majorly, from 1977 till 2001, it's the highest Δ Deflection rate was recorded as every prior year was almost increased by 150%. These factors usually varies from high volatility and instability due hyperinflation or economic crises.[67]

From 2001 till now, with the aid of better monetary policy structures and structural reforms or improved fiscal discipline, the ratios are in between 1.01-1.24 meaning still there is a prior deflation increment to prior year and never decrement in this inflation value.[68] Holding the economy stable is another state of art, keeping everything in an

equilibrium which in a perfectly competitive market economy its quite hard to achieve. The main aim of policy makers is to reduce inflation values to help out economy to perform better than prior year but due political and other reasons, this is a hard task to accomplish.

Chapter 3

CONCLUSSION & RECOMMENDATIONS

The main objective of this study is to set that the results obtained from each chart analysis to be in the expected result range. Since this thesis report was solely dictated on GPI which was a sustainability derivative regarding the adoption of sustainable practices to real life circumstances of Northern Cyprus. Beside the objective, the thesis study tries to light the importance of how construction economy is affecting the growing GDP considering [69] also concluded that in research of Russian Federation and China's development status, there is a direct connection and valid correlation between GDP growth and the total number of sustainable infrastructures which is major objective of GPI adoption on infrastructures. We have accepted that due to limitation of GPI data sets that isolation of confirmed and unconfirmed companies who oblige the regulations that were conducted by the Health and Safety Organization could not be found and relative inspection list was thought to be a pass or fail kind of test. From 2018 until present, number of total accidents kept increasing but the total inspection amount is decreasing which shows poor state of application regarding to GPI which directly correlates lower sustainability adoption rate in construction practices.

Death toll is another indicator for adoption purposes where it can be clearly seen that construction sector is covering over 50% of every year's total count except 2018 which the regulations initiation year but soon after it kept increasing, showing another poor adoption for both contractor and consumer perspectives. Since the construction

economy having solid increments compared to every prior year which was clearly stated in Chart 5 that the sector is lacking guidelines as for sustainable practices matter, same could not be said. To be able to support the importance of construction economy, total private investment of construction sector was calculated then compared with domestic invest of construction sector which this was gathered from summation of rural and urban construction investments. The ratio of this showed the relative importance of this socio-economic sector is increasing every year meaning it has more attention than prior year up till now. Throughout my investigation period for relative research papers and publication searches, I have seen that the importance of sustainable practice adoption is a key factor for both contractor and consumer perspective. The domestic contractors are lacking these properties in major of the infrastructures. This is due that there is very low application of green construction debt which basically is a specific low interest funding for those who is helping environment having special offers for their needs. Every part that I have mentioned up till now is a sub sector in GDP of the economy but to be able to make comparison comments about the importance of GDP in Construction sector, Chart 6 was drawn. Except the years from 2006 till 2009 due TL to YTL then back to TL conversion with the ratios explained in this thesis before, the Speed of Growth for $GDP_{cons.} > GDP$, indicating there is a higher income rate compared to other sub-sectors. Yet another relative importance of the sector was confirmed in here.

Trade openness was chosen to be variable because it consists of the ratio for Real Total Revenue in Real Gross Domestic Product. Having GDP which excludes deflation creates more robust in direct ratio.[70] examined that nominal GDP targeting rules do not require real time knowledge among the outcome gaps. Concluded result was

nominal/current GDP allows central banks to aim on one variable. Hence, [71] conducted a study in China's national accounts from 2004 to 2018 and concluded that the GDP deflator supported the national accounts by reconciling the reasonable adjustments to GDP growth and also concluded that it visualizes a better understanding during economic boom years.

From 1980 until 2000, a solid decrement on trade openness was carried. This showed that the economy is turning to more import based rather than export based. An interesting remark is that for almost 20 years' time, economy being bouncing between midranges but this does not show the economic situations are getting better. That required to check the Real GDP deflation vs Exchange rates since there is a trade openness but is it following similar path due increasing rates vs. hard currencies like US\$. With correct policy managements and right decision making, economists sole purpose is to control deflation but on the controversy, with low sustainable practice adoptions and huge deflation. It can be clearly seen that economy is on its fall. Who has fault in this? Policy drivers rather than policy makers I would say. Then I wanted to check how does the deflation is performing prior to its year which it wasn't very much necessary that chart 8 already forecasted what's coming and unsurprisingly, except for very specific years that the inflation was always above 1 which meant, it never decreased rather than kept increasing.

As it was stated clearly on the beginning of this conclusion that I wanted to clarify my current predictions about the state of policy implications in Construction sector within the Northern Cyprus and yet I had challenges with data observations and required variable based values where this would allow me to re direct the study into a different methodological path but I achieved the same purpose of showing relative weak performance of sustainable practice adoption on not only in one sub sector but more of a generalized concept. I tried to correlate the Policy adoption as ISG's data sets which directly dictates the sole vision of sustainability so that I could prove my relative point of view regarding to current state of construction industry and sustainability condition in which in a way of showing not only macroeconomic based but more of real life scenarios related situations were shown. I proved the relative importance of construction sector among GDP and how does this sector showing overall weak policy adoption in initiation to finalization of construction. As a Director & 6 years of experienced Civil Engineer myself, I have lot more to speak about the current stages of this construction direction in Northern Cyprus but this thesis study just proved my initial expectations which displayed a low rate of sustainable practices adoption. I wanted to investigate what is the current situation of my homeland in sustainable practices adoption in construction economy yet neither consumers or government have the required policy decisions or solid inspections regarding to this ideology.

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APPENDICES

Appendix A: Datasheet of Variables from 1977 – 2021

Year	TPI of Construction Sector (TL)	GDP (%)	GDP (%) Of Construction Sector	GPI Number of Companies Inspected)	DI of Construction Sector (TL)	RTR (Import + Export) (MIL)	RTO ((Import + Export) / GDP deflator) (%)
1977	-	3,810.5	153.0	-	-	1,945.58	0.51
1978	-	4,031.3	160.3	-	-	2,155.79	0.53
1979	-	4,210.1	171.7	-	-	2,406.55	0.57
1980	-	4,248.4	135.7	-	-	2,593.69	0.61
1981	-	3,929.8	170.7	-	-	2,552.99	0.65
1982	5887.3	4,369.5	202.7	-	-	3,339.92	0.76
1983	3116.9	4,440.4	208.8	-	-	4,070.39	0.92
1984	6016.1	4,725.2	270.4	-	-	4,111.30	0.87
1985	22,216.6	5,080.4	263.8	-	-	4,004.57	0.79
1986	43,655.0	5,324.1	366.5	-	-	3,821.42	0.72
1987	45,334.9	5,684.1	451.3	-	-	4,733.44	0.83
1988	40,104.1	6,084.0	465.6	-	-	4,816.77	0.79
1989	92,611.9	6,603.0	501.3	-	-	4,931.80	0.75
1990	161,910.2	6,977.4	506.3	-	-	5,277.41	0.76
1991	300,815.2	6,606.4	540.1	-	-	4,314.79	0.65
1992	591,917.9	7,124.7	655.2	-	-	5,183.88	0.73
1993	1,182,111.0	7,547.4	704.7	-	420,893	5,053.00	0.67
1994	2,261,274.2	7,268.3	646.7	-	987,072	4,458.46	0.61
1995	7,366,653.7	7,457.8	507.5	-	1,868.116	4,277.38	0.57
1996	13,106,864.2	7,673.4	523.3	-	2,586.497	3,855.99	0.50
1997	24,958,225.7	7,990.4	647.5	-	8,879.760	4,357.13	0.55
1998	24,650,607.3	8,468.1	694.6	-	12,769.143	4,601.44	0.54
1999	43,103,730.7	9,090.8	708.6	-	22,038.188	4,386.45	0.48
2000	165,649,716.1	9,037.9	841.4	-	33,095.875	4,130.96	0.46
2001	238,710,417.3	8,545.9	669.6	-	56,426.914	2,883.18	0.34
2002	492,570,082.0	9,133.1	776.0	-	80,856.242	3,444.16	0.38
2003	558,878,236.2	10,177.1	1,015.0	-	108,615.925	4,190.67	0.41
2004	659,136,318.1	11,739.6	1,068.9	-	142,063.580	6,085.95	0.52
2005	500,315,371.2	13,327.0	1,271.0	-	227,539.175	7,577.79	0.57
2006	957,441,189.3	15,090.7	2,136.9	-	501,808.634	7,660.39	0.51
2007	1,090,767,562.1	15,310.8	2,227.3	-	696,965.149	6,904.48	0.45
2008	873,152,280.4	14,797.2	2,049.0	-	734,285.535	6,534.26	0.44
2009	1,580,887,664.1	13,950.4	1,670.8	4504	645,264.884	5,493.66	0.39
2010	1,219,838,122.5	14,451.3	1,734.6	4738	646,576.632	6,552.51	0.45
2011	1,537,921,798.5	15,032.1	1,791.3	4081	478,834.878	7,123.64	0.47
2012	1,126,262,809.6	15,102.4	1,503.9	6839	639,465.209	7,186.60	0.48
2013	1,557,307,014.4	15,293.6	1,498.6	3576	115,584.726	7,012.40	0.46
2014	1,641,904,406.2	16,045.6	1,430.8	4576	2,383,974.530	7,634.15	0.48
2015	2,415,691,507.8	16,702.9	1,524.1	3639	1,016,538.202	7,220.02	0.43
2016	2,529,686,723.1	17,337.8	1,611.6	3658	1,180,710.355	7,327.90	0.42
2017	3,218,994,883.6	18,284.7	1,782.3	3330	1,608,260.891	8,643.00	0.47
2018	2,381,071,159.7	18,531.1	1,917.3	4203	2,806,278.381	9,344.40	0.50
2019	4,371,877,015.0	18,568.9	1,992.1	3082	2,777,356.489	8,279.02	0.45
2020	-1,097,968,291.5	15,561.0	1,481.6	2958	3,258,689.417	7,272.86	0.47
2021				2646			

Appendix B: TPI & DI Datasets – Ratio of DI to TPI

17	Year	TPI of Construction Sector (TL)	DI of Construction Sector (TL)	Ratio of DI to TPI
18	1993	1,118,111.00	420,893.00	37.6
19	1994	2,261,274.20	987,072.00	43.7
20	1995	7,366,653.70	1,868,116.00	25.4
21	1996	13,106,864.20	2,586,497.00	19.7
22	1997	24,958,225.70	8,879,960.00	35.6
23	1998	24,650,607.30	12,769,143.00	51.8
24	1999	43,103,730.70	22,038,188.00	51.1
25	2000	165,649,716.10	33,095,875.00	20.0
26	2001	238,710,417.10	56,426,914.00	23.6
27	2002	492,570,082.00	80,856,242.00	16.4
28	2003	558,878,236.20	108,615,925.00	19.4
29	2004	659,136,318.10	142,063,580.00	21.6
30	2005	500,315,371.20	227,539,175.00	45.5
31	2006	957,411,189.30	501,808,634.00	52.4
32	2007	1,090,767,562.10	696,965,149.00	63.9
33	2008	873,152,280.40	734,285,535.00	84.1
34	2009	1,580,887,664.10	645,264,884.00	40.8
35	2010	1,219,838,122.50	646,576,632.00	53.0
36	2011	1,537,921,798.50	478,834,878.00	31.1
37	2012	1,126,262,809.60	639,465,209.00	56.8
38	2013	1,557,307,014.40	115,584,726.00	7.4
39	2014	1,641,904,406.20	2,383,974,530.00	145.2
40	2015	2,415,691,507.80	1,016,538,202.00	42.1
41	2016	2,529,686,723.10	1,180,710,355.00	46.7
42	2017	3,218,994,883.60	1,608,260,891.00	50.0
43	2018	2,381,071,159.70	2,806,278,381.00	117.9
44	2019	4,371,877,015.00	2,777,356,484.00	63.5
45	2020	-1,097,968,291.50	3,258,689,417.00	-296.8

Appendix C: GDP De-Inflation Method

	A	B	C	D
1	Year	Real GDP (with 1977 prices) (TL)	GDP (Current Prices) (TL)	GDP Deflation (%)
2	1977	3,810.5	3,810.5	100.00
3	1978	4,031.3	5,281.0	131.00
4	1979	4,210.1	8,504.5	202.00
5	1980	4,248.4	17,541.5	412.90
6	1981	3,929.8	24,525.6	624.09
7	1982	4,369.5	34,148.0	781.51
8	1983	4,440.4	47,040.2	1,059.37

Appendix D: Real GDP Deflation vs. Change in (Δ) GDP Deflation

59	Year	GDP Deflation (%)	Change in GDP Deflation (%)
60	1977	100.00	-
61	1978	131.00	1.31
62	1979	202.00	1.54
63	1980	412.90	2.04
64	1981	624.09	1.51
65	1982	781.51	1.25
66	1983	1059.37	1.36
67	1984	1564.75	1.48
68	1985	2497.33	1.60
69	1986	3665.27	1.47
70	1987	5086.23	1.39
71	1988	7985.67	1.57
72	1989	13782.50	1.73
73	1990	22182.95	1.61
74	1991	34416.60	1.55
75	1992	56671.89	1.65
76	1993	91968.42	1.62
77	1994	228135.42	2.48
78	1995	471707.09	2.07
79	1996	828536.77	1.76
80	1997	1472809.92	1.78
81	1998	2759306.16	1.87
82	1999	4477821.26	1.62
83	2000	7207205.82	1.61
84	2001	12525590.90	1.74
85	2002	15533644.26	1.24
86	2003	18738844.70	1.21
87	2004	21472680.05	1.15
88	2005	23588951.84	1.10
89	2006	27178243.49	1.15
90	2007	30509548.07	1.12
91	2008	34657463.13	1.14
92	2009	38818103.41	1.12
93	2010	39093610.51	1.01
94	2011	43634452.46	1.12
95	2012	45792931.12	1.05
96	2013	49559314.20	1.08
97	2014	55095403.15	1.11
98	2015	61131507.96	1.11
99	2016	66937329.87	1.09
100	2017	79584415.00	1.19
101	2018	98940698.07	1.24
102	2019	115295601.48	1.17
103	2020	137681490.60	1.19