QATAR UNIVERSITY

COLLEGE OF ENGINEERING

SUSTAINABILITY INDEXING AND BENCHMARKING FRAMEWORK FOR OIL AND GAS COMPANIES IN QATAR: REVEW, ANALYSIS, AND FUTURE PERSPECTIVES

BY

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ABSTRACT

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Title: Sustainability Indexing and Benchmarking Framework for Oil and Gas Companies in Qatar: Review, Analysis and Future Perspectives

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The oil and gas sector has a major impact on sustainability dimensions characterized by environmental, economic, and social aspects. Because of this multi-dimensionality of sustainability objectives and the complexity involved in the industry practices, multi-criteria decision analysis techniques have become gradually more popular in decision making for sustainable businesses. The aim of this thesis is to develop a dedicated systematic and comprehensive framework for sustainability assessment of the oil and gas industry in Qatar, which covers the three pillars of sustainability. Five leading companies from the oil and gas sector in Qatar are selected to be the focus of this study. Procedures of selecting and quantifying the significant indicators, converting them into dimensionless values for rational benchmarking, weighting them according to their importance, and ranking the alternatives according to the aggregated scores are presented. Monte Carlo simulation and sensitivity analysis are conducted to investigate the effect of uncertainty and to ensure reliability as well as the robustness of aggregated scores.

DEDICATION

I dedicate this thesis to my beloved husband, Mohammed Ali, who has offered unwavering support and encouragement during the past years of my master's degree journey.

To my parents, Manal Abubaker and Ahmad Fadel, who implanted in me the love of learning from an early age. I cannot begin to express my gratitude to them for all of the support, love, praise, and prayers they have sent my way along this journey.

To my daughter and son, Rozana and Feras Ali, who have been inspiring me, made me stronger, better and more content than I could have ever imagined.

To my siblings, Malak, Hadeel and Saleem Fadel, for believing in me and pushing me to pursue my dreams.

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CHAPTER 1: INTRODUCTION

1.1 Background

“Sustainable Development” terminology is being used more frequently in the past decade. It is very essential for regional organizations to understand this term clearly so that they could be a part of the sustainable development of the nation. Qatar National Vision of 2030 has published the ultimate national objectives for the coming two decades. Sustainable development is embraced in all strategies and goals set for the country in all sectors. However, sustainable development is a process not a goal to be achieved. It is part of a system that integrates social, economic and environmental guidelines (Richer 2014; Kucukvar et al. 2019; Onat et al. 2018; Onat et al. 2019).

The United Nations established 17 sustainable development goals that represent the most encountered challenges worldwide. These goals support the three dimensions of sustainability: economic, social and environmental. The established goals are listed in the figure below:

Figure 1 Sustainable development goals

Due to the significant footprints of the Oil and Gas industry, the focus of this study will be to address and highlight the sustainability of this particular sector in Qatar. This sector represents the backbone of the country's economy. Since 2006, Qatar has been producing the largest amount of liquid natural gas while oil and gas production accounts for more than 70% of the governmental revenues.

When considering sustainability in the oil and gas industry, it can be referred to as a great source of environmental pollution and hazardous catastrophes during the production stages. According to (Anis and Siddiqui 2016), major Oil and Gas disasters and absence of sustainable routines are rationally related. With this in mind, Qatar has joint the United Nations' Sustainable Stock Exchange Initiative in 2016 to be committed to encouraging sustainable practices in the market.

1.2 Problem Statement

As the awareness of the concept of sustainability is increasing, evaluating the performance of organizations with respect to sustainability practices becomes a crucial subject. Qatar Stock Exchange has become a member of the Sustainable Stock Exchange Initiative, which encourages liable investments, business transparency, and accountability towards a sustainable future. This research involves performing an analysis of the current sustainable performance of Oil and Gas companies in Qatar through reviewing published GRI reports by the nominated companies for the study. A comprehensive assessment framework is developed specifically for the purpose of evaluating and benchmarking the current performance of the selected companies. This framework can be used as an appraisal means by Qatar Stock Exchange to keep track of the performance of its listed companies. In addition, this research aims to identify the critical parameters that influence the evaluation outcomes using the established assessment framework.

1.3 Objectives

The main objectives of this research study are listed below:

1- Performing a review on the global sustainability initiatives and universal reporting guidelines, which are aiming to improve transparency and awareness of sustainable indicators.

2- Reviewing assessment frameworks developed by researchers for the purpose of having a designated appraisal system that examines sustainability performance.

3- Collecting real data from published GRI reports to be incorporated into the assessment procedure for the selected companies.

4- Identifying the assessment parameters through selecting the vital sustainability indicators that fall into the three dimensions of sustainability: environmental, economic and social.

5- Determining the importance of the selected indicators by conducting an expert judgment evaluation context.

6- Establishing a comprehensive assessment framework that can evaluate individual organizations and compare their performances.

7- Identifying the critical parameters that are greatly influencing the assessment outcomes.

8- Investigating the forecasted results associated with different levels of uncertainties in the input parameters.

1.4 Scope

The scope is dominated by the availability of data in the annually published GRI reports. Companies with reliable data available in their annual published sustainability reports were included. Therefore, the scope was narrowed down to include five companies in the study during the data collection stage. In addition, indicators were selected based on their availability in the five reports of the chosen companies. Hence, fifteen indicators were selected for the three dimensions of sustainability.

1.5 Outline of the study

This study started with inspecting published research about business sustainability and assessment frameworks in Chapter 2. In addition, global initiatives and reporting frameworks were revised in this chapter. Chapter 3 describes the methodology embraced and the various approaches used to develop this research. It includes information about the assessment framework, tools used, gathering and processing of the collected data. While in Chapter 4 findings and results are discussed in details including data analysis, results discussions and validation results. Finally, a summary of major findings, recommendations and limitations are available in Chapter 5. In addition, a brief description of future work is delivered in the concluding chapter.

CHAPTER 2: LITERATURE REVIEW

The overall objective of this chapter is to create the implication of the study field then, identify the contribution of this thesis. This chapter involves examining the different methodologies used in the field of sustainability assessment and evaluation. As a result, the appropriate approach for achieving the research objectives is developed in Chapter 3.

2.1 Business Sustainability

According to Financial Times (Financial Times, n.d.), Business sustainability is often defined as "a process by which companies manage their financial, social and environmental risks, obligations and opportunities. These three impacts are sometimes referred to as the triple bottom line comprising of profits, people and planet".

In recent years, many studies focused on evaluating the business sustainability applied by organizations. Some studies focused on the type of industries as discussed in the following two articles: Labuschagne, Brent, and Erck, Ron P G (2005) proposed a new framework to evaluate the sustainability of operations in the manufacturing sector in South Africa. The article started by comparing existing frameworks such as GRI, United Nations, and others and ended with a new proposed framework that addresses all sustainability indicators on an institutional and operational level. The new framework focuses on the operations and processes rather than the products as it assumes that the product is the output and will be subjected to the operations and practices of the organization.

Jooh LeePati (2011) studied the relationships among the business performance of an oil and gas organization and its sustainability performance. This research took into account the various strategic factors such as labor productivity, size of the organization, capital, and cost. The study used the Pacific Sustainability Indices, which are data set published by Roberts Environmental Center and results indicated how significant those indices in improving sustainable business performance in the context of the Oil and Gas industry.

On the other hand, some studies focused on the size of an organization; for example, Urban and Naidoo (2012) explored and tested this delicate relationship between operations skills and Small/ Medium Enterprises sustainability. It also targets to perform experimental research in the manufacturing environment of this business size. Various methods are developed and tested for consistency and rationality that was built on previously established literature on sustainability and operations skills. Five operation skills factors were identified by factor analysis that shows a link with business sustainability.

Whereas Dyllick and Muff (2015) addressed the main challenges faced by business sustainability regardless of the size or type of an organization. The researchers directed how authentic sustainable businesses are distinguished and then categorized them into three typologies as addressed in this paper, which are “Refined Shareholder Value Management, Managing for the Triple Bottom Line and True Sustainability”. In addition, they discussed the connection between sustainable development on both organizational and global levels.

2.2 Sustainability Indicators

An indicator is a measure that can be quantitative or qualitative, helps in understanding where the evaluated object is, which way is it going and how far is it from its goal. However, a Sustainability indicator reflects the organizational performance in the context of environmental, social and economic aspects.

Sustainable development has been associated with the selection of a set of indicators that helps in evaluating organizational sustainable performance. Warhurst (2002) pointed out that selected Indicators should be demonstrating the main areas of business sustainability. Those key areas are summarized by product sustainability and sustainable business practices. Product sustainability is all about its usage and contribution to health, quality of life, and well-being over its lifecycle (Abdul Ghani et al. 2017; Kucukvar et al. 2018, 2017; Sen et al. 2019; Shaikh et al. 2018). While the extent of how a project is being managed to reach sustainable development goals is referred to as Sustainable business practice.

Dekker Et Al. (2012) mentioned two categories, in which the selection of indicators falls into, Top-down and Bottom-up approaches. The Top-down approach is adapted when the top managers define goals and accompanying indicators. The data collected is generally highly technical requiring experts' interpretation; therefore, it gives deeper analysis than the other approach. Whereas the Bottom-up approach is based on the community and stakeholders contribution in the process of indicators selection. This approach is more basic and broad than the Top-down approach. A hybrid approach can be used when the approaches are combined and used in the process of indicators selection.

Furthermore, in order to breakdown the organizational sustainability issues into several indicators the following points are listed (Belton and Stewart, 2002):

- Applicability: indicators must be evaluated and linked to the "highest level" goals by decision-makers. Their preferences and values must as well be conveyed in relation to these goals.
- Understandability: decision-makers must share the same understandings in regards to concepts and indicators while making decisions.
- Measurability: the indicators should be quantifiable and measurable; however, it is impossible in some cases, for example, ethical considerations. Thus, suitable MCDA modeling techniques must be selected to handle qualitative criteria.
- Non-redundancy: typically, each indicator should measure a different element to avoid including one indicator more than once in the analysis. In order to dodge duplication and inaccurate information, similar indicators should be combined into one indicator if possible.
- Objectivity: there should be independence among the indicators in order that the preference for one indicator does not depend on the level of another.
- Completeness and conciseness: including all relevant issues and identifying related indicators are extremely important. Nonetheless, extra/unnecessary details may make these two contradicting decision analysis requirements challenging. Hence, there is a huge need to balance between the two of them.
- Operationality: the purpose of the information provided by indicators is to measure process and sustainability, while not to exert the decision-makers by huge amounts of information and very complex level of details.

- Simplicity: indicators should be simplified to the maximum extent without losing its insight of capturing the essence of the identified sustainability issues. There are no firm and quick rules as to how the above guidelines should be achieved even though they should be followed as closely as possible. However, in many cases, it will depend on the type of decision problem.

2.3 Sustainability Reporting

Sustainability reporting is helping organizations to function efficiently and effectively by indicating the health of the industry. Nowadays, companies realize the importance of sustainability reporting as a means to improve their competitiveness through transparency and innovation. Correspondingly, sustainability reporting is moving into the mainstream of any business practice, therefore failure in reporting usually negatively affects the performance and reputation of a firm. The positive effect on social, environmental and human rights topics is obvious and stakeholders, governments and businesses are all benefiting from it. Sustainability reporting adds values to the following areas:

- Transparency about non-financial performance: which helps to gain a good reputation, establishing leadership, openness, liability and improving the connection with stakeholders such as customers, investors, and communities.
- Improved processes and internal management: Monitoring and reporting the resources consumption helps in cost reduction and improves decision-making processes.

- Comprehensive analysis of vision and strategies: highlighting the strengths and weaknesses of the organization. Sustainability can be a fundamental part of organizational strategies.
- Reduced compliance costs: Meeting regulatory requirements by gathering the necessary data efficiently and cost-effectively can be achieved through measuring the sustainability performance of the organization.
- Competitive advantage: by attracting investors and entering new markets. Companies can be in a stronger negotiating position when they are seen as leaders in innovators.

Generally, there are two aspects of business sustainability as referred in "Sustainability reporting — the time is now" (2013). Requirements of Reporting involve measurement of the critical elements, which are needed for effective sustainable procedures. However, Strategy is built upon sustainability reporting by helping in addressing the challenges and creating a competitive advantage for an organization. In other words, sustainability reporting is the first critical step in implementing the needed strategy for an organization to understand the influence of their business practices on the economy, society, and environment, and then develop the mitigation plan for the negative impacts.

Sustainability matters have become as significant as financial performance for any business; therefore, sustainability reporting must be standardized and easy to compare among local and international business practices. Hence, sustainability performance and impacts reporting must be using comparable and high-quality data.

Successful sustainability strategies implantation requires organizations to use a comprehensive sustainability reporting framework. Therefore, there are various initiatives formed to establish key indicators and frameworks for sustainability development and communication. The following section provides an overview of the most popular Initiatives and their frameworks.

2.4 Sustainability Initiatives

The following subsections discuss the most famous sustainability initiatives and their backgrounds. They were found to guide governmental and non-governmental sectors to incorporate sustainability matters in their organizational strategies and communication.

2.4.1 Global Reporting Initiative

In 1997 the GRI was created for Ecologically Responsible Economies of Boston and the Tellus Institute in the USA. To ensure a global perception of sustainability records, the United Nations Environment Program (UNEP) merged as a partner in 1999 (Global Reporting Initiative, n.d.). GRI provides information guidelines for the following objectives:

- To present a vision of the social and environmental impacts of an enterprise clearly.
- To permit shareholders and stakeholders to make decisions concerning investments based on well-known information.
- To generate reports that supplement rather than substitute other reports.
- To provide a framework to judge sustainability records.

- To provide the means to conduct benchmarking between the different establishments.

Accordingly, the performance indicators of the GRI framework are directly linked to each of the economic, environmental and social aspects of a firm. This approach is also known as the Triple Bottom Line or the three “P’s” (people, planet and profit).

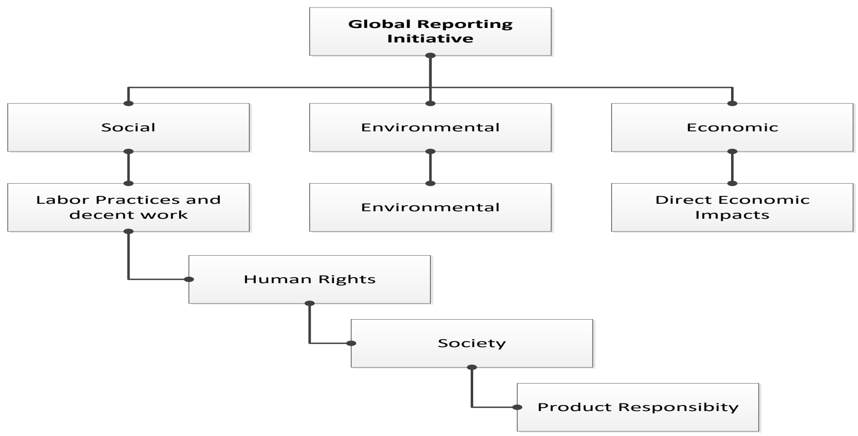

Figure 2 Categorized configuration of the global reporting initiative (GRI) framework (source: Singh et al. 2012)

The GRI framework has been acknowledged as the most-used guidelines by organizations for the purpose of sustainability reporting (Junior, and Best, 2017). Looking at published information on the GRI website (https://www.globalreporting.org), it is noticeable that the number of GRI sustainability reports issued has significantly grown in the past few years. For instance, 93% of the world’s leading 250 corporations report on their sustainability performance with GRI indicators. The figure below shows the increase of GRI use for sustainability reporting.

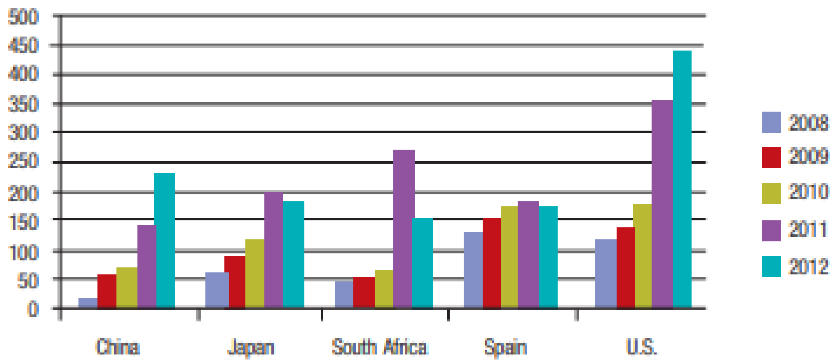

Figure 3 Increase of GRI reporting from 2008 to 2012 (source: Hughen et al., 2014)

One of the objectives of GRI reporting mentioned earlier is to help stakeholders in the decision-making process that happens when dealing with any business association or organization. Some researchers focused on this objective and touched the concept of stakeholders' effect on sustainability reporting. For instance, Fernandez-Feijoo, Romero, and Ruiz (2014) grouped stakeholders into four groups (consumers, investors, employees, and environment) and discussed the level of transparency required by each group within the GRI framework. The results showed that the higher pressure on transparency requirements from stakeholders the higher the level of transparency obtained in sustainability reporting by an organization. In addition, investors and employees are the most significant influencing groups on transparency levels.

Investors and other stakeholders are not only considering financial data of a company for their investments and business decisions nowadays. In reality, they are increasingly relying on nonfinancial figures and data, which yields the long-term value of a company. The article by Hughen et al. (2014) discusses how companies with a long-term business culture of sustainability beat other companies in terms of net revenue and stock price. financial reporting alone no longer fulfills the needs of stakeholders as much as information about detailed organizational performance which not only reflects financial aspects but also environmental and social aspects too.

Dennis (2001) reviewed 23 global companies with a formal commitment to sustainability standards in their products, processes, and services to evaluate the GRI Sustainability Reporting Guidelines. Those companies are within their target industry groups, which are energy and oil, consumer good, and healthcare. The study found that companies are significantly improving their sustainability reporting in terms of quality and level of details. In addition, companies tend to focus on environmental performance. They had some suggestions for sustainability reporting; for example using standardized data, which makes the benchmarking process easier.

2.4.2 United Nations Sustainable Stock Exchange Initiative:

This initiative aims to guide organizations to function regarding ESG standards and increase sustainability investments. The UN Conference on Trade and Development, the principles for responsible investment, UN environment program finance initiative and lastly the UN Global Compact, are involved in the organization of SSE. In 2009, New York City, USA the first meeting for SSE was carried out and annual meetings were started after that. The very first SSE partners have been joined by almost all the major global stock exchanges from countries both of developed or developing nature. Through the making of voluntary public commitment, the SSE initiative has always invited exchanges internationally to act as SSE partner exchange.

By this, they promote the ESG disclosures that have been improved as well as performances among listed companies. Thus, the SSE operates with the entire Partner Exchanges via capacity building, dialogue, and research to make the momentum a continuity as well as promoting transparent and sustainable global capital markets. Moreover, the SSE invites participation from companies, regulators, investors and other critical stakeholders found within its consultative groups. (sseinitiative, n.d.)

2.4.2.1 Environmental, Social and Governance Framework (ESG)

ESG denotes the three dominant factors for sustainability measurement and ethical impact of any investment. Those factors are described below.

2.4.2.1.1 Environmental issues

Investors are considering sustainability issues into their investments options, as a result of the significant growth of the ecological risks and hazards. It represents the effects of processes and operations of an organization on the environment.

2.4.2.1.2 Social Concerns

It denotes the company's' relationship with its workforces and retailers. It is concerned about employee health and safety and aligning vendors' relationship with business standards.

2.4.2.1.3 Corporate governance concerns

This factor represents all liabilities and accountabilities of leading positions of an organization. It concerns the management of the company including shareholders and stakeholders roles.

Figure 4 Guidance to ESG reporting (source: London Exchange Group)

2.4.3 The International Integrated Reporting Council (IIRC International Framework)

The International Integrated Reporting Council (**IIRC**) was formed in August 2010 in Wales. It is a “global association of regulators, investors, companies, standard setters, the accounting profession, and NGOs. The coalition is promoting communication about value creation as the next step in the evolution of corporate reporting” (integrated reporting, n.d.)

IIRC intents to develop an international framework to communicate organizational values to stakeholders. It involves a leading board, a working cluster, and three crews to cope with satisfying the development needs, communications, and authority.

The IIRC organizational structure was slightly changed in November 2011. A nonprofit secretariat firm was established to support the initiative. In addition, another committee was formed for duties related to proposals and executive compensation for the initiative.

The main objective of the IIRC is to provide an “internationally accepted integrated reporting framework” that enables organizations to communicate their strategies of creating value over time concisely. In December 2013 the first version of its international reporting framework was issued. It provided the fundamentals of reporting to stakeholders for the aim of supporting the decision-making process by considering the relationship between the organizational functions and the resource usage and effects. The IIRC vision is expressed in the following way

“The IIRC's long term vision is a world in which integrated thinking is embedded within the mainstream business practice in the public and private sectors, facilitated by Integrated Reporting as the corporate reporting norm. The cycle of integrated thinking and reporting, resulting in efficient and productive capital allocation, will act as a force for financial stability and sustainability”. (IAS, 2012)

Figure 5 Timeline of construction of IIRC framework (source: IAS, 2012)

2.4.4 Sustainability Accounting Standards Board (SASB)

The Sustainability Accounting Standards Board was initiated to improve and broadcast the principles of sustainable accounting in 2011 in the United States. Social and ecological issues are linked to accounting and financial reporting. The comprehensive standard of SASB is different from other initiatives such as GRI, which works with the current financial regulations of a system, it is summarized by Peter Drucker's phrase, "what gets measured gets managed". It provides specific reporting standards dedicated to specific industries for the purpose of facilitation of benchmarking and assessment. A classification system for sustainable business has been developed covering ten sectors and 80+ industries. Started from 2012, working clusters from each industry are assembled for the purpose of completing the standards within 30 months. Accordingly, fundamental indicators are updated annually. (Wikipedia, 2019)

The SASB conceptual framework provides the fundamental principles for sustainability accounting. It is illustrated in the figure below.

Figure 6 SASB conceptual framework (source: Sustainability Accounting Standards Board, n.d.)

2.5 Sustainability Assessment

Sustainability assessment is a complex appraisal methodology and a critical part of sustainable development (Onat et al. 2017a,b; Park et al. 2017; Kucukvar et al. 2016). To illustrate, it is a methodology "that can help decision-makers and policymakers decide what actions they should take and should not take in an attempt to make society more sustainable"(Onat et al. 2016; Gumus et al. 2016; Egilmez et al. 2016; Sala, Ciuffo, and Nijkamp 2015). Certainly, assessing sustainability is gradually becoming common practice in the product, policy, and institutional appraisals (Park et al. 2016; Kucukvar et al. 2014; Onat et al. 2014a,b).

Sustainability Assessment is a very complex process as it involves high uncertainty, multiple perspectives of stakeholders, various forms of data, and incompatible objectives (Zhao et al. 2016; Onat et al. 2016a,b,c; Gumus et al. 2016).

However, Multiple Criteria Decision Analysis (MCDA) methods are very reliable in eliminating the complexity associated with the sustainability assessment process (Egilmez et al. 2016a,b; Kucukvar et al. 2016; Kucukvar et al. 2015). Therefore, MCDA methods are significantly widely used for sustainability assessment decisions making processes. Wang et al. (2009) reviewed the most used MCDA methods for the purpose of sustainability assessment and classified them into three categories Elementary Methods, Unique synthesizing criteria methods and Outranking Methods. Some examples of the most commonly used methods from each MCDA category are discussed in Table 1.

Table 1. Common MCDA Methods

MCDA Category	MCDA Method	Description
Elementary Methods	weighted sum method	This is the most commonly used method for sustainable energy systems. A score of each alternative is calculated with the equation: $S_i = \sum_{j=1}^{n} w_j x_{ij} \qquad i = 1,2, \dots m$ The alternative with the highest score is the best. (Wang et al. 2009)

MCDA Category	MCDA Method	Description
Unique synthesizing criteria methods	AHP method	AHP is one type of weighted sum method. It is broadly used in complex problems of various industry types. This method allows structuring criteria and sub-criteria in a hierarchy topped by the goal and bottomed by the alternatives to be evaluated. In addition criteria and sub-criteria can be weighted according to their importance. Stefanovi et al. (2014) used AHP to rank different four scenarios of waste management practices in the city if Nis, Serbia
	Fuzzy Set Methodology	Fussy set theory was introduced by Zadeh in 1965. It provides solutions to the biased input used in MCDA methods by using binary terms. Kucukvar et al. (2014) proposed MCDA methods using the fuzzy set methodology for selecting the best pavement alternative.

MCDA Category	MCDA Method	Description
Outranking Methods	Performance Ranking Method	This method is mostly used in the energy industry. It is applicable to problems with a limited number of alternatives and criteria. Pairwise comparison is used to evaluate the alternatives with respect to a number of criteria.

In this section, the previously published work of MCDA application on sustainability assessment is reviewed. Many researchers contributed by presenting a specific framework for specific industry type or assessment goal. The main and common objective of those published frameworks is to assist decision makers in the evaluation process by choosing the most sustainable option. The following segment lists reviewed previous work with their main findings and approaches.

Saad, Nazzal, and Darras (2019) introduced a new sustainability assessment framework that can assess manufacturing processes in a logical and comprehensive way. The framework consists of seven steps that decision makers can follow to assess the sustainability performance of the system. The first step is to define the goal or objective of the assessment framework. Then key sustainability indicators must be chosen; they can be categorized as Quantitative and Qualitative indicators. Next step is quantifying and assigning weights for the selected set of indicators. Following is normalization and aggregation of the indicators' values. Finally doing the sensitivity analysis to make sure that the results are not sensitive to changes.

Azapagic and Perdan (2009) presented an integrated framework, which provides systematic guidance for multiple criteria decisions in the context of the sustainability assessment process. The proposed framework consists of three stages: problem structuring, Problem Analysis, and Problem Resolution. The three stages are iterative throughout the assessment process.

Zhang et al. (2014) developed an improved Sustainable Development Ability prototype model to be implemented throughout the construction projects lifecycle. The dynamic sustainability factors of construction projects are incorporated into the assessment. This paper used a simulation model of a case study with different scenarios to study the dynamic factors affecting the projects' sustainability level. In brief, results were indicating that technological advancement is greatly influencing the project sustainability throughout its lifecycle.

Another framework was developed by Labuschagne, Brent, and Erck, Ron P G (2005) after reviewing global frameworks commonly used for sustainability performance assessment. The suggested framework emphasized on operational performance as presented below.

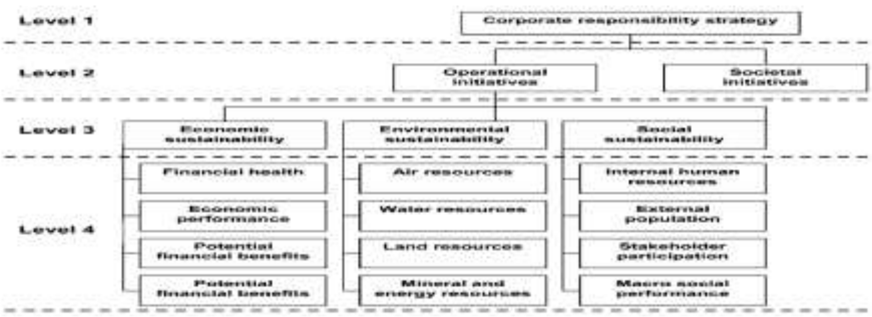

Figure 7 Proposed operational sustainability framework (source: Labuschagne et al., 2005)

To sum up, Sustainability assessment, in general, involves the evaluation of indices through three key steps, which are Normalization, Weighting, and aggregation. Singh et al. (2012) argued that the steps of Normalization and Weighting of indices are characterized by uncertainty as they are built on subjective judgments. While on the other hand, there are scientific methods that guarantee consistency of indices aggregation. Research work is continuous and endless in that field towards improving the sustainability assessment process by providing a systematic approach that leads to ideal decisions.

2.6 Summary of Gaps in the Literature Review

The literature review has shown that there are many models, methods, frameworks for sustainability assessment of different industries. Most studies used MCDA as an appraisal means to evaluate and benchmark the sustainability performance of organizations within a specific type of industry. It was noticed that AHP is the most used method for the assessment process due to simplicity and applicability. Reviewing published literature also reveals that the weighting process for criteria (indicators) had a great influence on the ranking of alternatives obtained using MCDA methods. However, equal criteria weights are still the most popular practice used in the assessment process.

This thesis will develop an assessment framework to be used in the oil and gas sector in Qatar. It will be a benchmarking tool to identify the leading oil and gas companies in the aspect of sustainability. The presented framework will be based on real data published in sustainability reports that are using GRI standards in Qatar. Oil and gas industry was selected to be the study focus due to its significant footprints in sustainability issues. Selecting the influential indicators that are capable of reflecting the sustainability performance of oil and gas organizations was one of the focus areas of this study. Indicators values must be representative of environmental, social and economic issues and suitable for benchmarking regardless of their nature, unit or organizational size. In addition, an expert-judgment sustainability analysis was done to ensure incorporating the importance of each indicator in the model. In summary, this study contributes to existing research in five ways, which are listed below.

1. Collecting real data from the most recent published sustainability reports on the database of GRI site (http://database.globalreporting.org/search/).
2. Performing an Expert Judgment based analysis to incorporate the importance of environmental, social and economic indicators in the study. In addition, using inputs from multiple experts to ensure the consistency of their outcomes.
3. Analytical work on the sustainability performance of the oil and gas industry in Qatar and identifying the dominant company.
4. Presenting a generalized framework to be used as a platform for benchmarking and sustainability assessment by the Sustainable Stock Exchange Initiative.
5. Performing Monte Carlo simulation and Sensitivity Analysis to investigate uncertainties and identify the critical parameters.

After conducting a thorough review of related topics, the approaches needed to achieve the defined objectives are discussed in the following chapter.

CHAPTER 3: METHODOLOGY

The methodology of this thesis work started with the literature review, which is discussed in details in Chapter 2. Then published sustainability reports from leading oil and gas companies in Qatar were reviewed. Needed data was collected and key stakeholders were identified to recognize the requirements of the sustainability assessment framework to be developed.

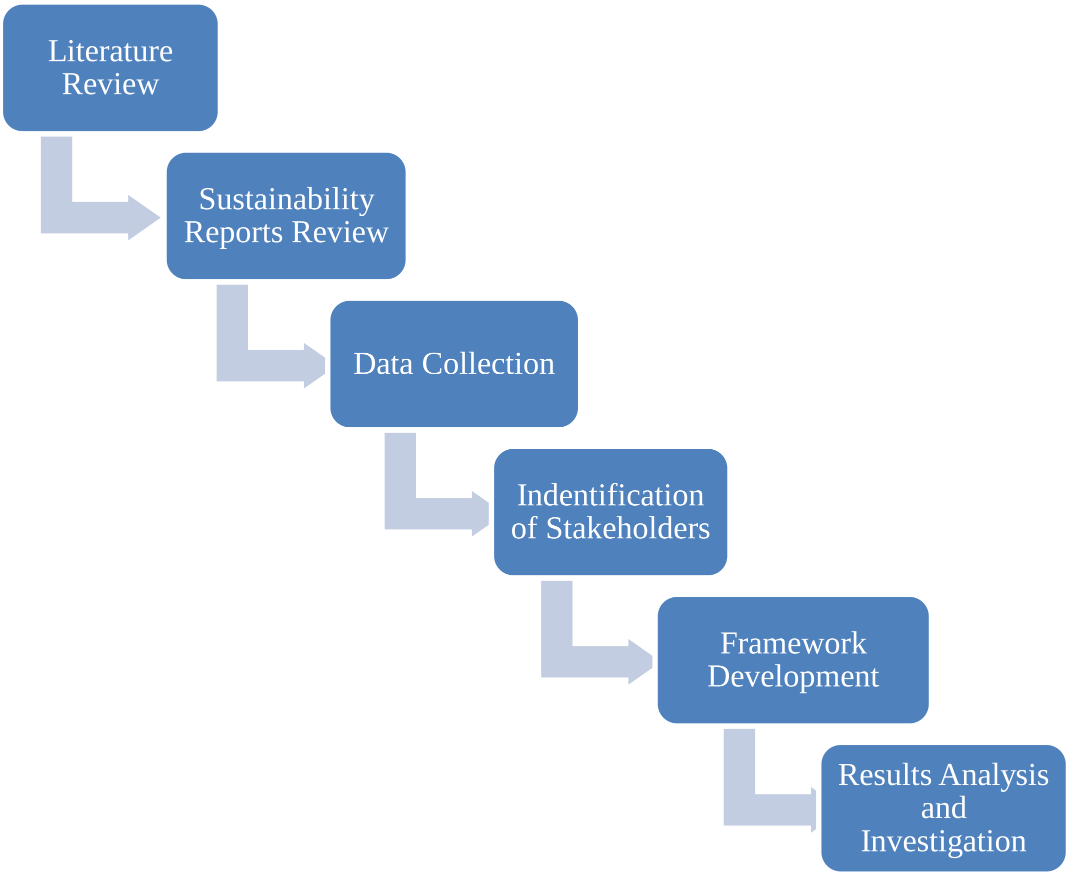

Figure 8 Research methodology- main stages

3.1 Sustainability Reports Review

Sustainability Reports of Qatari Companies available in GRI database (database.globalreporting.org) were reviewed. It was found that 29 of companies are committed to post annual sustainability reports in GRI database. However, the focus is on GRI sustainability reports for this study. The following graph shows 61% of posted reports using the GRI reporting framework compared to other sustainability reports.

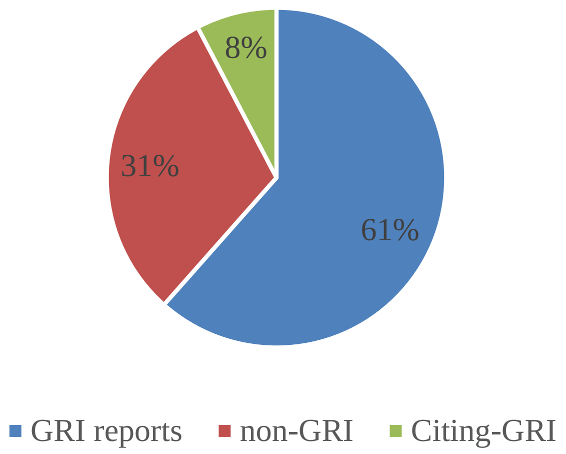

Figure 9 Sustainability reporting frameworks used by Qatari companies

Sustainability reports not using GRI standards were excluded. It was found that companies used three GRI reporting guidelines; G4, G3, and G3.1. Most of the companies used G4 guidelines for their sustainability reports starting from the year 2013. In addition, sectors involved in sustainability reporting were studied to identify the most dynamic industry type. The following chart proves that most available sustainability reports were from the energy sector.

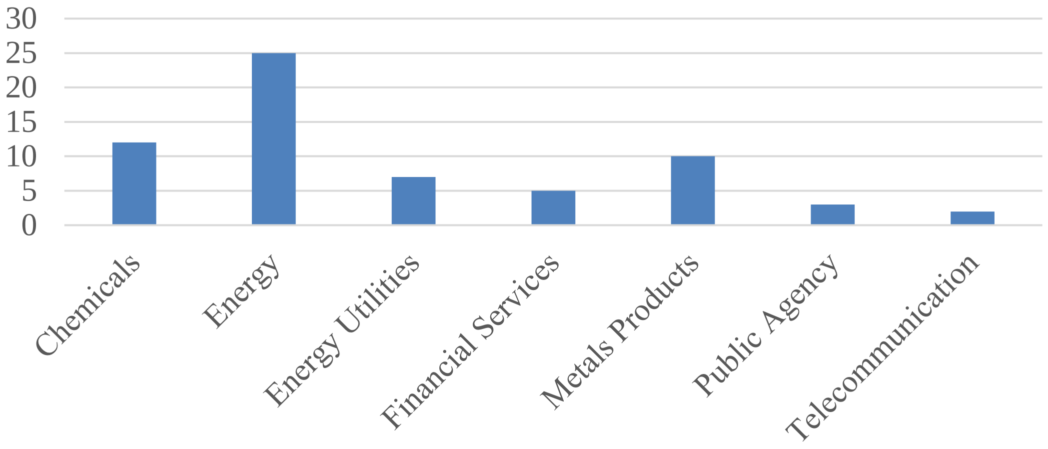

Figure 10 Published sustainability reports by industry sectors

For this reason, the Energy sector was selected to be the emphasis of this study. More specifically, the Oil and Gas industry as it characterizes the fundamental portion of the energy sector in Qatar.

3.2 Data Collection

Data collection involved the documentation of all sustainability indicators supporting the environmental, social and economic performance of the companies. Key performance indicators published by the Qatar Stock Exchange for ESG Reporting were used to identify the type of information needed from each report. In addition, any financial data provided were recorded to support the economic pillar of sustainability. Qualitative and quantitative data were collected based on ESG guidance.

During the data collection process, it was noticed that there is an insufficiency in the reviewed reports. In other words, there was a lack of information needed to represent the sustainability performance of the company. For instance, it was noticed that governance data were inadequate; hence, they were excluded from the study. Moreover, social and economic performances were poorly reported compared to environmental performance. While diversity in reporting data between different companies in terms of nature and units was observed. Finally, some companies were excluded from the study due to poor reporting. Preliminary data collection sheet is available in Appendix (A).

3.3 Identification of Stakeholders

Stakeholders are defined to incorporate their requirements and level of transparency needed from the assessment framework. Qatar Stock Exchange is responsible for evolving sustainability performance and transparency in the domestic market. They have been voluntarily committed to join the United Nations Sustainable Stock Initiative to improve local companies' reporting transparency for investors; hence, enhance the global competitiveness of the market. This all pours in fulfilling Qatar's 2030 vision.

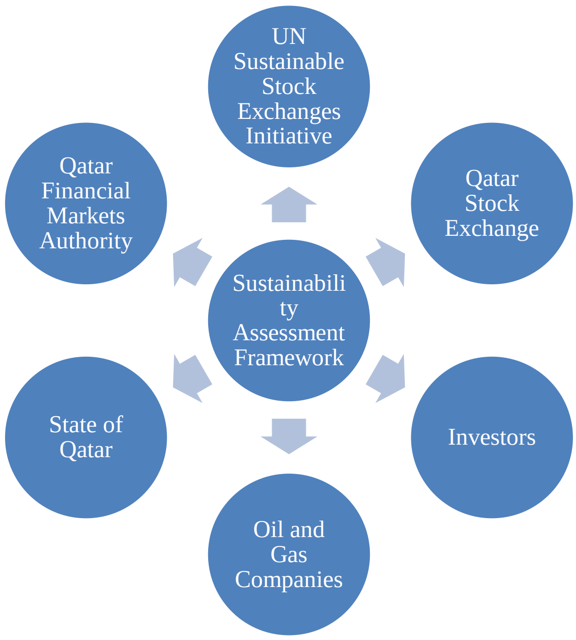

Figure 11 Main stakeholders for the proposed assessment framework

3.4 Framework Development

A decision-making framework is developed for the purpose of sustainability assessment of five major oil and gas companies in Qatar. The framework is based on Multi-Criteria Decision Analysis (MCDA) technique which is defined as “a framework for supporting complex decision-making situations with multiple and often conflicting objectives that stakeholders groups and/or decision-makers value differently” (Syke et al. 2013). The use of MCDA methods will guarantee the satisfaction of different requirements from different stakeholders and decision makers. Figure (12) shows the basic MCDA framework and the following paragraphs describe it.

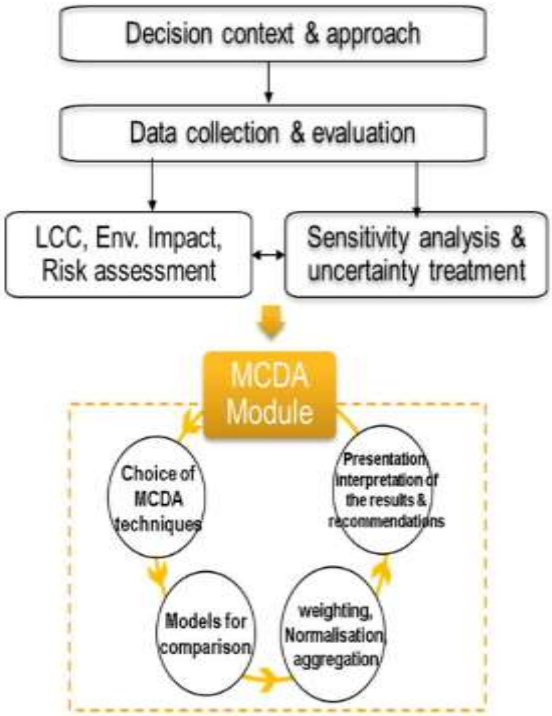

Figure 12 Generic framework for MCDA workflow (source: Zhou 2019)

The main elements of the decision problem, which are the stakeholders, their objectives, available alternatives, and ruling criteria, are part of the Decision Context.

Identifying the decision context will provide a starting point to identify the needed data and resources (Park et al. 2015; Egilmez et al. 2015). Then, data collected can be evaluated and analyzed. Using the MCDA approaches, data can be processed to rank the alternatives based on their generated score. Firstly, a suitable MCDA method must be chosen. Then the criteria weights must be allocated to account for the importance of each criterion (Kucukvar et al. 2014a,b; Tatari and Kucukvar, 2011). Finally, the scores are obtained for each alternative considering the required level of details and how key findings must be represented. Sensitivity Analysis is conducted to test the framework in terms of variability, uncertainty or both.

The developed framework consists of 10 steps and is demonstrated in the flowchart below. A detailed description of each step of the framework is presented in the next subsections.

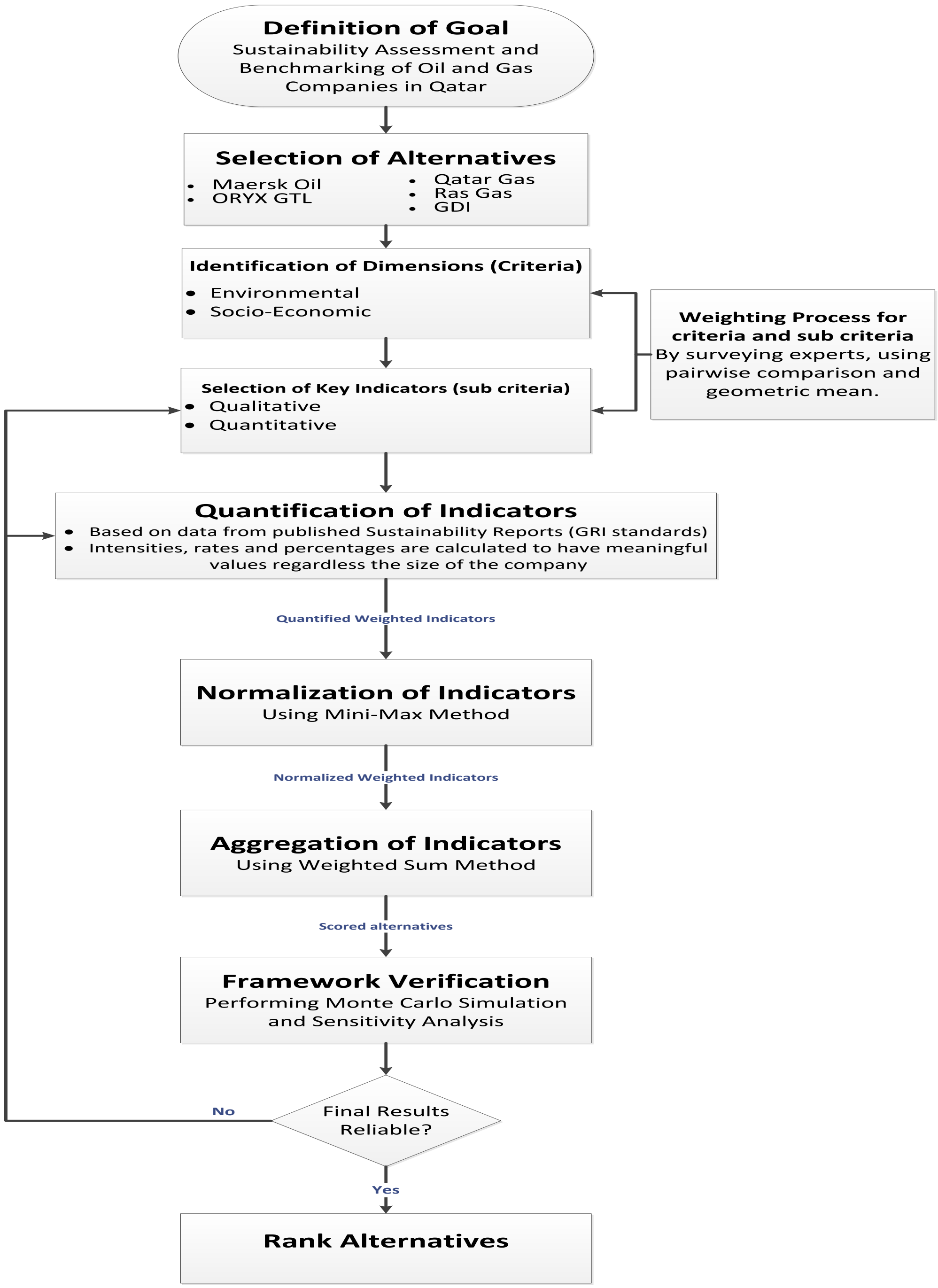

Figure 13 Proposed sustainability assessment framework

3.4.1 Goal Definition

The main objective of this study is to assess and benchmark the sustainability performance of Qatari oil and gas sector using triple-bottom-line impacts of the industry practices. As a result, the most sustainable performance in the field of oil and gas industry is identified.

3.4.2 Selection of alternatives

Based on the availability of indicators in the last published sustainability reports (using GRI standards), the following companies were selected:

1. Maersk Oil; 2014
2. ORYX GTL; 2014
3. Qatar Gas; 2015
4. Ras Gas; 2014
5. Gulf Drilling International (GDI); 2016

It was assured that the sustainability reports selected for these companies were the latest available. In addition, the companies selected must have a strong presence in the oil and gas sector in Qatar. An overview of each company is represented in the table below.

Table 2 Overview of Selected Companies

No.	Company Name	Overview
1	MAERSK OIL	Maersk Oil works in partnership with Qatar Petroleum. It has delivered in the past decade at more than $9 billion. The main product of this company is hydrocarbon production. It owned 34 offshore platforms in 2014.
2	ORYX GTL	ORYX GTL is one of the leading companies in the production of high-quality, environmentally responsible GTL (Gas-to-Liquids) products. Their main products are low-Sulphur diesel, naphtha, and LPG as of 2006. The main production facilities of ORYX GTL are located in Ras Laffan Industrial City (RLC), which is located North of Doha20.
3	قطرغاز QATARGAS	Qatargas, which had been operating for 31 years as of 2015, is a gas processing company, focusing mainly on converting gas from the world's largest unassociated gas field (North Field), into LNG. The company supplies LNG to a variety of buyers all over the world, prominent ones being the United Kingdom and Japan21. Figure 10 shows a brief timeline of the company.

No.	Company Name	Overview
4		RasGas is a domestic company accountable for all oil and gas industry undertakings in Qatar. RasGas operates on the North Field that covers more than 6,000 square kilometers that are reported to have more than 900 trillion standard cubic feet22. The primary product is LNG that is processed in Ras Laffan Industrial City. RasGas operates seven LNG production trains, of which two are mega-trains, each with a capacity of 7.8 Million tons per annum. In addition, it is one of the leading helium producers in the world.
5		Gulf Drilling International is a leading drilling contractor operating in Qatar. It started as a joint venture between Qatar Petroleum (QP) and Japan Drilling Co., Ltd. (JDC). In 2008, the QP shares were transferred to Gulf International Services, that is now a public shareholding company. It is also listed on the Qatar Stock Exchange (QSE). Its mission is to work safely, efficiently and sustainably18. It owns nine offshore jack-up drilling rigs and eight land rigs as of 2017. The major clients it serves are Qatar Petroleum, Shell Qatar, RasGas, Dolphin Energy, and Qatar Gas.

3.4.3 Perception of Sustainability Dimensions

Using sustainability reports, the three pillars of sustainability were considered as the topmost criteria of the MCDA framework (Tatari and Kucukvar, 2012). It was noticed that companies were more transparent in environmental issues while they were more minimalist with social and economic data. For that reason, social and economic dimensions were combined into one criterion. Following is a general description of each criterion.

3.4.3.1 Environment

Environmental performance is conserved about the following issues. Resource and energy minimization, renewable resources and energy, waste minimization, recycling, elimination of toxic and hazardous substances (Atilgan et al. 2017; Onat et al. 2017; Toufani et al. 2018). The aim of sustainable environmental development is to ensure having a business that has clean, green and eco-friendly operations and production (Noori et al. 2015; Kucukvar et al. 2014; Zhao et al. 2016).

3.4.3.2 Socio-Economy

Economic and social tactics are also essential for a sustainable system (Onat et al. 2015; Noori et al. 2015; Kucukvar and Samadi, 2015). The economic dimension is concerned about organizational financial issues such as mortgages, investments, income, utilities, and annuities. While corporate practices that support workforce diversity and equity while interacting positively with the community is under the social sustainability dimension (Onat et al. 2016); Kucukvar et al. 2017)

3.4.4 Selection of Indicators

Data Collection was an essential step to be done before selecting the appropriate sustainability indicators for this study. In fact, data availability in published sustainability reports was the main selection factor for the indicators. Moreover, selected indicators must be representing the triple bottom line of sustainability issues.

It was noticed that there was inconsistency in the reported indicators by different companies. For example, in the environmental issues, some companies stated the primary energy source while some of them did not. On the other hand, social issues were mostly subjectively reported rather than using clear measured figures. For instance, employee benefits, safety and health programs, and community work were all reported in qualitative form. Finally, economic indicators were limitedly available in the sustainability reports. The final list of selected indicators is listed in the table below. Data collected for each indicator mentioned above are listed in appendix (A)

Table 3 Selected Indicators and Associated Units

Sustainability Dimension	Sustainability indicators	Measuring units
Environmental Dimension	Energy Consumption	Million GJ
	Carbon/ GHG Emissions	Million Tons Co_2 equivalent
	Water Consumption	Million m^3
	Waste generated	Tons
	Waste Recycled	Tons
	Full Time Employees	Amount

Sustainability Dimension	Sustainability indicators	Measuring units
Socio-Economic Dimension	Employee Diversity	Number of Nationalities
	Total Work Hours	Million Hours
	Employee Training Hours	Thousand Hours
	No. of Injuries	Injury count
	Women in the Workforce	Amount
	Qatari Employee	Count Amount
	Local Procurement	Company count
	Total Revenue	Million $

3.4.5 Quantification of Indicators

Data collected for the selected indicators mentioned above are for different business sizes. However, all selected companies are operating a large business as they have 250+ employees. Staff headcount is one of the most common ways to define the size of the company as mentioned by (Nordlöf 2014). The following chart shows the variation in company size considering the number of employees.

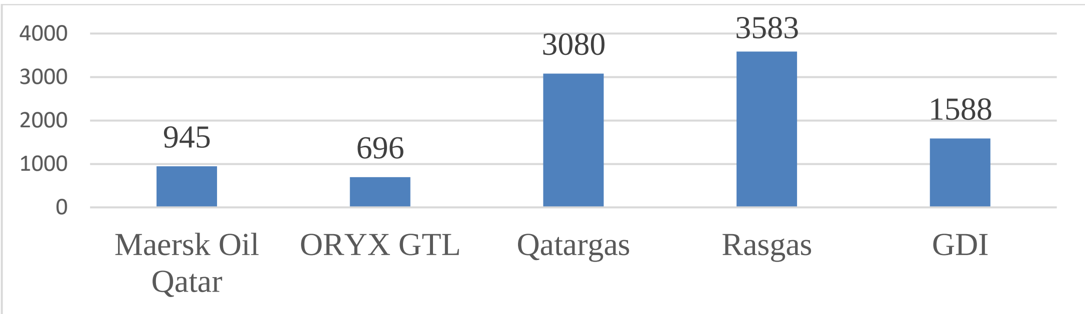

Figure 14 Employee headcount for selected companies

Considering the above fact, data collected must be matched in a way to reflect the company's performance compared to other companies regardless of the size or the nature of companies. However, data collected are absolute values that cannot be utilized for benchmarking purposes. For instance, annual energy consumption is greater when the company is larger. To overcome this problem, relative indicators such as intensities, percentages, ratios or rates must be used. Usually, intensities are activity measures with regards to monetary units. For example, the absolute indicator of energy consumption was stated as energy intensity by dividing it by annual revenue. To illustrate, GDI's annual energy consumption is 111,304,733.6 GJ and Energy intensity = annual energy consumption (GJ)/annual Revenue ($) = 111,304,733.6 GJ/ 506,770,452= 4.553×10-3 GJ/$ which can be expressed as 4.553 GJ/1000$. In addition, ratios like TRIR (Total Recordable Incident Rate) and TIRF (Lost Time Incident Rate) are representing the number of OSHA recordable incidents and lost time injuries respectively to the number of worked hours. Percentages are used as well for indicators like Qatarization percentage and percentage of women in the workplace. In addition, units used for all indicators were unified among all companies included for the study. The table below clarifies the collected absolute values and the obtained relative indicators with units.

Table 4 Absolute Indicators, Relative Indicators, and Associated Units

Absolute Indicators	Relative Indicators	Units
Energy Consumption	Energy Intensity	GJ/1000 $
Carbon/ GHG Emissions	GHG Emission Intensity	m3/ Million $
Water Consumption	Water Intensity	m3/ Million $
Waste generated	Waste Intensity	Tons/ Million $
Waste Recycled	Percentage of Waste Recycled	%
Full-Time Employees	Employee Intensity	Million $/ Employee
Employee Diversity	Diversity Intensity	Nationalities/Billion $
Total Work Hours	Total Work Hours Intensity	hrs./ Million $
Employee Training Hours	Employee Traning Hrs. Intensity	hrs./ Million $
No. of OSHA recordable incidents	TRIR	-
No. of lost time injuries	LTIR	-
Women in the Workforce	Percentage of Women in the Workforce	%
Qatari Employee	Percentage of Qatari employees	%
	Rate of Qatarization	%
Local Procurement	Percentage of Local Procurement	%

Definitions for all indicators, all calculations are done to obtain the absolute values of selected indicators and resulted quantified indicators are available in appendix B, and C respectively.

3.4.6 Weighting Process

AHP pairwise comparison method was used to define the importance of criteria and sub-criteria. Originating accurate rating weights based on experienced judgments is one of the key advantages of the AHP method. In addition, the knowledge and experience of the decision maker can be utilized using this method. It starts by constructing a matrix of size (n × n) for each level of the hierarchy, except for the “Goal’ level. Next is the pairwise comparison step which covers giving a judgmental score of the relative importance between two elements. The relative scales for pairwise comparison were developed by Saaty TL (1980) and they are always used for this method. The table below represents the scalar and reciprocal values used for scoring.

Table 5 Scalar and Reciprocal Values Used for Scoring (Saaty TL, 1980)

Scalar Value	Reciprocal Scalar Value	Definition
1	1	Equally important
3	1/3	Moderately more important
5	1/5	Strongly more important
7	1/7	Very strongly more important
9	1/9	Extremely more important

In our analysis, the pairwise comparison method is used to determine the relative weights of the criteria and sub-criteria levels. Three expert inputs were incorporated to obtain the importance weights of the criteria and sub-criteria; in other words, each one filled the pairwise comparison tables in a separate sheet (an example of environmental indicators matrix is shown below). The complete developed and filled tables are shown in appendix (D).

Table 6 Importance Scoring Using Pairwise Comparison

Pairwise criteria comparison	EI	GHGE	WUI	WI	WR
Energy Intensity (EI)	1	5	6	6	8
GHG Emission Intensity (GHGE)	1/5	1	7	9	8
Water usage Intensity (WUI)	1/6	1/7	1	4	7
Waste Intensity (WI)	1/6	1/9	1/4	1	5
Waste Recycled (WR)	1/8	1/8	1/7	1/5	1
column sum	1.66	6.38	14.39	20.2	29

The experts were asked to fill the blue cells only using the scales provided in Table (5). In case the importance is relatively higher for the Row elements, the Scalar Values are used. On the other hand, if the importance is relatively higher for the column element, the Reciprocal Scalar Values are used. The rest of the matrix scores (white cells) is calculated as in inverse to the relative blue cell's value. The sum of the values obtained in each column is calculated as well.

Next step is to calculate the vector of priorities by first obtaining the average normalized values. This is done by dividing the score (a_{ij}) of the i_{th} Row and j_{th}

Column by the sum of column values ($\sum_i^n a_{ij}$), where n is the number of criteria in the matrix. Then all the values of each Raw is summed up in a column (Raw Sum) as shown in the table below. Then the vector of priorities or in other words the criteria weights are calculated by devising each value by the number of criteria (n) using the equation $w_i = \frac{1}{n}\sum_i^n \frac{a_{ij}}{\sum_i^n a_{ij}}$. The total of all criteria weights of the matrix $\sum_i^n w_i$ must be equal to 1. All calculations carried out to obtain criteria weights are presented in appendix (D)

Table 7 Calculating Sub-Criteria Weights

Pairwise comparison	EI	GHGE	WUI	WI	WR	Row Sum	Sub-criteria Weight
EI	0.60	0.78	0.42	0.30	0.28	2.38	0.48
GHGE	0.12	0.16	0.49	0.45	0.28	1.49	0.30
WUI	0.10	0.02	0.07	0.20	0.24	0.63	0.13
WI	0.10	0.02	0.02	0.05	0.17	0.36	0.07
WR	0.08	0.02	0.01	0.01	0.03	0.15	0.03
						Total Weights	1

After calculating the weights, consistency verification is performed to ensure that they are reliable for the framework. This is a very critical step as the weights are obtained using subjective judgmental scores. The consistency ratio (CR) is calculated using the formula

$$CR = CI/RI$$

Where the Consistency Index $CI = \frac{\lambda_{max} - n}{n-1}$, and the Random Index RI is obtained from the following table.

Table 8 Random Index According To Matrix Size (Saaty & Forman, 1993)

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

* The matrix will be consistent and adequate if CR is less than or equal to 0.1

Calculating λ_{max} involves the following steps:

1- Multiplying the judgment scores Raw with the obtained weights vector. For instance, the calculation of the first raw of the matrix is (1x0.48+5x0.30+6x0.13+6x0.07+8x0.03=3.39). A new vector is obtained.

2- Dividing all the values of the new vector by the respective criteria weight, hence (3.39/0.48=7.12).

3- Finally λ_{max} is obtained calculating by the average of the values calculated from the previous step (NV/W).

The next table represents the calculations carried out for calculating the consistency ratio following the steps described above.

Table 9 Consistency Ratio Calculations

	EI	GHGE	WUI	WI	WR	Sub-criteria Weight	New Vector	NV/W
Energy Intensity (EI)	1	5	6	6	8	0.48	3.39	7.12
GHG Emission Intensity (GHGE)	1/5	1	7	9	8	0.30	2.16	7.27
Water usage Intensity (WUI)	1/6	1/7	1	4	7	0.13	0.74	5.88
Waste Intensity (WI)	1/6	1/9	1/4	1	5	0.07	0.36	5.10
Waste Recycled (WR)	1/8	1/8	1/7	1/5	1	0.03	0.16	5.32
λ_{max}								6.14
CI								0.28
RI								1.12
CR								0.25

After calculating λ_{max} and CI accordingly, the appropriate random index is selected from the table according to the matrix size. For our case the matrix size is 5×5, hence RI= 1.12. From there, the CI is calculated to be equal to (0.28) which is not acceptable as it is more than 0.1. The detailed calculations of consistency indexes are available in the appendix (E).

To overcome this problem, and to increase the consistency of the judgmental scores, 3 experts were asked to give scores to the selected indicators. After having three score values from experts, the scores are combined using the Geometric Mean equation and used for the calculations described above.

Geometric Mean= $\sqrt[n]{(a_1 a_2 \ldots \ldots a_n)}$

The consistency ratio was calculated to each individual scoring sheet and to the combined ratings. It was noticed that the consistency is increased to the acceptable range i.e. 10% when combining the individual scores. Thus, obtained weights are reliable for the study. The table below clarifies the resulted ratios.

Table 10 Consistency Ratios Calculated for Each Expert Input and Combined Inputs

	input (1)	input (2)	input (3)	combined inputs
Consistency Ratio of Environmental Indicators	0.140	0.254	0.145	0.081
Consistency Ratio of Socio-Economic Indicators	0.182	0.215	0.154	0.094

3.4.7 Normalization of Quantified weighted indicators

Data Normalization is a crucial part of any decision making process. As mentioned earlier, MCDA methods are used to score and order alternative according to a certain group of criteria. Generally, each criterion may have different type and nature, hence a different unit. Therefore, normalization is needed to create dimensionless rates, which allows aggregation into final scores and obtaining the associated rank of alternatives.

There are several normalization definitions according to the study fields. For instance, there are two different definitions for two different areas, “in Databases, data normalization is viewed as a process where data attributes, within a data model, are organized in tables to increase the cohesion and efficiency of managing data. While, In statistics and its applications, the most common definition is the process of adjusting values measured on different scales to a common scale, often prior to aggregating or averaging them” (Wikipedia).

(Trusal 1985) studied five normalization techniques to find which method best appropriate with the AHP method. The results of his study showed that logarithmic normalization technique is inapplicable with AHP method while the other four methods can be used with no issues.

The Max-Min technique is selected for this study, as it is relatively simple and easy to be applied. Waste recycled, employee intensity, diversity intensity, employee-training hours, Percentage of women in the workplace, Qatarization percentage, and local procurement percentage are all benefit criteria. Hence, the following normalization equation is used:

$$x_{ij} = \frac{r_{ij} - r_{min}}{r_{max} - r_{min}}$$

where r_{ij} represents the collected data for the ith alternative company and jth indicator (sub criteria), while $r_{max}\ and\ r_{min}$ are the min and maximum values of data collected for each indicator group.

On the other hand, the cost criteria are normalized using the below equation.

$$x_{ij} = \frac{r_{max} - r_{ij}}{r_{max} - r_{min}}$$

Which is used for the following indicators as we aim to minimalize them: Energy Intensity, GHG Emission Intensity, Water Intensity, Waste Intensity, TRIR, and LTIR.

3.4.8 Aggregation

Weighted sum method is used to calculate the score of each alternative. It is one of the most MCDA methods used for the assessment of sustainability, especially in the energy sector. The following equation is used for this method.

$$S_i = \sum_{j=1}^{n} w_j x_{ij} \qquad i = 1,2,3 \dots . m$$

Where i refers to the alternative number, j is the criteria number, w_j is the criteria weight, x_{ij} is the normalized value of alternative i over criteria j and S_i is the score obtained for alternative i.

The following graph shows the hierarchy of the assessment elements. The top level represents the goal, which is benchmarking the sustainability performance of the alternatives. Then, the main criteria level, which consists of Environment and Socio-Economy. Following is the sub-criteria level, which consists of 15 components. The final level represents the alternatives to be scored based on sustainability performance. The greater the obtained score, the better the sustainability performance. Hence, alternatives will be ranked based on their scores and the best performance will be distinguished. Weights obtained from AHP method are written in red under each criterion and sub-criterion.

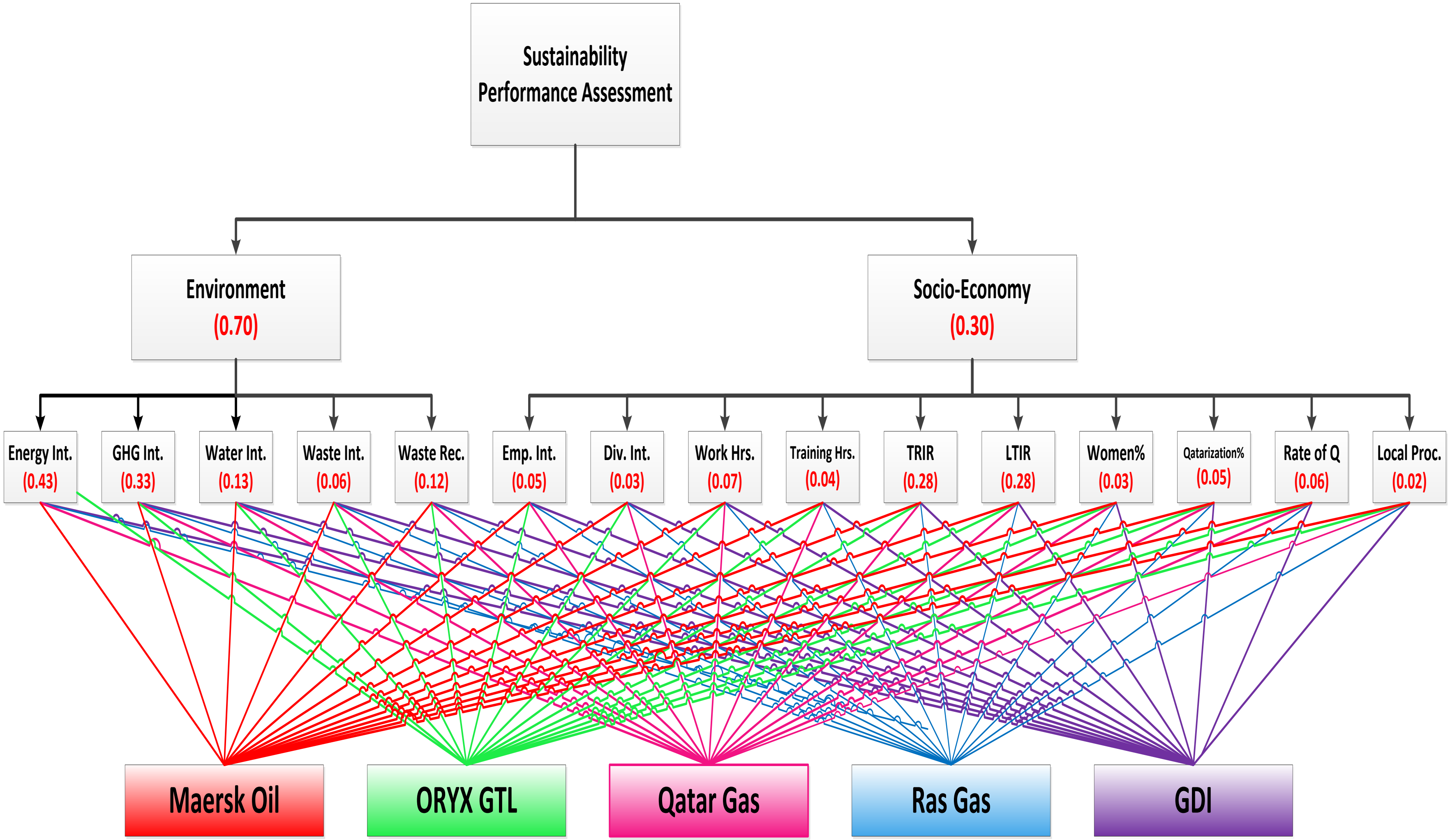

Figure 15 Aggregation hierarchy for scoring alternatives

3.4.9 Monte Carlo Simulation and Sensitivity Analysis

The uncertainty of collected data and weights obtained from the AHP method must be measured for efficient alternatives comparison and accurate evaluation of sustainability performance. As a result, the effectiveness of the established assessment framework will be ensured.

Monte Carlo Simulation is used for measuring the uncertainty associated with the model. This method is defined as "a technique used to understand the impact of risk and uncertainty in financial, project management, cost, and other forecasting models. A Monte Carlo simulator helps one visualize most or all of the potential outcomes to have a better idea regarding the risk of a decision." (towardsdatascience, n.d.)

In order to perform a Monte Carlo simulation, the Crystal Ball Analytical tool is used. A forecasting and risk analysis program measures uncertainty and defines it out from a decision-making problem. Crystal Ball is a program that performs forecasting and risk analysis and represents graphical results helping in taking the uncertainty out of decision-making. Over a technique known as Monte Carlo simulation, Crystal Ball forecasts the full range of potential results for a given scenario. It also demonstrates confidence levels, so that the likelihood of any specific event happening is known. It performs simulations and forecasts the possible outcomes, which contributes to better decisions by considering all possible scenarios.

The forecasts occasioned from these simulations help measure areas of risk so decision-makers can have as much information as possible supporting wise decisions. In addition, it identifies which variables mostly affect the outcomes.

Crystal Ball uses the term "Assumptions" for uncertain values. It defines all the possible values within a probability distribution. Then calculates possible scenarios by processing values from the defined probability distribution. This is done in three steps as described in the following flowchart.

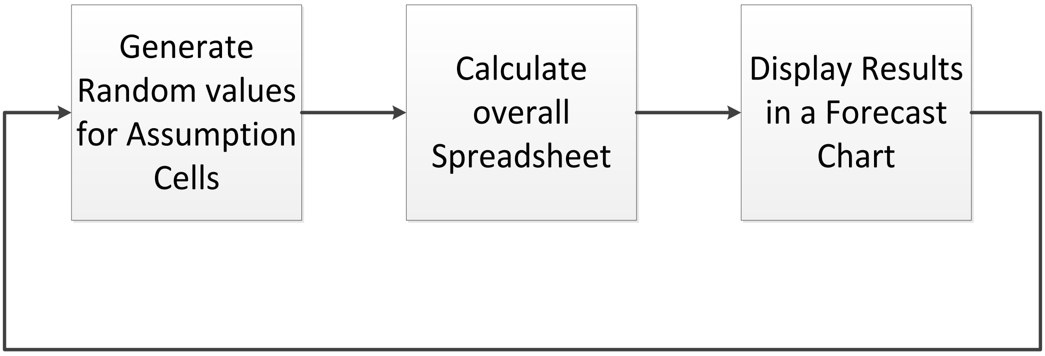

Figure 16 Steps of Monte Carlo simulation in Crystal Ball software

In this research, three levels of uncertainties will be considered. Which are illustrated in the aggregation hierarchy below.

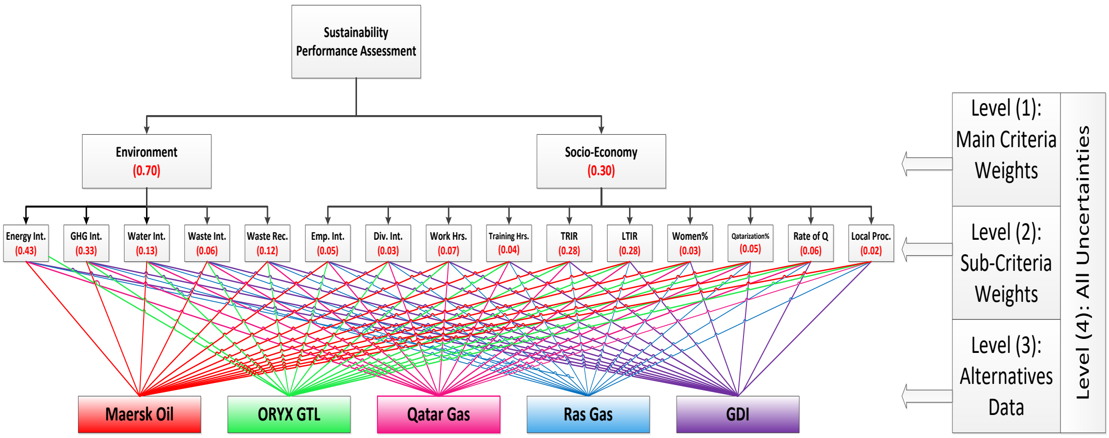

Figure 17 Uncertainty levels

The first level of uncertainty is the main criteria weights. Those weights are obtained from experts judgments using the AHP method, which implies a high level of uncertainty. Similarly, the second level of uncertainty represents the weights obtained for sub-criteria. While the data collected for each company represents the third level of uncertainty. Finally, all uncertainties are examined altogether to measure them and determine the most influencing factors on the outputs. Thus for each alternative four Monte Carlo simulation runs are performed. This study uses 10,000 trials for each simulation run and stores forecasted results by assuming the following hypothesis (Tatari et al. 2012; Onat et al. 2014).

1- All assumptions are normally distributed
2- Standard Deviation is 10% from the mean.
3- The confidence level is 95%.

To sum up, this chapter discussed the methods and approaches used to conduct this research. The study approach started by GRI reports review and data collection, identify the indicators, and develop the assessment framework based on expert judgment to establish the importance weights. The following chapter represents the findings and results of this research.

CHAPTER 4: RESULTS AND DISCUSSIONS

In order to meet the acknowledged goal of this research study, the following points are addressed in this section.

1- Assess and evaluate the sustainability performance of the selected companies from the Oil and Gas industry in the State of Qatar.

2- Benchmark the sustainability performance among the selected companies and identify the leading company.

3- Examine the uncertainty in the collected data and acquired criteria weights to assure the efficiency of the assessment framework.

4- Distinguish the most critical indicators that are influencing the sustainability performance of each company.

The findings of these investigations are discussed in this section.

4.1 Data Analysis

As mentioned earlier, data were collected from published GRI sustainability reports for the selected companies. Then, they were quantified in Intensities, percentages, and rates forms to make sure that they are consistent regardless of the size of the company. After that, they were normalized to dimensionless quantities using Max-Min Method. The obtained values range from 0 to 1, where 0 is the minimum quantity for the benefit sub-criteria and the maximum quantity for the cost sub-criteria. While 1 is the maximum quantity for the benefit sub-criteria and the minimum quantity for the cost sub-criteria. Having this step ensures the reliability and robustness of the results. The table in Appendix (F) represents the normalized values of the selected indicators for the chosen five companies.

4.2 Obtained weights

As previously discussed, the weights are obtained using the AHP method. The response was collected from three experts to reach the consistency ratio required for a proper analysis. Geographic Mean method was used to obtain a single value for the weights. The following chart represents the weights obtained for the main criteria. The environmental criterion has greater significance in the sustainability performance as voted by the experts.

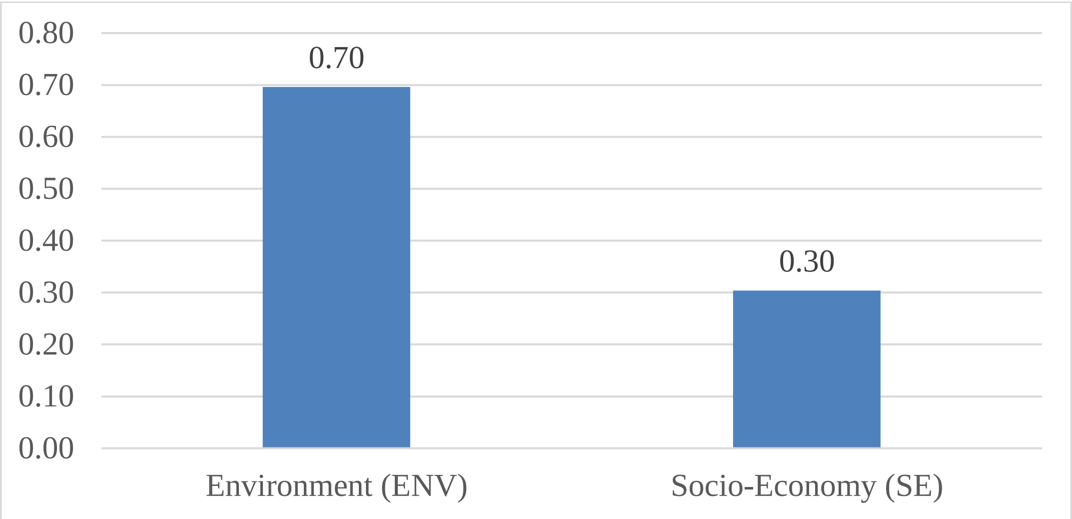

Figure 18 Weights for the main criteria

Weights were obtained for the sub-criteria under each main criteria. It should be mentioned that the weights of each group must to be equal to one. The following chart illustrates the weights of environmental sub criteria group. It can be noticed that Energy intensity had the highest importance while Waste recycled has the lowest.

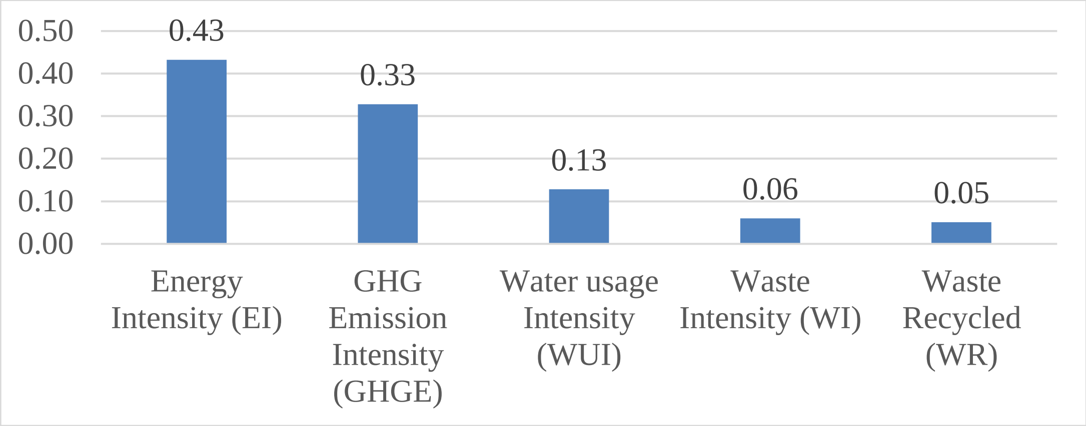

Figure 19 Environmental sub criteria weights

In addition, the Socio-Economic sub criteria weights are represented in the following diagram. TRIR and LTIR indicators are the most critical ones, hence the greatest weights. While local procurement has the lowest weight among the Socio-Economic indicators.

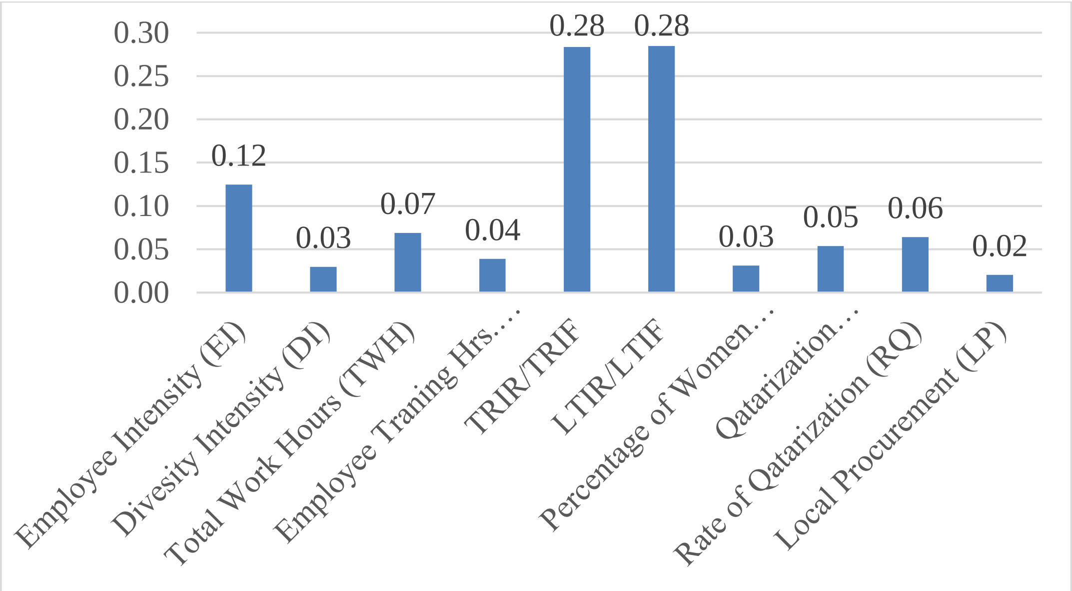

Figure 20 Socio-economic sub criteria weights

4.3 Evaluation of sustainability performance

In this section, the weighted sum method is used to assess and benchmark the sustainability performance of the selected companies from the Oil and Gas sector in Qatar. In this method, the collected data and expert's judgmental weights will be aggregated to score each company and assess how sustainable is their strategies and practices used in the business. The scores are calculated by multiplying the weights of the criteria and subcritical with the associated normalized values of the indicators as per the following equation:

$$S_i = \sum_{j=1}^{n} w_j x_{ij} \qquad i = 1,2,3 \dots . m$$

For example, to calculate the score for Maersk Oil Company, the calculations are carried out as the following.

$$\begin{aligned} S_M = 0.7 \times (1 \times 0.43 + 1 \times 0.33 + 0.91 \times 0.13 + 1 \times 0.06 + 0.81 \times 0.05) + 0.3 \\ \times (1 \times 0.12 + 1 \times 0.03 + 0.87 \times 0.07 + 1 \times 0.04 + 0 \times 0.28 + 0.69 \\ \times 0.28 + 1 \times 0.03 + 0.64 \times 0.05 + 0.41 \times 0.06 + 0.47 \times 0.02) \\ = 0.83 \end{aligned}$$

Aggregated scores of the five companies are shown in the diagram below. It identifies Maersk Oil as the leading company in terms of sustainability performance while GDI has the least score among the alternatives.

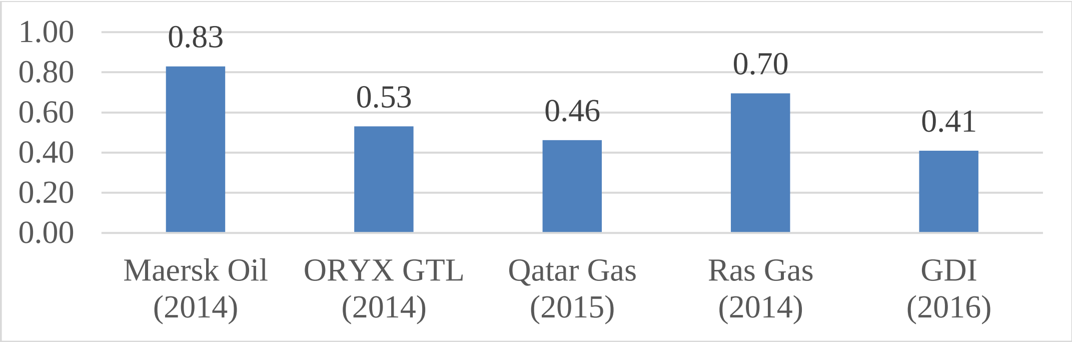

Figure 21 Composite scores for the five companies

4.4 Monte Carlo Simulation Results

Using Crystal Ball software, Monte Carlo simulation was performed to examine the uncertainty in the evaluation Model. In this subsection, the results of the simulation runs are discussed for each company. As described previously, the uncertainty is considered separately in each level of the Decision Hierarchy. In other words, the simulation is performed in four different scenarios as listed below:

Scenario (1) main criteria weights

Scenario (2) sub criteria weights

Scenario (3) collected data for each alternative

Scenario (4) all of them together

4.4.1 Maersk Oil

The following diagrams display the forecasted values of the overall score for Maersk Oil obtained from simulation runs. It can be noticed that the forecasted scores range is maximum when all uncertainties are considered. The range is almost equivalent in both of the following scenarios: uncertainty in main criteria weights and indicator’s data. In addition, the minimum range of forecasted outcomes was when uncertainty is only deliberated for sub-criteria weights.

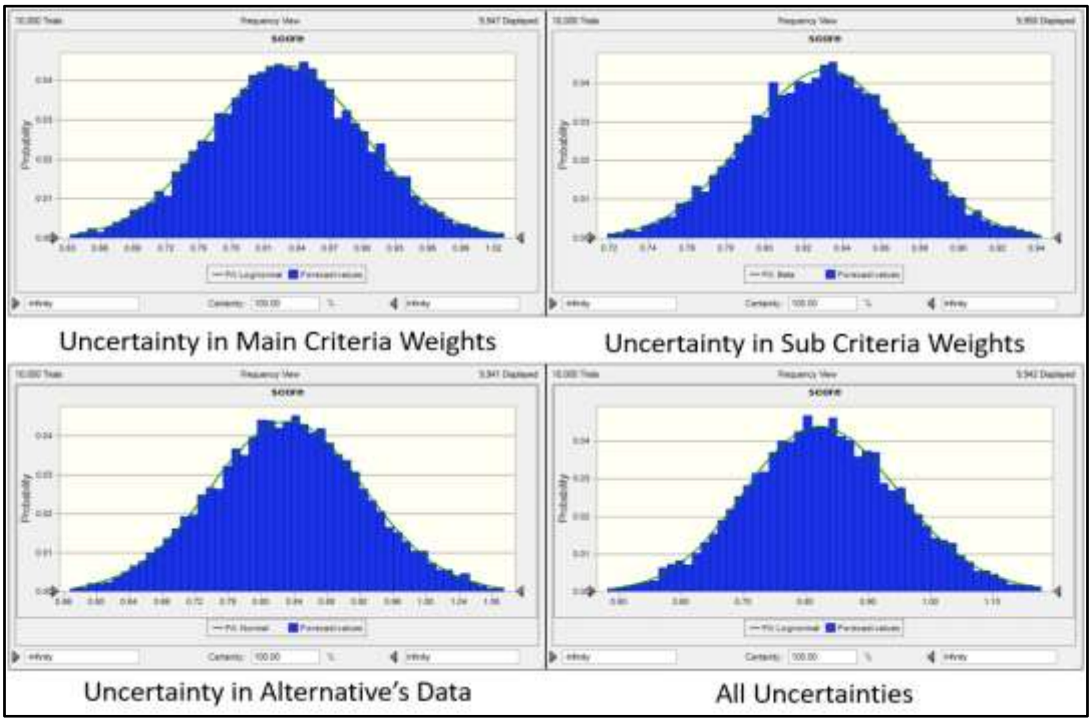

Figure 22 Forecast values – Maersk Oil

In addition, a sensitivity analysis was performed for all different scenarios to determine the critical parameters of the assessment model. In the case of Maersk oil, environmental criteria were significantly more critical than socio-economic criteria when the first scenario was performed. While for the second scenario, energy intensity and GHG emission intensity weights are the most sensitive weights among the sub-criteria weights. On the other hand, considering the data collected for the selected indicators, TRIR indicator data has the highest sensitivity score. Finally, considering all the uncertainties, TRIR indicator data and Environmental main criteria weight have the highest sensitivity scores. The figure below lists all sensitivity scores for elements scored greater than 1%.

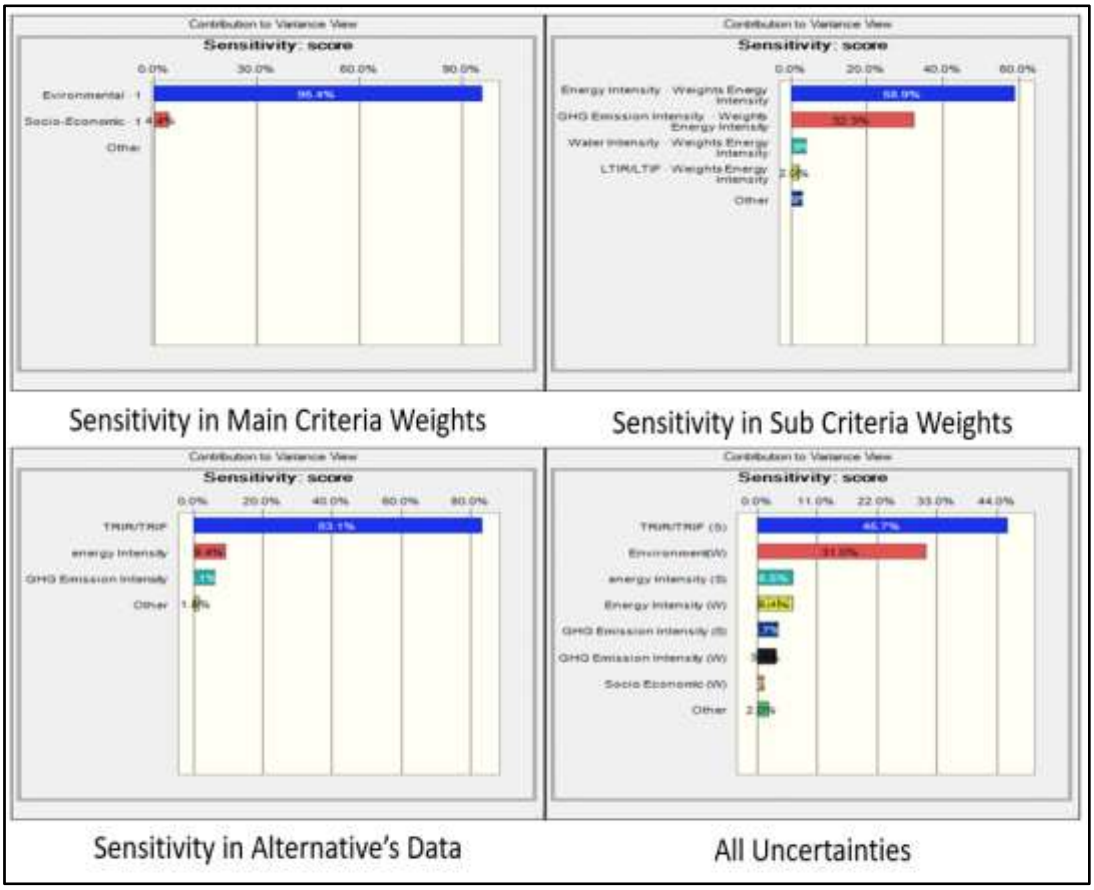

Figure 23 Sensitivity of uncertainties – Maersk Oil

Scatter plots were implemented in each scenario for all assumptions. The following figure combines the most sensitive elements plotted against the forecasted scores for the fourth scenario. It can be noticed that the higher the sensitivity, the greater the correlation between assumptions and score.

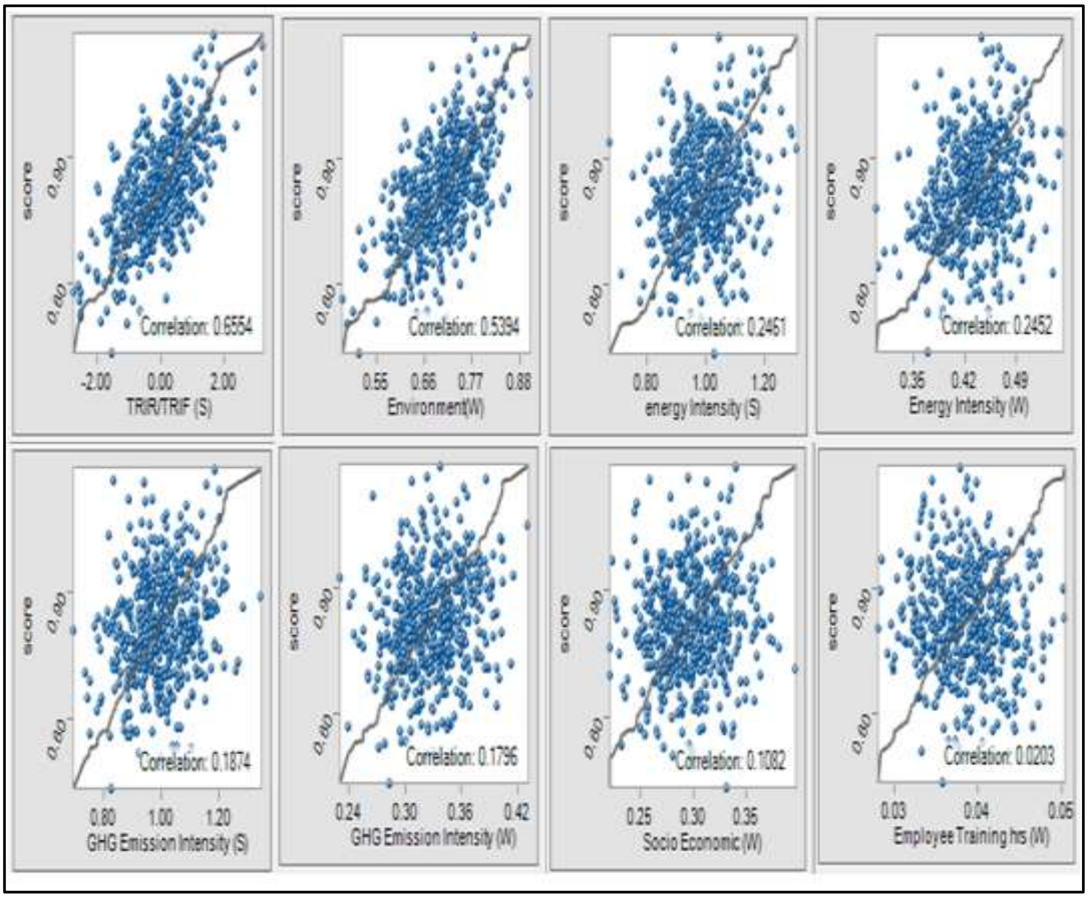

Figure 24 Scatter diagrams of sensitive elements (forth scenario)

4.4.2 ORYX GTL

Examining the different four scenarios for ORYX GTL, the following diagrams were acquired. It was found that uncertainty in collected data and all uncertainties scenario have a wider range of outcomes than main and sub-criteria weights.

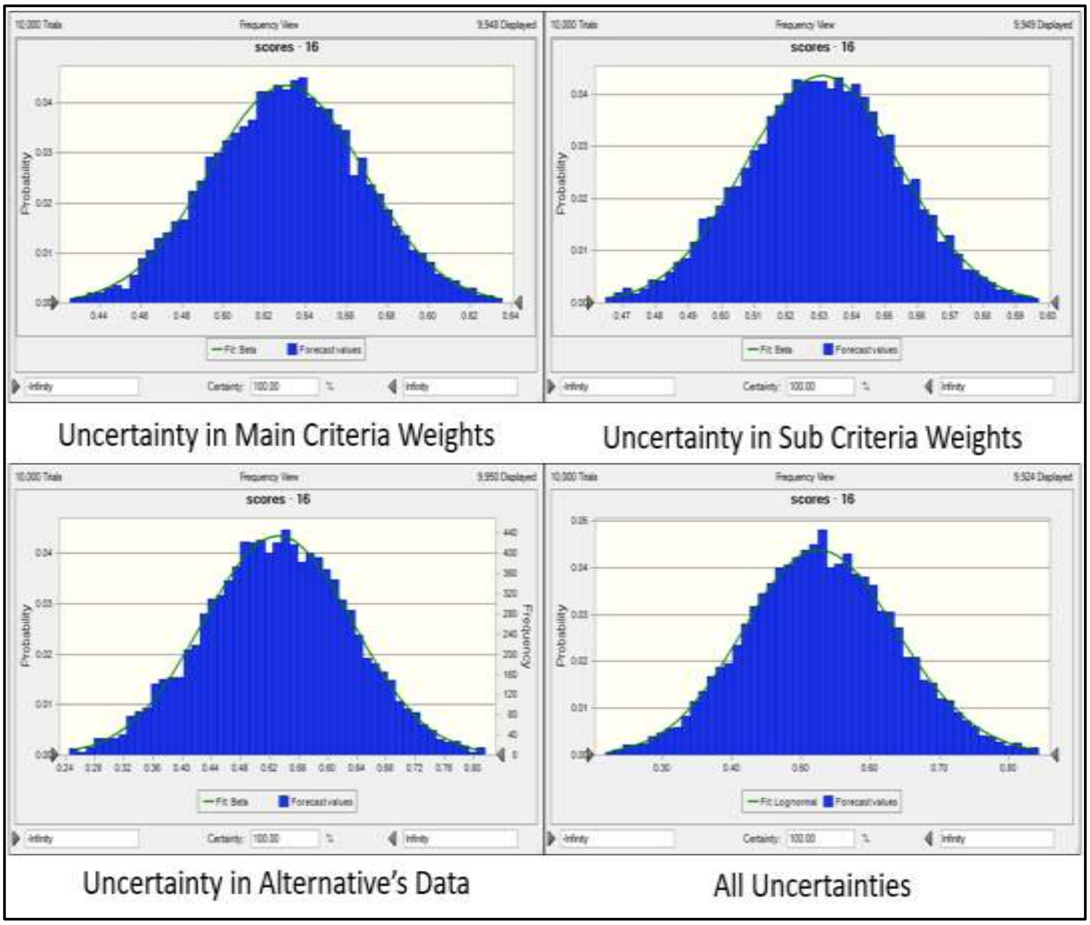

Figure 25 Forecast values – ORYX GTL

Conducting the sensitivity analysis for the assumptions of the four scenarios, the following figure combines the main findings. For the first scenario, it can be noticed that environmental criterion are slightly greater than the socio-economic criterion. While in the second scenario, energy intensity, GHG emission, TRIR, and LTIF have the greatest sensitivity scores than other sub-criteria weights. Moreover, water intensity and waste intensity data have the greatest contribution to the final score variance when the uncertainty of data collected is considered. Again, Water intensity has significantly higher sensitivity score when all uncertainties are considered.

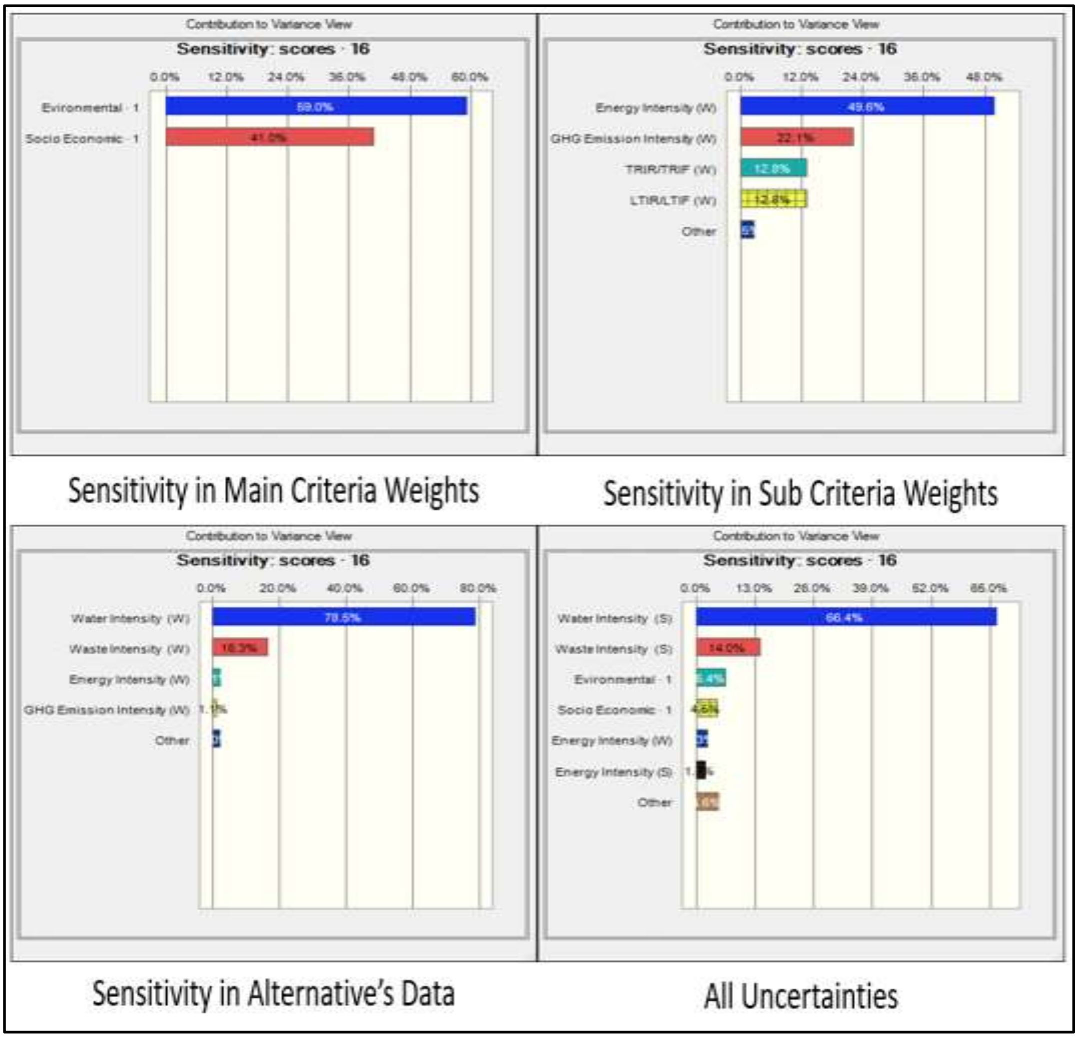

Figure 26 Sensitivity of uncertainties – ORYX GTL

Looking at scatter plots below, the high correlation of sensitive parameters are noticeable. To clarify, factors with higher correlation have a greater influence on the forecasted scores. Thus, the scores increase positively by increasing the value of assumptions. On the other hand, energy intensity has low correlation, which means there is no relation between the two considerations.

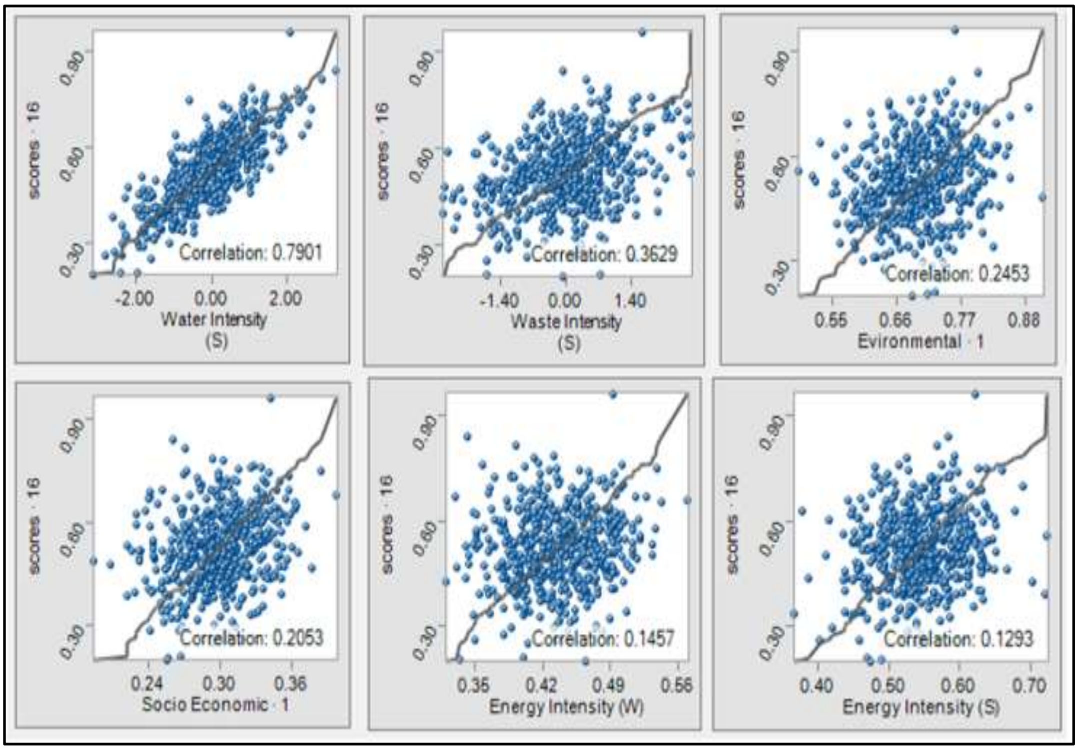

Figure 27 Scatter diagrams of sensitive elements (forth scenario)

4.4.3 Qatar Gas

Looking at the forecasted values resulted from the simulation runs the following points are derived. When all uncertainties are considered, the resulted scores are wide-ranged. Similarly, the same range occasioned when data collected for selected indicators are identified as assumptions. On the other hand, when uncertainty is undertaken in main and sub-criteria weights, the range is tighter. Accordingly, criteria weights have less effect on the forecasted scores than the data collected.

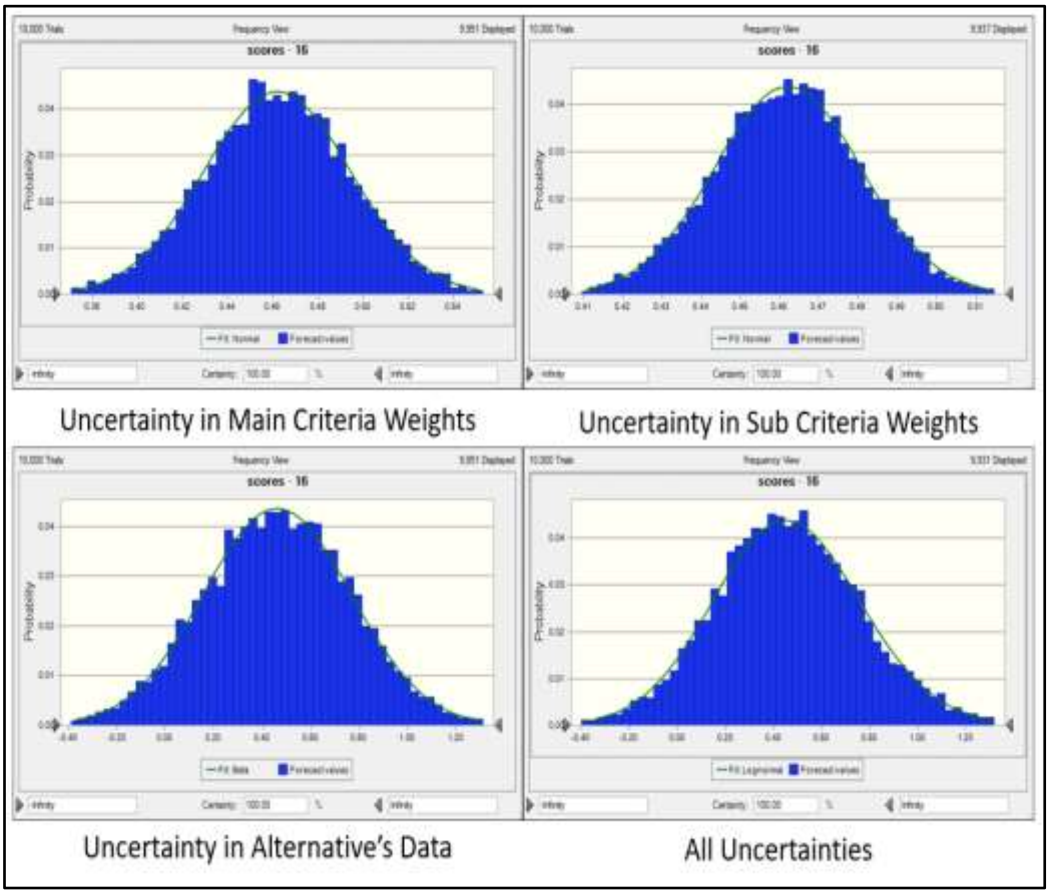

Figure 28 Forecast values – Qatar Gas

Environmental main criteria weight has greater sensitivity than socio-economic criteria weight as shown in the figure below. In the second scenario, GHG emission has the greatest connectivity with the forecasted scores, while in the third and fourth scenarios, energy intensity data is significantly more critical than any other element.

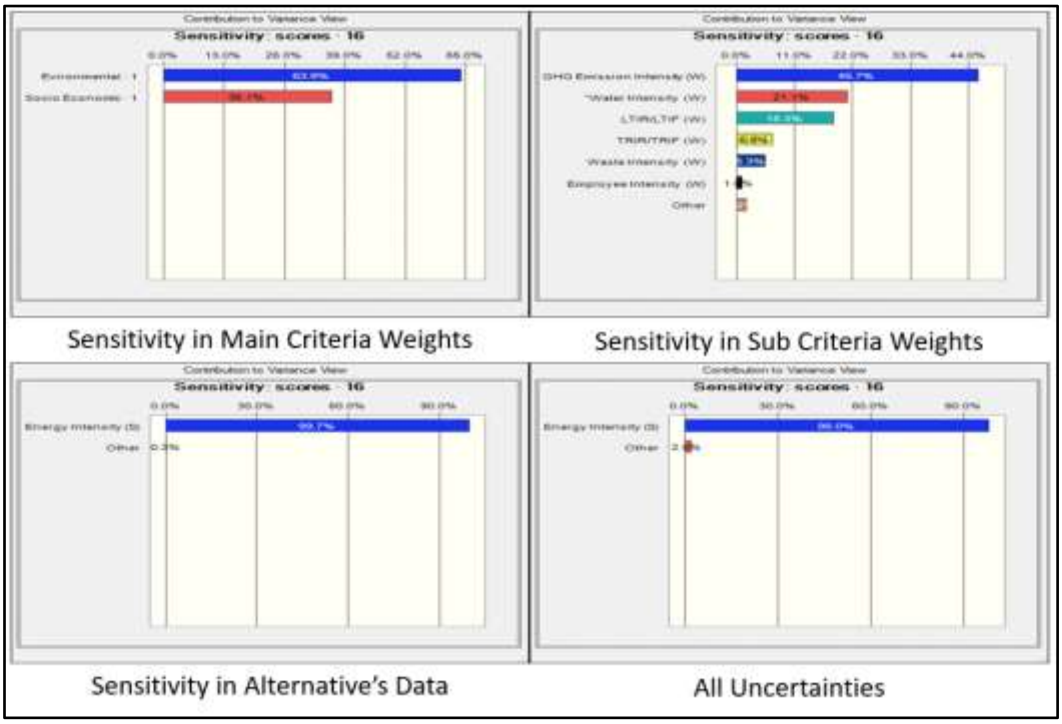

Figure 29 Sensitivity of uncertainties – Qatar Gas

Below scatter plots illustrate the high correlation of energy intensity score when compared to the percentage of women in workplace weight.

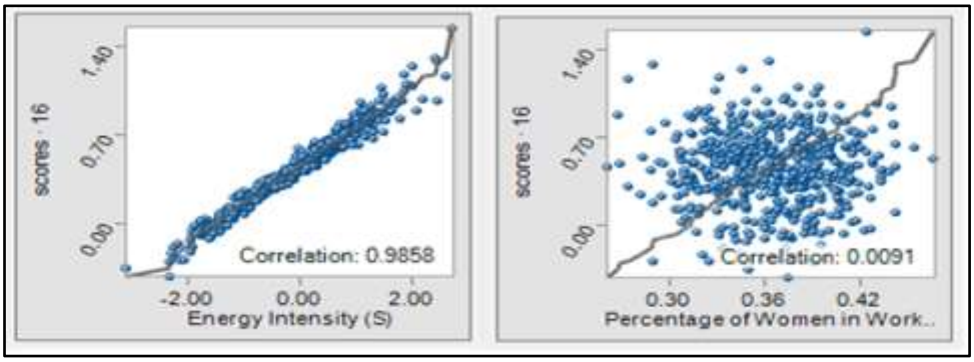

Figure 30 Scatter diagrams of sensitive elements (forth scenario)

4.4.4 Ras Gas

Moreover, the simulation results for Ras Gas indicates that the greatest range of outcomes is created when all uncertainties are considered in the simulation model. While the sub-criteria weights and indicators' data scenarios gave a similar range of forecasted scores.

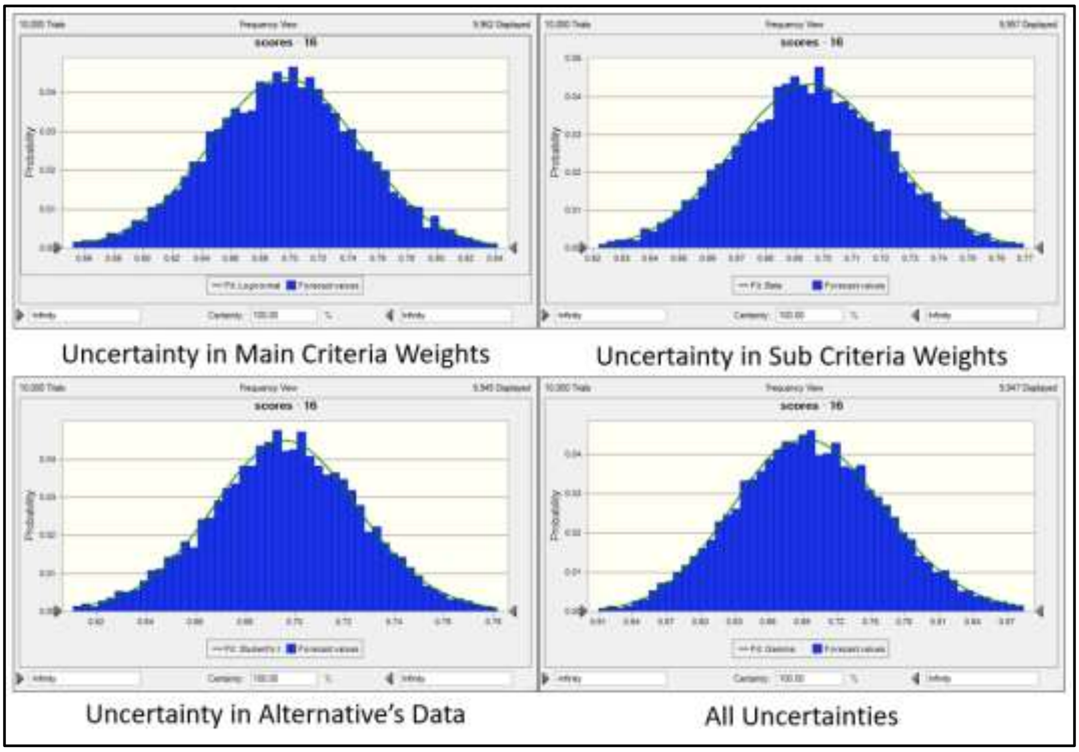

Figure 31 Forecast values – Ras Gas

Sensitivity analysis results are listed below for Ras Gas. Similar to previous alternatives, environmental main criteria weight is more sensitive in considering the uncertainty in the main criteria weight. In the second and third scenario, GHG emission intensity has significantly greater sensitivity than other sub-criteria weights and indicators' data. While environmental main criteria weight has a significant contribution to the score variance when all uncertain parameters are considered.

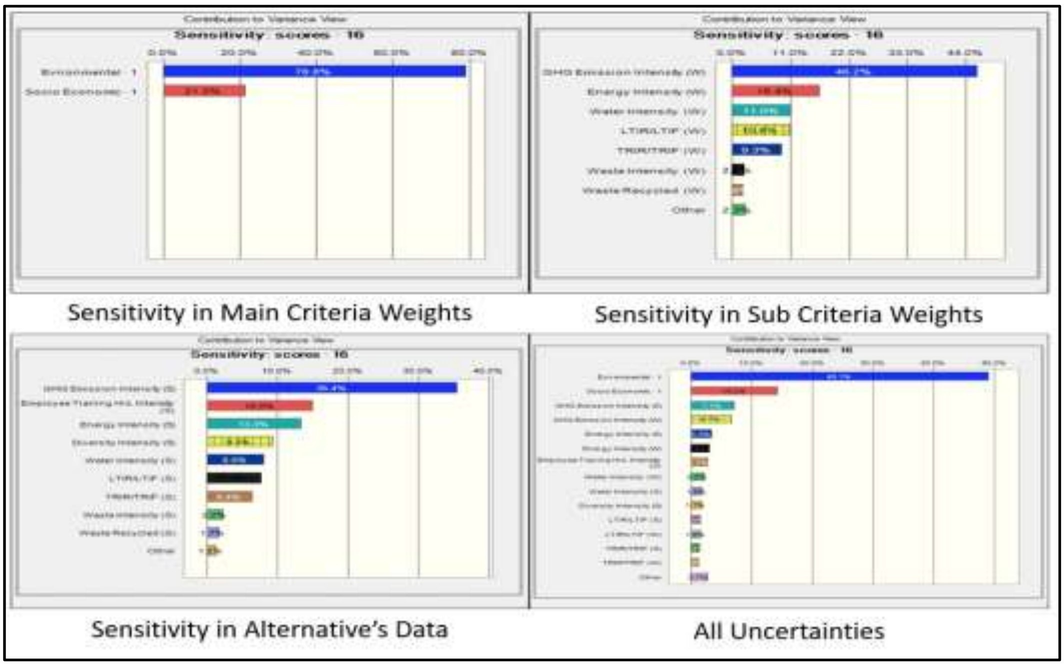

Figure 32 Sensitivity of uncertainties – Ras Gas

The following scatter plots are arranged from most to least sensitive elements from the fourth simulation scenario.

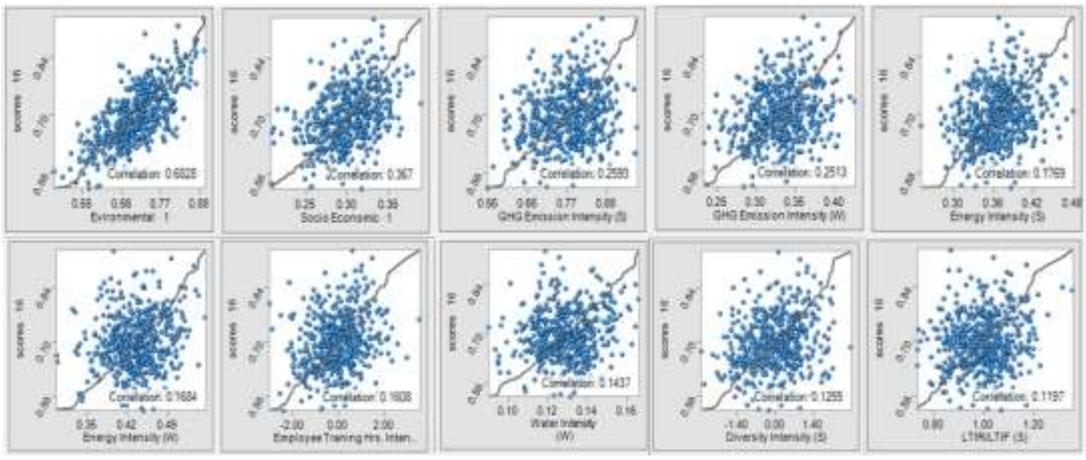

Figure 33 Scatter diagrams of sensitive elements (Forth Scenario)

4.4.5 GDI

Performing the simulation scenarios for GDI Company, it was also found that all uncertainties (weights and data) are giving the widest range of outcomes. In addition, considering only the data collected gave similar results. While weights of criteria have less effect on outcome variability range.

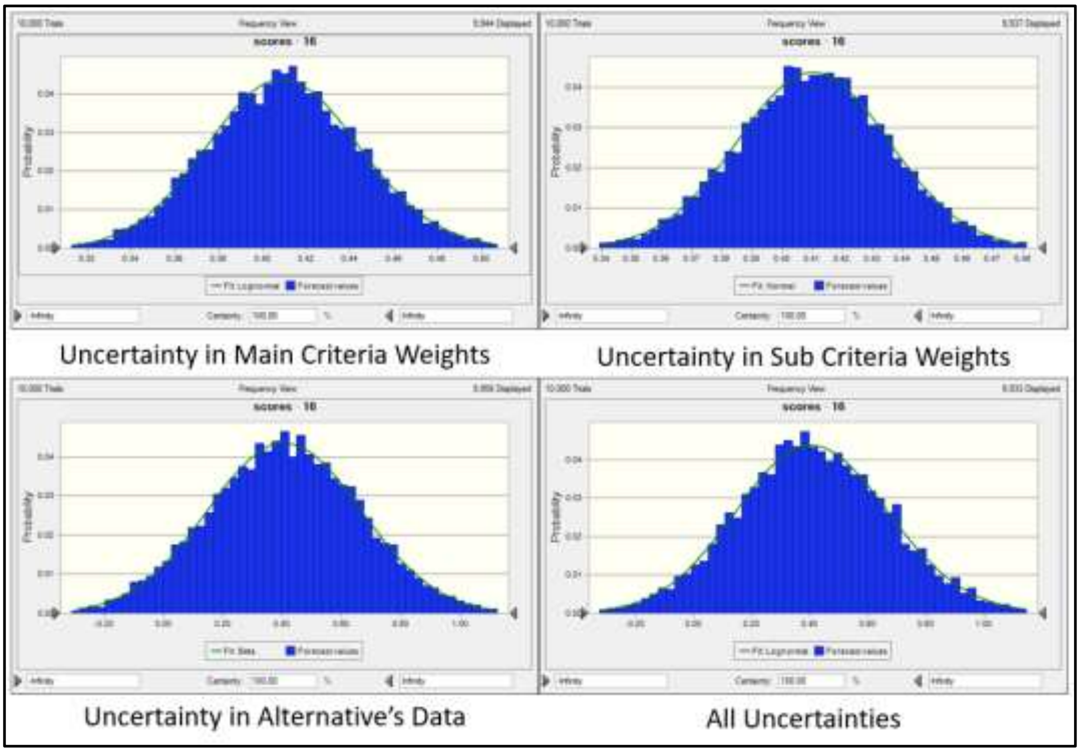

Figure 34 Forecast values – GDI

Similar to the other companies, environmental main criteria weights has greater sensitivity. While energy intensity is dominating the other sub-criteria weights with its effect on the score. Finally, GHG emission data has the highest contribution to variance in forecasted scores.

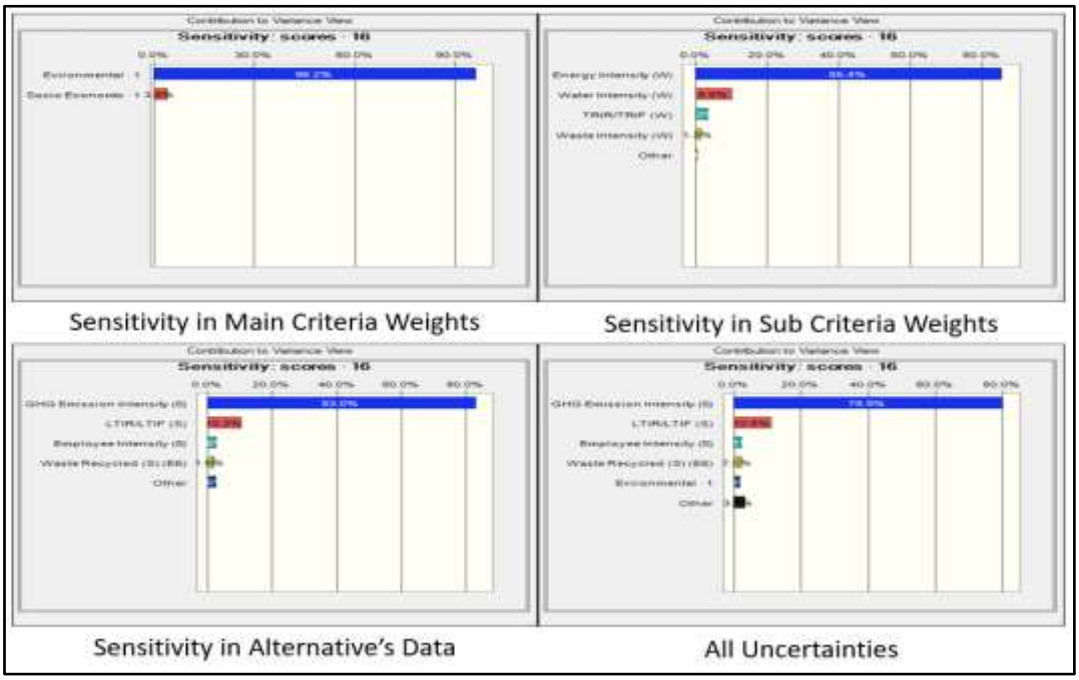

Figure 35 Sensitivity of uncertainties – GDI

Furthermore, the fourth scenario's uncertainties are plotted against forecasted scores to demonstrate the correlation of the sensitive elements.

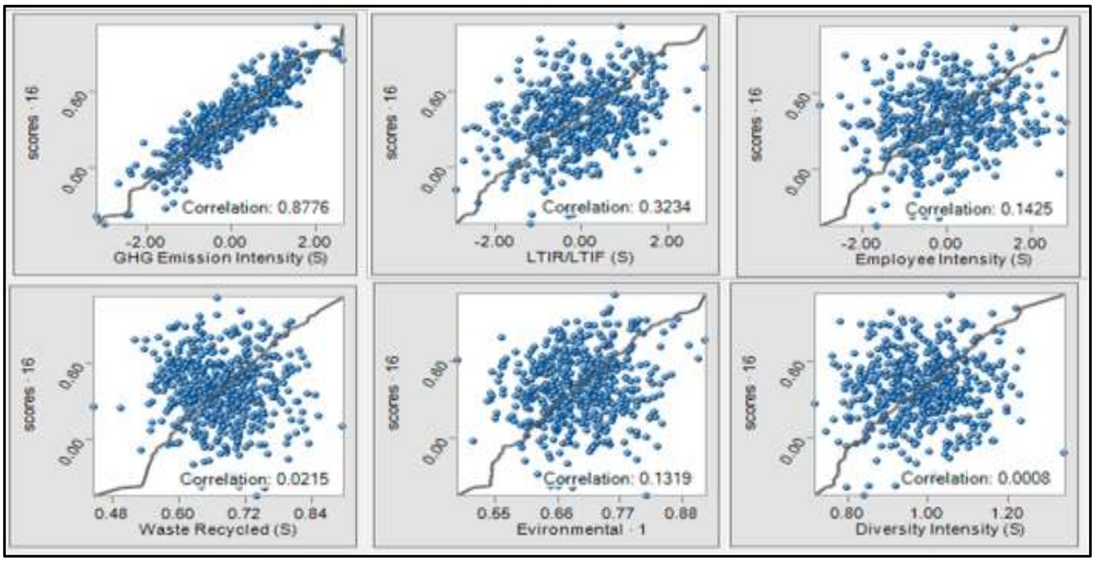

Figure 36 Scatter diagrams of sensitive elements (forth scenario)

To sum up, when all uncertainties in collected data and obtained weights were considered the forecasted scores has a wider range of values. In addition, it was noticed that the collected data has more effect on data range than criteria and sub-criteria weights. To demonstrate the previous statement, the ranking of the alternatives using resulted are compared in each scenario. The maximum, minimum forecasted scores and mean (real) scores of each alternative are plotted for the four scenarios. Hence, it can be noticed that the ranking results are still the same in the first and second scenarios, or in other words when the uncertainty of criteria weights are only considered. While on the contrary, the ranking is reformed when simulation runs were performed with third and fourth scenarios when uncertainty in collected data is involved.

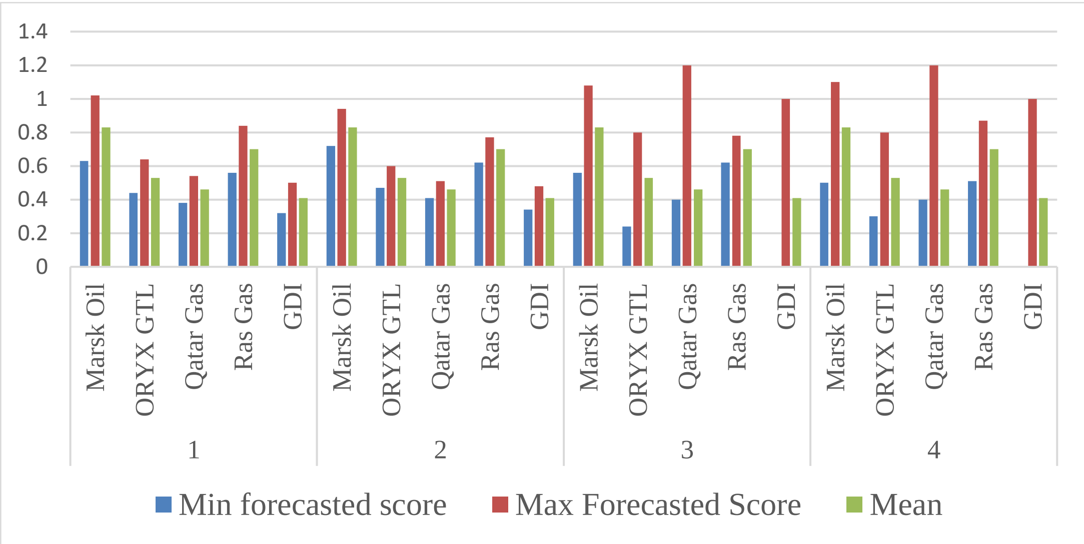

Figure 37 Comparison of Min, Max forecasted scores and real scores for all scenarios

From sensitivity analysis, Environmental criteria weight has more sensitivity in all inspections performed against the alternatives. Considering sub criteria weights, it was noticed that energy intensity and GHG emission intensity weights are the most critical weights. On the other hand, when data collected is considered, TRIR, water intensity, energy intensity, and GHG emission intensity were highlighted in the results. Identifying the most critical variables that are significantly affecting the forecasted scores helps:

- Companies to invest in actions which may help in strengthening the weak spots by reducing uncertainties.
- The management to know which variables have a high impact on sustainability performance, which helps in proper allocation of recourses
- Decision makers to understand the effect of uncertainties and incorporate them into their decisions.

Finally, when all uncertainties are undertaken in the study, it was noticed that sensitivity patterns are similar to the third simulation scenario for most of the results of the alternatives. In fact, this means that collected data is cruelly dominating the final scores of the alternatives. The complete simulation and sensitivity analysis report done by Crystal ball software is available in the appendix (G).

CHAPTER 5: CONCLUSION

In the last decade, the terminology of “Sustainability development” has been increasingly the focus in many types of research, business strategies, governmental policies, and global initiatives. Organizations realized the importance of aligning their strategies with sustainability targets, which is not only reflected in the three pillars of sustainability; environment, society, and economy. Though it is also leading to enhance global competitiveness via attracting international investments. The meaning of business sustainability, its advantages, its challenges, it's reporting, and assessment is thoroughly discussed in Chapter 2.

The fast development of Qatar in all sectors makes sustainability a critical issue for the country. It is becoming an urgent matter every day to ensure meeting the needs of people living here, while also protecting the environment for future generations. Qatar is developing the business strategies of the country by guiding companies and originations to be aware of sustainability infrastructure. Prime Minister and Interior Minister H E Sheikh Abdullah bin Nasser bin Khalifa Al Thani exemplified the approaches of the country saying: “We will continue with developing our capabilities, ensuring that our nation continues to enjoy a decent life, looking to the future with confidence to its leadership and country will generate substantial multiplier effects on the wider economy, lifting demand for goods and services and driving the country’s development in line with the Qatar National Vision 2030”.

5.1 Research summary

In this research sustainability of oil and gas sector in Qatar is investigated. Selected companies were evaluated and benchmarked to identify the leading company and rank them according to their sustainability performance. This was done through an established assessment framework that uses expert judgment to evaluate the importance of the sustainability indicators through the AHP method. Then calculate the performance score of each company using data collected and established weights using a simple scoring method. Furthermore, the criticality of indicators' values and weights was tested through Monte Carlo Simulation and sensitivity analysis. Possible outcomes were studied for different scenarios with different uncertainties accounted.

5.2 Research Findings

Investigating different assessment outlines used in different sectors and different settings, a comprehensive sustainability assessment framework was developed to be used in Qatar specifically for the Oil and Gas sector. Companies were evaluated based on data collected from GRI sustainability reports published annually and importance weights derived from experts voting. The obtained scores prove that Maersk Oil has the best performance in terms of sustainability issues. In view of the simulation and sensitivity analysis results, it was proven that the accuracy of data is highly recommended for scoring the alternatives. As outputs were greatly affected by the uncertainty of the data and resulted in altering the ranking of alternatives obtained using the assessment framework. On the other hand, the uncertainty of weights of main and sub-criteria (sustainability indicators) didn't cause significant changes in the outputs (ranking of an alternative).

5.3 Limitations and recommendations

During data collection, it was noticed that not all companies are committed to publishing sustainability reports every year. In addition, inconsistency in data provided in the published reports is observed. In other words, there were no specific indicators of values or units used to reflect the sustainability performance of companies. Therefore, only companies with significant information that can be utilized for the study were selected although their reports were published in different years.

It is recommended that companies must be compelled to publish annual sustainability reports. Those reports must be consistent with data that can be used easily to reflect sustainability performance. In addition, they must be easily used for benchmarking purposes domestically and internationally.

5.4 Future Work

As mentioned earlier, the scope of the study was dominated by the amount of information available in the published sustainability reports by the selected companies. Future studies can encounter more indicators, data, and companies in the analysis. Time series analysis can be conducted for annual sustainability performance during certain years and comparisons can be derived about the improvements and degrade of compartments. Future research can use different MCDM methods such as weighted product method, analytic hierarchy process, fuzzy AHP, and TOPSI for data aggregation and alternatives ranking. In addition, future inputs from industry experts can be merged to obtain the importance weights of indicators to ensure higher consistency ratios.

It was found in this study that data accuracy is highly critical. Hence, research studies can be conducted to focus on data collection processes. For instance, data sampling and measurements methods can be suggested. Those studies can focus on improving transparency and accuracy of data reported. In addition, improve the uniformity of data used for benchmarking purposes.

The developed assessment framework can be used by Qatar Sustainable Stock

Exchange to evaluate its listed companies and benchmark them. This framework can be converted into an automated assessment tool with computerized collected data input then reporting assessments outputs.

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APPENDIX A: PRELIMINARY DATA COLLECTION

Table 11 Sustainability Reporting Overview

No.	Company Name	Sector	report type	2017	2016	2015	2014	2013	2012	2011	2010	2009	GRI-G4 reports	GRI-G3.1 reports	GRI-G3 reports	GRI reports	non-GRI	Citing-GRI	Total
1	**Doha Bank**	Financial Services	GRI		GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	non-GRI	GRI-G3.1	non-GRI (2014)		2	3	0	5	2	0	7
2	**Gulf Drilling International**	Energy	GRI		citing-GRI	GRI-G4	GRI-G4	GRI-G4					3	0	0	3	0	1	4
3	**Al Khaliji Bank**	Financial Services	non-GRI		non-GRI								0	0	0	0	1	0	1
4	**Al-Sadd Sports Club**	Non-Profit / Services	non-GRI				non-GRI	non-GRI	non-GRI				0	0	0	0	3	0	3
5	**Barwa Real Estate**	Real Estate	non-GRI		non-GRI								0	0	0	0	1	0	1
6	**Exxonmobil Qatar**	Energy	non-GRI					citing-GRI					0	0	0	0	0	1	1
7	**KAHRAMAA**	Energy Utilities	GRI			GRI-G4	GRI-G4	GRI-G3.1					2	1	0	3	0	0	3
8	**Maersk Oil Qatar (MOQ)**	Energy	non-GRI				citing-GRI	non-GRI	non-GRI				0	0	0	0	2	1	3
9	**Ministry of Energy & Industry - Qatar**	Public Agency	GRI					GRI-G3.1	GRI-G3.1	GRI-G3.1	non-GRI		0	3	0	3	1	0	4
10	**M power**	Energy Utilities	GRI					GRI-G4	GRI-G3.1	GRI-G3.1			1	2	0	3	0	0	3
11	**ORYX GTL**	Energy	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	0	0	5
12	**Ooredoo**	Telecommunication	non-GRI		non-GRI		non-GRI	non-GRI	non-GRI	non-GRI	non-GRI		0	0	0	0	6	0	6
13	**QAFCO**	Chemicals	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1		GRI-G3		2	2	1	5	0	0	5
14	**QAPCO**	Chemicals	GRI		GRI-G4	GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				4	1	0	5	0	0	5
15	**Qatalum**	Metals Products	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	0	0	5
16	**QAFAC**	Energy	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				3	1	0	4	0	0	4
17	**Qatargas**	Energy	GRI		GRI-standards	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3			2	2	1	5	0	0	5
18	**Qatar Gas Transport Company Ltd**	Energy Utilities	non-GRI		citing-GRI	citing-GRI		non-GRI	non-GRI				0	0	0	0	2	2	4
19	**Qatar Insurance Company**	Commercial Services	non-GRI		non-GRI								0	0	0	0	1	0	1
20	**Qatar National Bank SAQ**	Financial Services	non-GRI		non-GRI	non-GRI	non-GRI	non-GRI	non-GRI	non-GRI			0	0	0	0	6	0	6
21	**Qatar Steel Company**	Metals Products	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	0	0	5
22	**Q-Chem**	Chemicals	GRI				GRI-G4	GRI-G4					2	0	0	2	0	0	2
23	**QIB**	Financial Services	non-GRI				non-GRI	non-GRI	non-GRI	non-GRI	non-GRI		0	0	0	0	5	0	5
24	**RasGas**	Energy	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3.1	GRI-G3	GRI-G3	2	3	2	7	0	0	7
25	**Ras Laffan Power Company (RLPC)**	Energy Utilities	GRI					GRI-G3.1					0	1	0	1	0	0	1
26	**Saipem Qatar**	Energy	non-GRI						citing-GRI	citing-GRI			0	0	0	0	0	2	2
27	**Vodafone Qatar**	Telecommunication	GRI		GRI-G4		GRI-G4	non-GRI					2	0	0	2	1	0	3
28	**Wintershall, Branch Qatar**	Energy	non-GRI					non-GRI					0	0	0	0	1	0	1
29	**WOQOD**	Energy	non-GRI		citing-GRI			GRI-G4					1	0	0	1	0	1	2
															Total	**64**	**32**	**8**	**104**

Table 12 GRI Reporting By Company Type

Sector	report type	2017	2016	2015	2014	2013	2012	2011	2010	2009	GRI-G4 re	GRI-G3.1 r	GRI-G3 re	GRI report
Financial Services	GRI		GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	non-GRI	GRI-G3.1	non-GRI (2014)		2	3	0	5
Energy	GRI		citing-GRI	GRI-G4	GRI-G4	GRI-G4					3	0	0	3
Energy Utilities	GRI			GRI-G4	GRI-G4	GRI-G3.1					2	1	0	3
Public Agency	GRI					GRI-G3.1	GRI-G3.1	GRI-G3.1	non-GRI		0	3	0	3
Energy Utilities	GRI					GRI-G4	GRI-G3.1	GRI-G3.1			1	2	0	3
Energy	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5
Chemicals	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1		GRI-G3		2	2	1	5
Chemicals	GRI		GRI-G4	GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				4	1	0	5
Metals Products	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5
Energy	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				3	1	0	4
Energy	GRI		GRI-stand	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3			2	2	1	5
Metals Products	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5
Chemicals	GRI				GRI-G4	GRI-G4					2	0	0	2
Energy	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3.1	GRI-G3	GRI-G3	2	3	2	7
Energy Utilities	GRI					GRI-G3.1					0	1	0	1
Telecommunication	GRI		GRI-G4		GRI-G4	non-GRI					2	0	0	2
Energy	non-GRI		citing-GRI			GRI-G4					1	0	0	1
										Total	35	25	4	64

Table 13 GRI Reporting by Industry Type

Sector	report typ	2017	2016	2015	2014	2013	2012	2011	2010	2009	GRI-G4 re	GRI-G3.1 r	GRI-G3 re	GRI reports	Total GRI of Each sector
Chemicals	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1		GRI-G3		2	2	1	5	12
	GRI		GRI-G4	GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				4	1	0	5	
	GRI				GRI-G4	GRI-G4					2	0	0	2	
Energy	GRI		citing-GRI	GRI-G4	GRI-G4	GRI-G4					3	0	0	3	25
	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	
	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1				3	1	0	4	
	GRI		GRI-stand	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3			2	2	1	5	
	GRI			GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	GRI-G3.1	GRI-G3	GRI-G3	2	3	2	7	
	non-GRI		citing-GRI			GRI-G4					1	0	0	1	
Energy Utilities	GRI			GRI-G4	GRI-G4	GRI-G3.1					2	1	0	3	7
	GRI					GRI-G4	GRI-G3.1	GRI-G3.1			1	2	0	3	
	GRI					GRI-G3.1					0	1	0	1	
Financial Services	GRI		GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1	non-GRI	GRI-G3.1	non-GRI (2014)		2	3	0	5	5
Metals Products	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	10
	GRI			GRI-G4	GRI-G4	GRI-G4	GRI-G3.1	GRI-G3.1			3	2	0	5	
Public Agency	GRI					GRI-G3.1	GRI-G3.1	GRI-G3.1	non-GRI		0	3	0	3	3
Telecommunication	GRI		GRI-G4		GRI-G4	non-GRI					2	0	0	2	2
														Total	64

Table 14 Preliminary Data Collection from GRI Reports

ESG Categories	ESG Key Performance Indicators	Measurement annual, unless indicated otherwise	Gulf Drilling International	M Power	ORYX GTL	Qatar Gas	Ras Gas	Woqod	Maersik Oil Qatar
Environmental	1. Environmental Policy	Does the company publish and follow an environmental policy? Yes/No	yes	yes				yes	Yes
	2. Environmental Impacts	Any legal or regulatory responsibility for an environmental impact:? Yes/No If yes, explain		NA		NA		BIODEGRADABLE PLAST	Yes, We integrate enviror
	3. Energy Consumption	Total amount of energy usage in MWh or GJ		40,803,032 GJ		282,853,277 GJ	252,267,330 GJ	235,616 GJ	total energy direct and
		Total direct energy consumption (GJ)	1,688,504						NA
		Total indirect energy consumption (GJ)	5,444						1,576 1,000t CO2eq
	4. Energy Intensity	Amount of energy used per M3 of space , and per FTE						NA	NA
	5. Carbon/GHG Emissions	Total amount of Carbon and **Green House Gas** emissions in metric tons (Tonnes)	103338	2,291,426 Tonnes	1692282 Tonnes	24,842,627 Tones	178000000 Tonnes	15,397.41 MT	1,449t
	6. Primary Energy Source	Specify the primary source of energy used by the company						Diesel, electricity	3107000 M3
	7. Renewable Energy Intensity	Specify the percentage of energy used that is generated from renewable sources		51%				NA	3,402t
	8. Water Management	Total amount of water consumption (m3)	121,237	111944 M3	1,264,698 m3	4,504,140 m3	3,510,000 m3	59,88 m3 is the total co	945
		Total amount of water discharged (m3)	106,789						NA
	9. Waste Management	Total amount of **waste generated**, recycled or reclaimed, by type and weight	4225 Tonnes	254.4 tonnes	31950 tonnes	6,805 Tonnes	17340 Tonnes	LUBRICANTS USED BY V	NA
		Number of significant spills	0						NA
		Total volume of spills	0.3						Yes
Social	10. Full Time Employees	Number of full time employees	1,684	92	696	3,080	3,337	1379	1.62 per million hours
	11. Employee Benefits	Total amount of employee wages and benefits	30,279,658 USD	7964844 USD	NA		NA	Total BoD remunation	Maersk is a LEAD member
	12. Employee Turnover Rate	Percentage of employee turnover	6.20%	5.20%	NA	5.50%	NA	0.0276	NA
	13. Employee Training Hours	Total number of hours of training for employees divided by the number of employees	23	20.7	30	40	39.2	12.65	Maersk is a LEAD member
	14. Health	Does the company publish and follow a policy for occupational and global health issues? Yes/No	yes	yes	yes		Yes	yes	25%
	15. Injury Rate	Total number of injuries and fatal accidents relative to the number of FTEs	1.41	0	0	0.65	0.12	19	22.75%
	16. Human Rights Policy	Disclosure and adherence to a Human Rights Policy		yes	NA		Yes	NA	NA
	17. Human Rights Violations	Number of grievances about human rights issues filed, addressed and resolved		NA	NA		NA	NA	NA
	18. Child & Forced Labor	Does the company prohibit the use of child or forced labor throughout the supply chain? Yes/No		yes	NA		NA	NA	NA
	19. Women in the Workforce	Percentage of women in the workforce	2.02%	3.3%	55%	10.30%	12%	6%	NA
	20. Qatarisation	Percentage of Qatari nationals in the workforce	6.80%	8.7%	9.5%	25.80%	36.3%	16.10%	NA
	21. Community Work	Number of hours spent, and/or other **community investments** made as a percentage of pretax profit	0.013%	NA	NA	16,609,966	4.6 events Montly	0.0017	NA
	22. Local Procurement	Percentage of total procurement from local suppliers	39%	72.80%	74%	71%	47%	0.85	NA
Economy	23. Revenues	Total amount of revenues	506,770,452					0	NA
	24. Direct costs	Total amount of Direct costs	302,262,801					22.2%, 2 of 9 of BoD ar	NA
	25. Profit for the year	Total amount of Profit	118,452,228					no	yes
	26. Cash generated by operations	Total cash generated by operations	265,841,765					NA	NA
	27. Net debt to equity		1.8%					NA	YES
	28. Divided per share		2.51					NA	NA
								NA	NA
							yes	yes	NA
							yes	yes	NA
							yes	NA	NA
ESG Reporting Generally	33. Sustainable Reporting Frameworks	Does the company publish a GRI, CDP, SASB, IIRC or UNGC report? Yes/No	Yes		yes		yes	Yes - Sustainability rep	sustainability report
	34. External Assurance	Are the company's ESG disclosures assured by an independent third party? Yes/No	non-listed		NA		yes	no	NA
report year			2015		2014	2015	2014		2014

Appendix B: Definitions of Indicators

Table 15 Indicators Definitions

Environmental Policy	The company publishes and follow an environmental policy which they state in their sustainability report.
Energy Consumption	The total amount of energy usage in Million GJ.
Energy Intensity	Amount of energy used in GJ per Million dollars of revenue.
GHG Emission Intensity	Amount of greenhouse gas that is released per thousand dollars of revenue. It is measured in tonnes CO2 equivalent/1000 Dollars.
Water Management	The total amount of water consumption by a company and details with respect to recycling if any. It is measured in Million m3.
Water Intensity	The amount of water consumption per million dollars of revenue.
Total Waste	Total waste produced by the company in one year measured in tonnes.
Waste Intensity	It is the waste produced by the company per million dollars in one year.
Waste Recycled [%]	The percentage of waste materials that were converted into new materials and objects.
Employee Intensity	It is the revenue in millions of dollars made per full-time employee.
Full-Time Employees	Number of full-time employees in the company.
Employee Diversity	Diversity among employees in terms of nationality reported in the number of nationalities in the country.
Diversity Intensity	Diversity among employees in terms of nationality. Measured in Nationalities per Billion dollars.

Total Work Hours	It is the sum of all the hours worked by all the employees in the company.
Total Work Hours Intensity	It is the number of work hours per million dollars of revenue.
Employee Training Hours	Number of training hours provided for employees (full-time, part-time, or temporary) measured in Thousand hours.
Employee Training Hours Intensity	Number of training hours provided for employees (full-time, part-time, or temporary) measured in Hours per Million $.
TRIR	The total recordable injury rate or total recordable injury frequency rate (TRIFR) is the number of fatalities or lost time injuries.
LTIR	The Lost Time Injury Frequency Rate is the number of lost time injuries occurring in the workplace.
Percentage of Women	Percentage of women in the total workforce.
Women in the Workforce	The total number of women in the workforce.
Qatarization Percentage	Percentage of Qatari nationals in the workforce.
Rate of Qatarization	The percentage change in Qatarization in a company per annum.
Qatari Employee Count	The total number of Qatari nationals in the workforce.
Local Procurement	Percentage of total procurement from local suppliers. This supports the economy of the country.
Total Revenue	Total capital generated by the company in a given year.

APPENDIX C: QUANITIFICATION OF INDICATORS

Table 16 Absolute Indicators Calculations, Units, and Values

sustainability Dimension	indicator	calculation method	Unit	Maersk Oil (2014)	ORYX GTL (2015)	Qatar Gas (2014)	Ras Gas (2014)	GDI (2016)
Evironmental	Energy Intensity	Energy consumption/ revenue	GJ/1000 $	1.748	7.249	13.872	9.419	4.553
	GHG Emission Intensity	GHG emission/ revenue	tonne CO2 eq/1000 $	0.133	1.347	1.218	0.885	2.525
	Water Intensity	water consumption/ revenue	m3/million $	262.415	1734.29	220.899	117.607	250.347
	Waste Intensity	waste produced/ revnue	tonnes/million $	0.287	29.118	0.333	0.647	9.511
	Waste Recycled	raste recycled/waste produced	percentage	43	22	22.5	51	9.1
socio-Economic	Employee Intensity	revenue/ No. of Emp.	million $/ employee	12.53	1.57	6.62	7.47	0.2
	Diversity Intensity	nationalities/ revenue	nationalities/billion $	4.223	28.525	2.943	2.352	166.806
	Total Work Hours Intensity	total work hrs/ revenue	hours/million $	3283.82	1153.73	1890.38	4304.81	17400.86
	Employee Training Hours Intensity	total traninig hrs/ revenue	hrs/million $	6.63	19.36	5.68	4.88	156.62
	TRIR	total recordable injury Rate	rate	1.62	0	0.65	0.12	0.75
	LTIR	Lost Time Injury Frequency Rate	rate	0.61	0	0.1	0.01	1.95
	Women in Workforce	no. of female emp./ total No. of emp.	percentage	25	9.5	10.3	12	1.83
	Nationals in Workforce	no. of Qatari emp./ total No. of emp.	percentage	25	32	24.6	34.3	8.5
	Rate of Qatarization	% of increase in Qatarization per year	percentage	23	43.5	25.8	36.3	8.5
	Local Procurement	no. of local suppliers/ total no. of suppliers	percentage	63	74.2	71	65	53
Basis of calculating intesities	Annual Revenue	NA	Million $	1184	1097.25	20390	26784	70734

APPENDIX D: USING AHP METHOD TO CALCULATE CRITERIA WEIGHTS

Following tables represent the importance rates collected for three experts using pairwise comparisons of criteria and sub-criteria.

Table 17 Main Criteria Pairwise Comparison

	ENV	SE
Environment (ENV)	1	3
	1	2
	1	2
Socio-Economy (SE)	1/3	1
	1/2	1
	1/2	1

Table 18 Environmental Sub-Criteria Pairwise Comparison

	EI	GHGE	WUI	WI	WR
Energy Intensity (EI)	1	4	3	6	7
	1	5	6	6	8
	1	1	5	4	3
GHG Emission Intensity (GHGE)	1/4	1	5	8	9
	1/5	1	7	9	8
	1	1	3	6	4
Water usage Intensity (WUI)	1/3	1/5	1	5	6
	1/6	1/7	1	4	7
	1/5	1/3	1	5	1/3
Waste Intensity (WI)	1/6	1/8	1/5	1	2
	1/6	1/9	1/4	1	5
	1/4	1/6	1/5	1	1/2
Waste Recycled (WR)	1/7	1/9	1/6	1/2	1
	1/8	1/8	1/7	1/5	1
	1/3	1/4	3	2	1

Table 19 Socio-Economic Sub-Criteria Pairwise Comparison

	EI	DI	TWH	ETHI	TRIR/TRIF	LTIR/LTIF	PWW	QP	RQ	LP
Employee Intensity (EI)	1	6	5	8	1/8	1/8	2	6	6	8
	1	7	6	9	1/8	1/8	2	6	6	8
	1	4	1/2	2	1/6	1/7	7	4	4	2
Divesity Intensity (DI)	1/6	1	1	2	1/9	1/9	1	1/6	1/6	6
	1/7	1	2	3	1/8	1/8	1	1/7	1/6	6
	1/4	1	1/7	1/4	1/9	1/9	1	1/2	1/2	1/3
Total Work Hours (TWH)	1/5	1	1	6	1/8	1/8	3	2	2	2
	1/6	1/2	1	7	1/8	1/9	3	2	2	2
	2	7	1	2	1/2	1/2	2	2	2	3
Employee Traning Hrs. Intensity (ETHI)	1/8	1/2	1/6	1	1/8	1/8	2	1/5	1/5	4
	1/9	1/3	1/7	1	1/8	1/9	2	1/5	1/5	4
	1/2	4	1/2	1	1/6	1/6	5	3	3	3
TRIR/TRIF	8	9	8	8	1	1	8	8	8	8
	8	8	8	8	1	1	9	9	8	8
	6	9	2	6	1	1	4	7	7	6
LTIR/LTIF	8	9	8	8	1	1	8	8	8	8
	8	8	9	9	1	1	9	9	8	8
	7	9	2	6	1	1	4	7	5	6
Percentage of Women in Workforce (PWW)	1/2	1	1/3	1/2	1/8	1/8	1	1	1/5	3
	1/2	1	1/3	1/2	1/9	1/9	1	1	1/6	3
	1/7	1	1/2	1/5	1/4	1/4	1	1/3	1/3	2
Qatarization Percentage (QP)	1/6	6	1/2	5	1/8	1/8	1	1	1	6
	1/6	7	1/2	5	1/9	1/9	1	1	1	6
	1/4	2	1/2	1/3	1/7	1/7	3	1	1	2
Rate of Qatarization (RQ)	1/6	6	1/2	5	1/8	1/8	5	1	1	6
	1/6	6	1/2	5	1/8	1/8	6	1	1	6
	1/4	2	1/2	1/3	1/7	1/5	3	1	1	2
Local Procurement (LP)	1/8	1/6	1/2	1/4	1/8	1/8	1/3	1/6	1/6	1
	1/8	1/6	1/2	1/4	1/8	1/8	1/3	1/6	1/6	1
	1/2	3	1/3	1/3	1/6	1/6	1/2	1/2	1/2	1

The following tables represent the combined experts' inputs into single values using Geometric Mean

Table 20 Main Criteria Weights: Combined Scores of Pairwise Comparison

	ENV	SE
Environment (ENV)	1	2 2/7
Socio-Economy (SE)	3/7	1
colomn sum	1.43679	3.28943

Table 21 Environmental Sub-Criteria Weights: Combined Scores of Pairwise Comparison

	EI	GHGE	WUI	WI	WR
Energy Intensity (EI)	1	2 5/7	4 1/2	5 1/4	5 1/2
GHG Emission Intensity (GHGE)	3/8	1	4 5/7	7 5/9	6 3/5
Water usage Intensity (WUI)	2/9	1/5	1	4 2/3	2 2/5
Waste Intensity (WI)	1/5	1/8	2/9	1	1 5/7
Waste Recycled (WR)	1/6	1/7	2/5	3/5	1
colomn sum	1.96356	4.2101	10.8295	19.0274	17.2418

Table 22 Socio-Economic Sub-Criteria Weights: Combined Scores of Pairwise Comparison

	EI	DI	TWH	ETHI	TRIR/TRIF	LTIR/LTIF	PWW	QP	RQ	LP
Employee Intensity (EI)	1	5 1/2	2 1/2	5 1/4	1/7	1/8	3	5 1/4	5 1/4	5
Divesity Intensity (DI)	1/6	1	2/3	1 1/7	1/9	1/9	1	2/9	1/4	2 2/7
Total Work Hours (TWH)	2/5	1 1/2	1	4 3/8	1/5	1/5	2 5/8	2	2	2 2/7
Employee Traning Hrs. Intensity (ETHI)	1/5	7/8	2/9	1	1/7	1/8	2 5/7	1/2	1/2	3 5/8
TRIR/TRIF	7 1/4	8 2/3	5	7 1/4	1	1	6 3/5	8	7 2/3	7 1/4
LTIR/LTIF	7 2/3	8 2/3	5 1/4	7 5/9	1	1	6 3/5	8	6 5/6	7 1/4
Percentage of Women in Workforce (PWW)	1/3	1	3/8	3/8	1/7	1/7	1	2/3	2/9	2 5/8
Qatarization Percentage (QP)	1/5	4 3/8	1/2	2	1/8	1/8	1 4/9	1	1	4 1/6
Rate of Qatarization (RQ)	1/5	4 1/6	1/2	2	1/8	1/7	4 1/2	1	1	4 1/6
Local Procurement (LP)	1/5	3/7	3/7	2/7	1/7	1/7	3/8	1/4	1/4	1
colomn sum	17.607	36.1932	16.4527	31.2921	3.1345	3.130185	29.8847	26.813	24.9302	39.7308

The following tables represent the calculations carried to obtain criteria weights.

Table 23 Obtained Main Criteria Weights

	ENV	SE	Row Sum	Criteria Weight
Environment (ENV)	0.696	2/3	1.391991646	0.695995823
Socio-Economy (SE)	0.304	0.304	0.608008354	0.304004177
			Total Weights	1

Table 24 Obtained Environmental Sub-Criteria Weights

	EI	GHGE	WUI	WI	WR	Row Sum	Sub-criteria Weight
Energy Intensity (EI)	0.50928	0.64474	0.41382	0.27547	0.32003	2.163331845	0.432666369
GHG Emission Intensity (GHGE)	0.18762	0.23752	0.43564	0.397297	0.38301	1.641089954	0.328217991
Water usage Intensity (WUI)	0.11364	0.05035	0.09234	0.243942	0.13978	0.640057838	0.128011568
Waste Intensity (WI)	0.09716	0.03142	0.01989	0.052556	0.09918	0.300209591	0.060041918
Waste Recycled (WR)	0.0923	0.03597	0.03831	0.030735	0.058	0.255310771	0.051062154
						Total Weights	1

Table 25 Obtained Socio-Economic Sub-Criteria Weights

	EI	DI	TWH	ETHI	TRIR/TRIF	LTIR/LTIF	PWW	QP	RQ	LP	Row Sum	Sub-criteria Weight
Employee Intensity (EI)	0.0568	0.15246	0.1499	0.1675	0.043892	0	0.10161	0.19548	0.21025	0.12685	1.246477965	0.124647797
Divesity Intensity (DI)	0.01029	0.02763	0.04003	0.03658	0.036867	0.036918	0.03346	0.00852	0.00964	0.05762	0.297564469	0.029756447
Total Work Hours (TWH)	0.02303	0.04195	0.06078	0.13996	0.063304	0.06095	0.0877	0.07459	0.08022	0.05762	0.690102516	0.069010252
Employee Traning Hrs. Intensity (ETHI)	0.01084	0.02414	0.01388	0.03196	0.043892	0.042261	0.09083	0.0184	0.01978	0.09147	0.387442297	0.03874423
TRIR/TRIF	0.41282	0.23909	0.30631	0.23228	0.31903	0.31947	0.22098	0.2968	0.30693	0.18294	2.836647908	0.283664791
LTIR/LTIF	0.43458	0.23909	0.31858	0.24158	0.31903	0.31947	0.22098	0.2968	0.27436	0.18294	2.847416921	0.284741692
Percentage of Women in Workforce (PWW)	0.0187	0.02763	0.02319	0.01177	0.04831	0.048376	0.03346	0.02586	0.00895	0.06596	0.312218505	0.031221851
Qatarization Percentage (QP)	0.01084	0.121	0.03039	0.06479	0.040089	0.040144	0.04826	0.0373	0.04011	0.10471	0.537628522	0.053762852
Rate of Qatarization (RQ)	0.01084	0.11494	0.03039	0.06479	0.041694	0.046707	0.14996	0.0373	0.04011	0.10471	0.641432124	0.064143212
Local Procurement (LP)	0.01127	0.01207	0.02655	0.00879	0.043892	0.043953	0.01277	0.00896	0.00964	0.02517	0.203068771	0.020306877
											Total Weights	1

APPENDIX E: CONSISTENCY RATES CALCULATIONS

Table 26 Consistency Ratio of Environmental Sub-Criteria Weights

	EI	GHGE	WUI	WI	WR	Sub-criteria Weight	New Vector	NV/W
Energy Intensity (EI)	1	2 5/7	4 1/2	5 1/4	5 1/2	0.432666369	2.49372062	5.763611
GHG Emission Intensity (GHGE)	3/8	1	4 5/7	7 5/9	6 3/5	0.328217991	1.88262854	5.735909
Water usage Intensity (WUI)	2/9	1/5	1	4 2/3	2 2/5	0.128011568	0.69588726	5.436128
Waste Intensity (WI)	1/5	1/8	2/9	1	1 5/7	0.060041918	0.30090059	5.011509
Waste Recycled (WR)	1/6	1/7	2/5	3/5	1	0.051062154	0.2674017	5.236789
							λ_{max}	5.44
							CI	0.11
							RI	1.12
							CR	0.097

Table 27 Consistency Ratio of Socio-Economic Sub-Criteria Weights

	EI	DI	TWH	ETHI	TRIR/TRIF	LTIR/LTIF	PWW	QP	RQ	LP	Sub-criteria Weight	New Vector	NV/W
Employee Intensity (EI)	1	5 1/2	2 1/2	5 1/4	1/7	1/8	3	5 1/4	5 1/4	5	0.124647797	1.5535007	12.46312
Divesity Intensity (DI)	1/6	1	2/3	1 1/7	1/9	1/9	1	2/9	1/4	2 2/7	0.029756447	0.31324249	10.52688
Total Work Hours (TWH)	2/5	1 1/2	1	4 3/8	1/5	1/5	2 5/8	2	2	2 2/7	0.069010252	0.80915114	11.72509
Employee Traning Hrs. Intensity (ETHI)	1/5	7/8	2/9	1	1/7	1/8	2 5/7	1/2	1/2	3 5/8	0.03874423	0.39767619	10.26414
TRIR/TRIF	7 1/4	8 2/3	5	7 1/4	1	1	6 3/5	8	7 2/3	7 1/4	0.283664791	3.63374763	12.81001
LTIR/LTIF	7 2/3	8 2/3	5 1/4	7 5/9	1	1	6 3/5	8	6 5/6	7 1/4	0.284741692	3.65464758	12.83496
Percentage of Women in Workforce (PWW)	1/3	1	3/8	3/8	1/7	1/7	1	2/3	2/9	2 5/8	0.031221851	0.33351403	10.68207
Qatarization Percentage (QP)	1/5	4 3/8	1/2	2	1/8	1/8	1 4/9	1	1	4 1/6	0.053762852	0.5859957	10.89964
Rate of Qatarization (RQ)	1/5	4 1/6	1/2	2	1/8	1/7	4 1/2	1	1	4 1/6	0.064143212	0.68163335	10.62674
Local Procurement (LP)	1/5	3/7	3/7	2/7	1/7	1/7	3/8	1/4	1/4	1	0.020306877	0.21729791	10.70071
												λ_{max}	11.35
												CI	0.15
												RI	1.49
												CR	0.10

APPENDIX F: NORMALIZED INDICATORS VALUES

Table 28 Normalized Indicators Values with Weights

Company	Environmental Indicators - intensity					Socio-Economic Indicators - Intensity									
	0.70					0.30									
	Energy Intensity (GJ/1000 $)	GHG Emission Intensity (m3/ Million $)	Water Intensity (m3/ Million $)	Waste Intensity (Tons/ Million $)	Waste Recycled (%)	Employee Intensity (Million $/ Employee)	Divesity Intensity (Nationalities/ Billion $)	Total Work Hours Intensity (hrs./ Million $)	Employee Traning Hrs. Intensity (hrs./ Million $)	TRIR/TRIF	LTIR/LTIF	Percentage of Women in Workforce (%)	Qatarization Percentage (%)	Rate of Qatarization (%)	Local Procurement (%)
weights	0.43	0.33	0.13	0.06	0.05	0.12	0.03	0.07	0.04	0.28	0.28	0.03	0.05	0.06	0.02
Maersk Oil (2014)	1.00	1.00	0.91	1.00	0.81	1.00	0.01	0.87	0.01	0.00	0.69	1.00	0.64	0.41	0.47
ORYX GTL (2014)	0.55	0.49	0.00	0.00	0.31	0.11	0.16	1.00	0.10	1.00	1.00	0.33	0.91	1.00	1.00
Qatar Gas (2015)	0.00	0.55	0.94	1.00	0.32	0.52	0.00	0.95	0.01	0.60	0.95	0.37	0.62	0.49	0.85
Ras Gas (2014)	0.37	0.78	1.00	0.99	1.00	0.59	0.00	0.81	0.00	0.93	0.99	0.44	1.00	0.79	0.14
GDI (2016)	0.77	0.00	0.92	0.68	0.00	0.00	1.00	0.00	1.00	0.54	0.00	0.00	0.00	0.00	0.00

APPENDIX G: CRYSTAL BALL REPORT

Number of trial runs (Monte Carlo Simulation) 10,000

Confidence Level: 95%

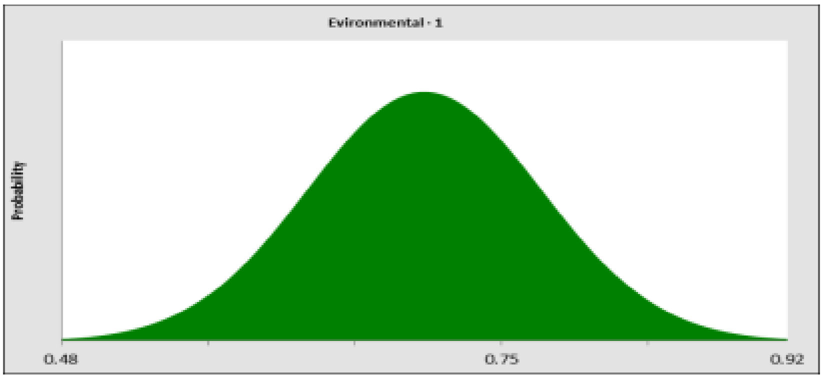
Maersk Oil: Main criteria Weights

Assumptions

Assumption: Environmental · 1

Normal distribution with parameters:

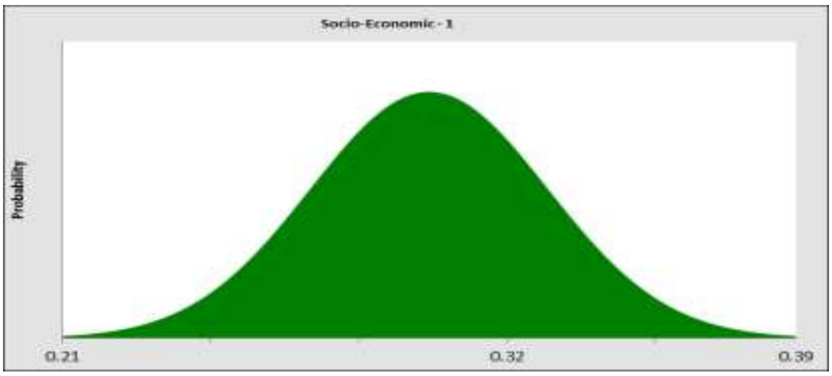
Mean	0.70
Std. Dev.	0.07



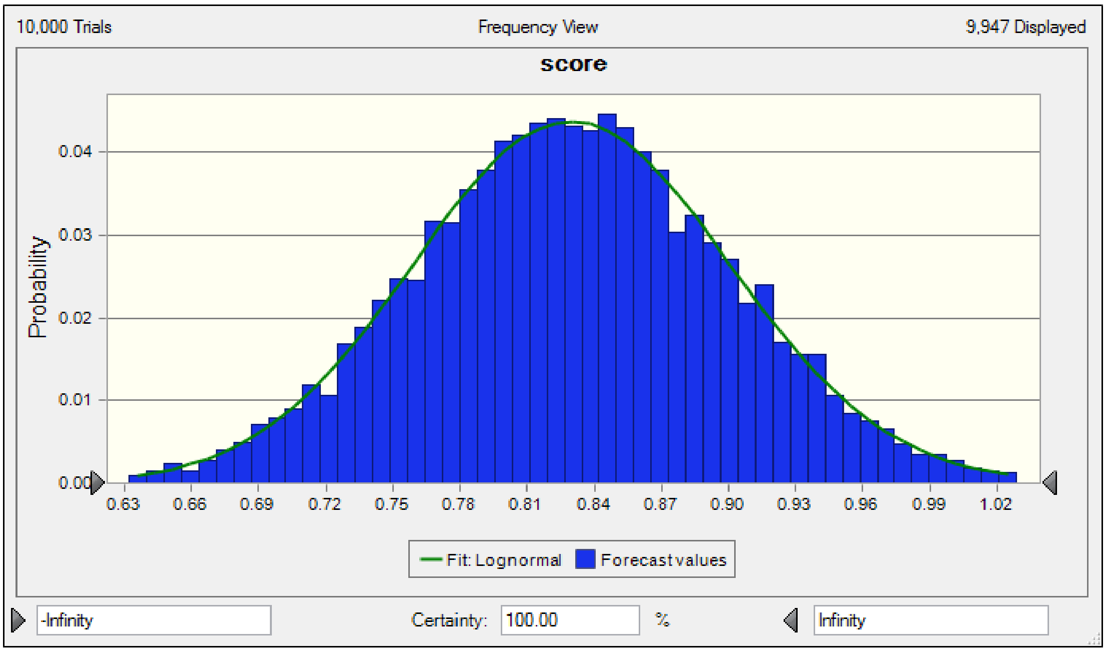
Assumption: Socio-Economic · 1

Normal distribution with parameters:

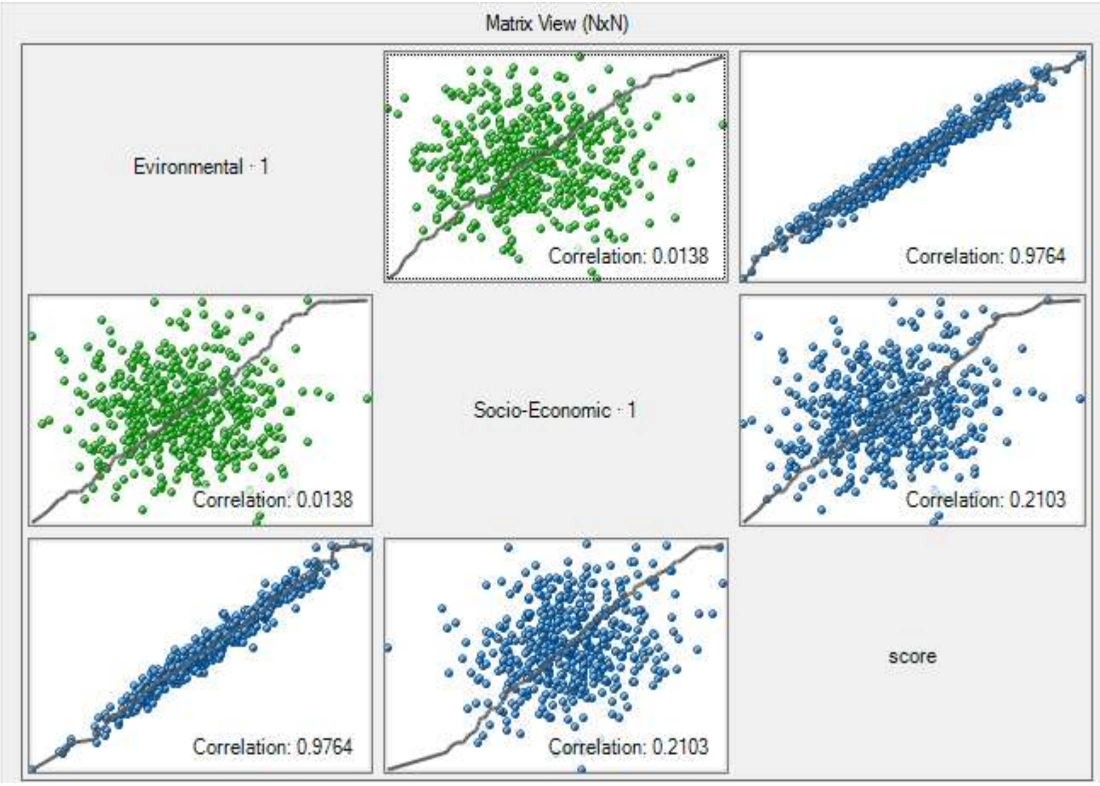
Mean	0.30
Std. Dev.	0.03



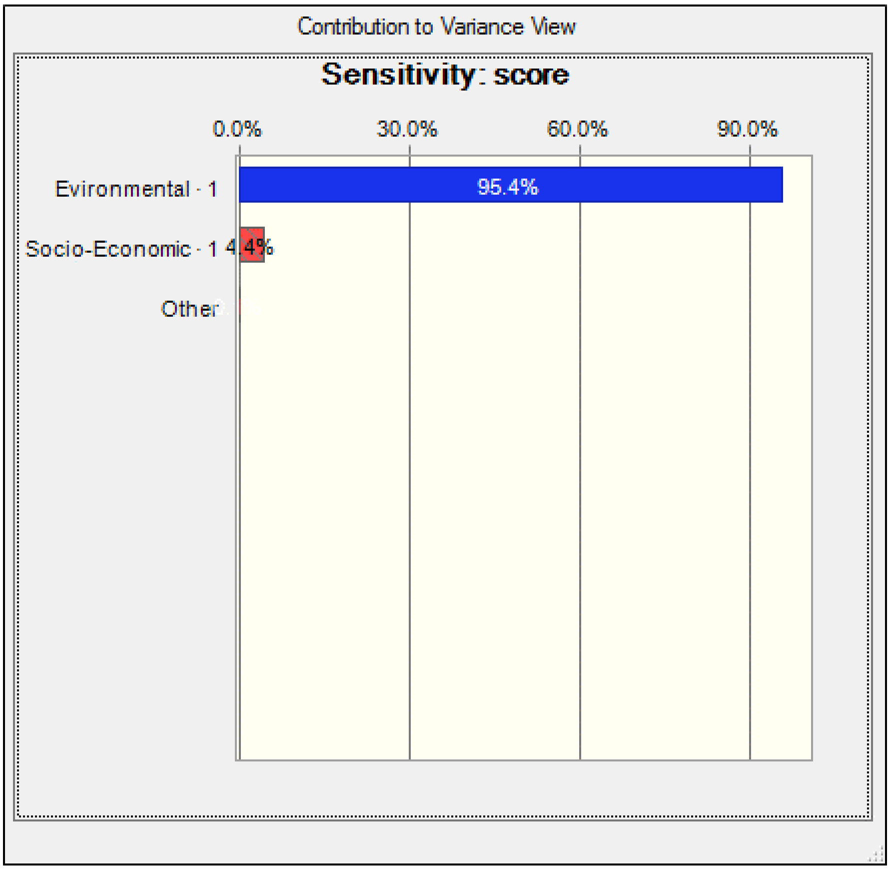
Forecasted scores



Scatter Chart



Sensitivity Chart



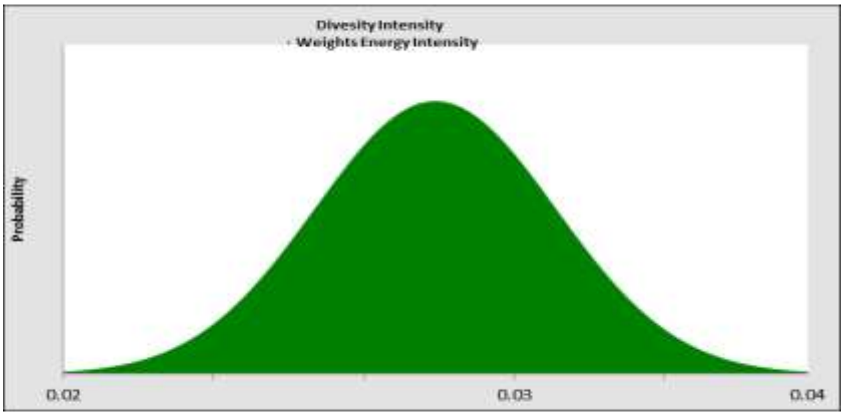
Maersk Oil: sub criteria Weights

Assumptions

Assumption: Diversity Intensity weight

Normal distribution with parameters:

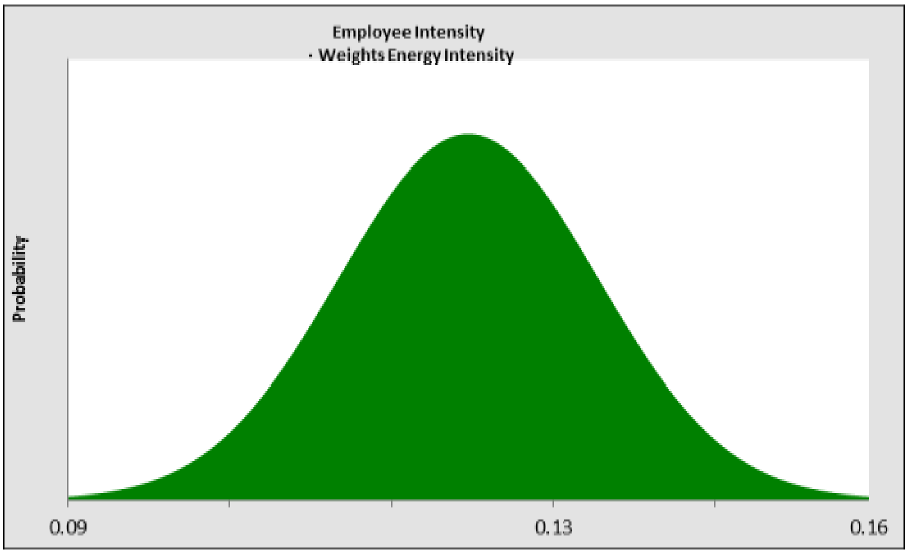
Mean	0.03
Std. Dev.	0.00



Assumption: Employee Intensity weight

Normal distribution with parameters:

Mean	0.12
Std. Dev.	0.01



Assumption: Employee Training Hours Intensity weight

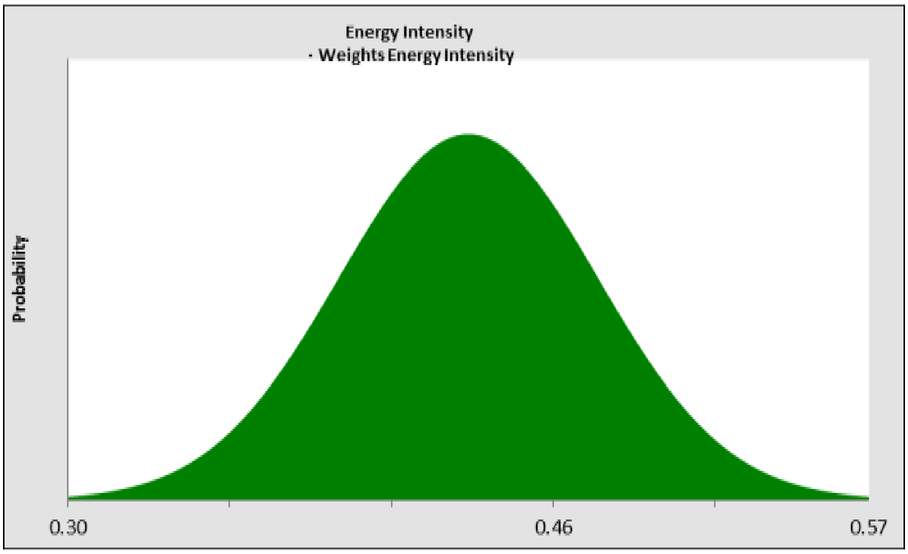
Normal distribution with parameters:

Mean	0.04
Std. Dev.	0.00

Assumption: Energy Intensity weight

Normal distribution with parameters:

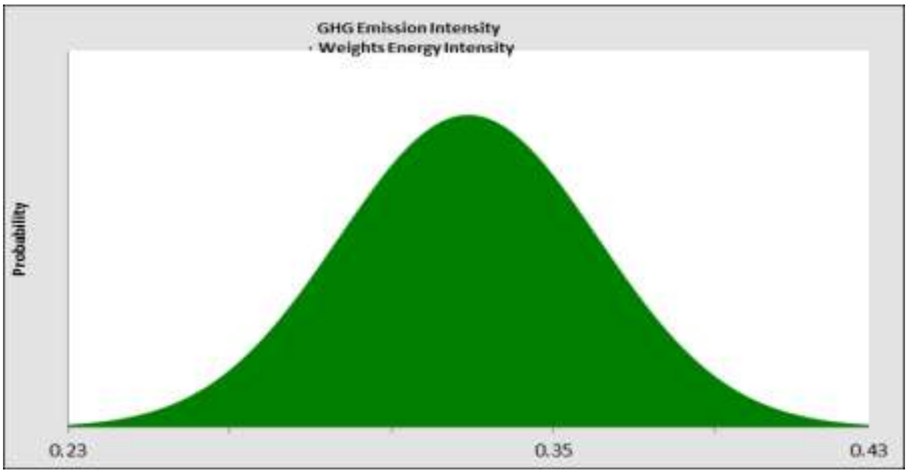
Mean	0.43
Std. Dev.	0.04



Assumption: GHG Emission Intensity weight

Normal distribution with parameters:

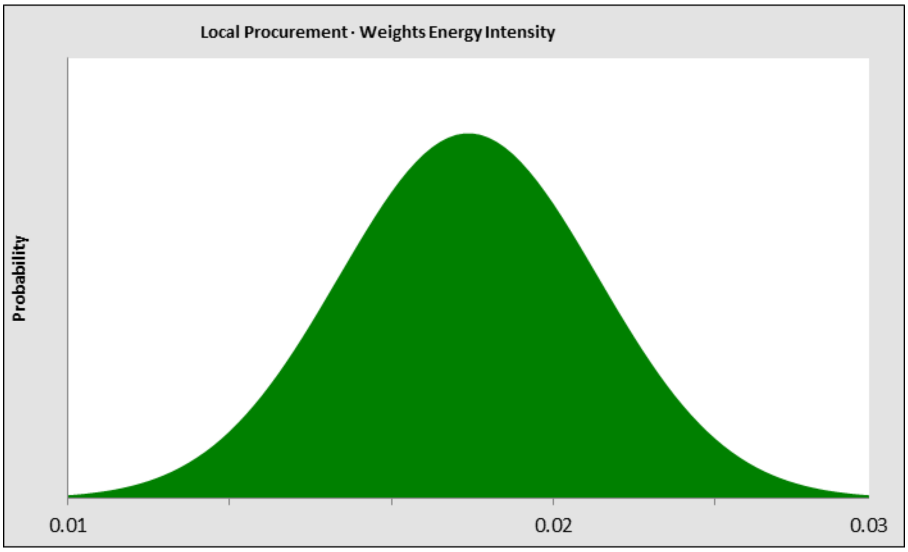
Mean	0.33
Std. Dev.	0.03



Assumption: Local Procurement weight

Normal distribution with parameters:

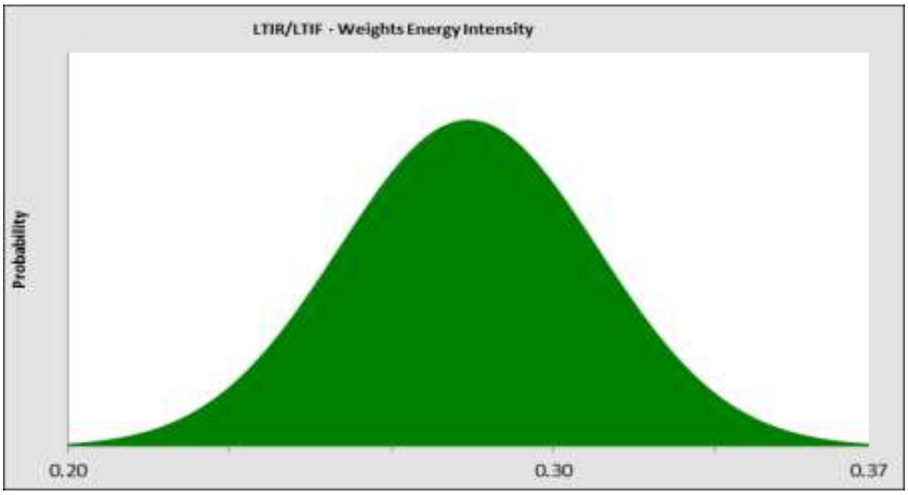
Mean	0.02
Std. Dev.	0.00



Assumption: LTIR

Normal distribution with parameters:

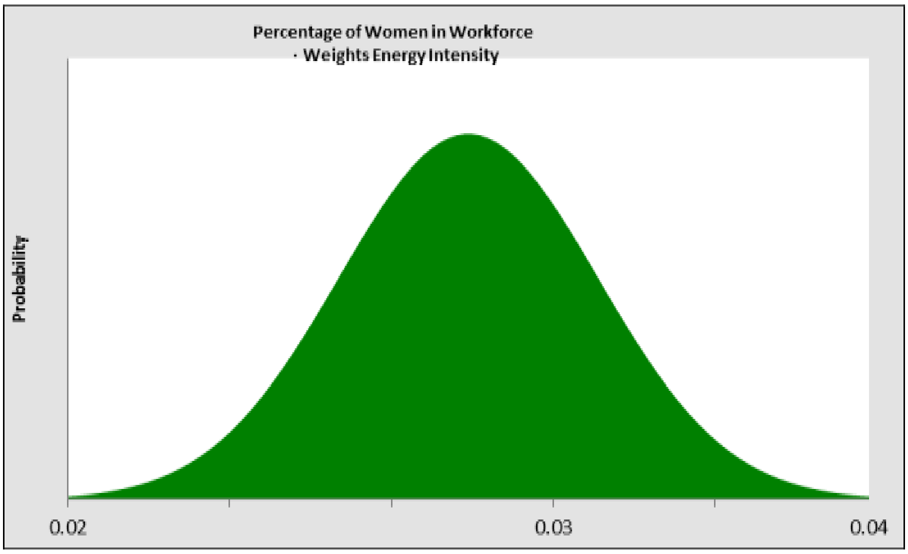
Mean	0.28
Std. Dev.	0.03



Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean	0.03
Std. Dev.	0.00

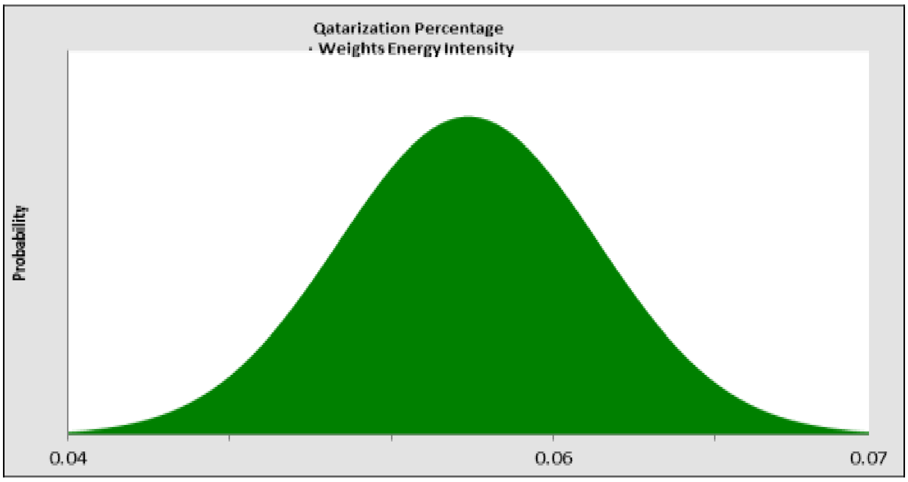


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.05

Std. Dev. 0.01

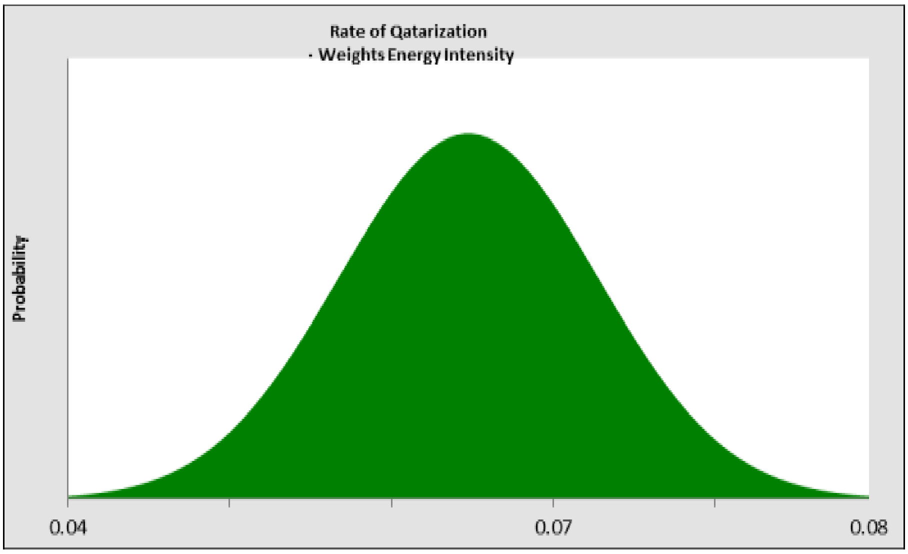


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.06

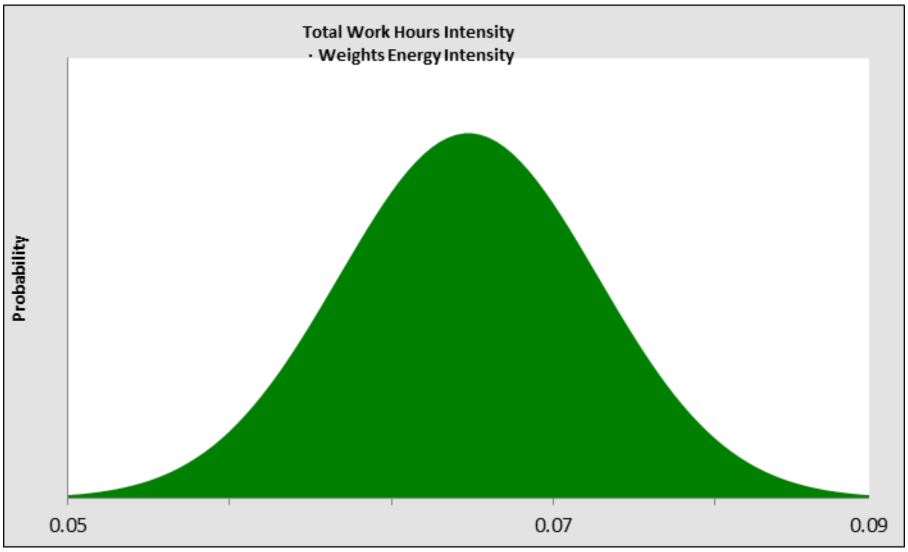
Std. Dev. 0.01



Assumption: Total Work Hours

Normal distribution with parameters:

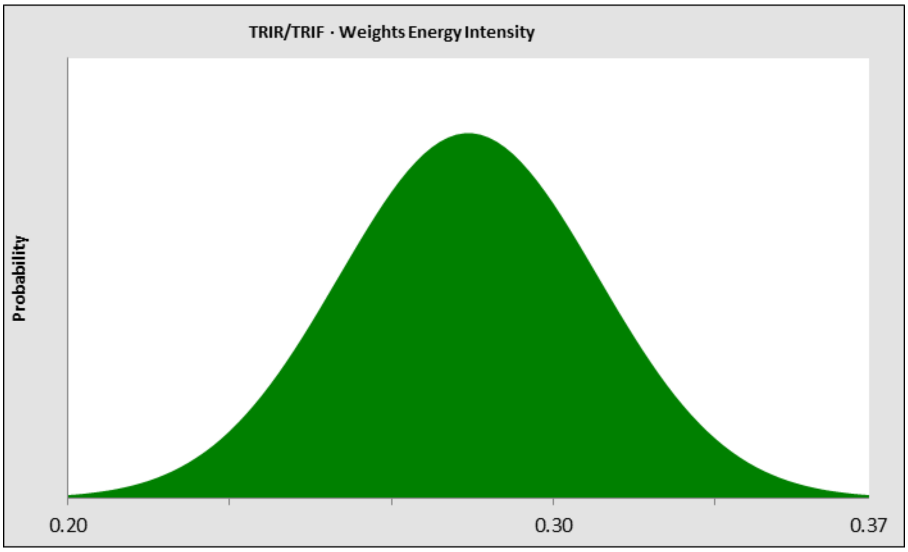
Mean	0.07
Std. Dev.	0.01



Assumption: TRIR

Normal distribution with parameters:

Mean	0.28
Std. Dev.	0.03

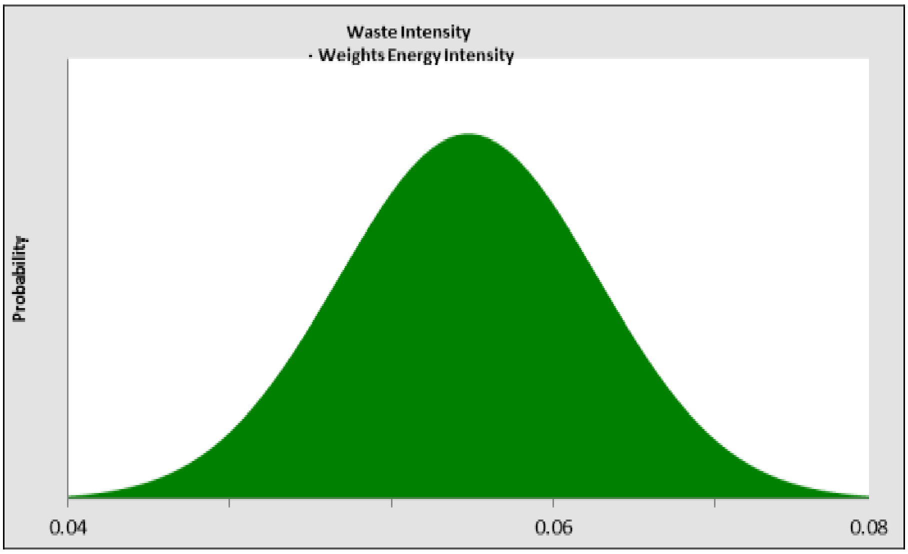


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

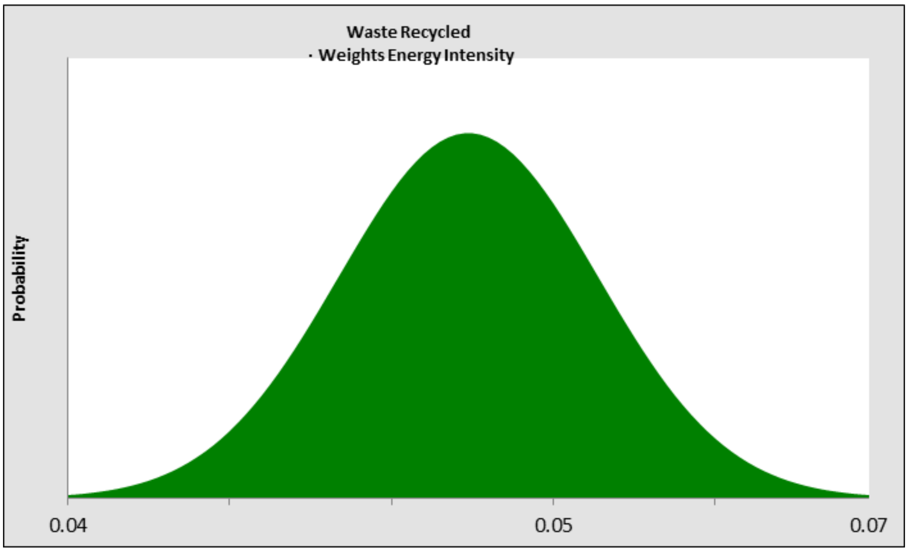


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.05

Std. Dev. 0.01

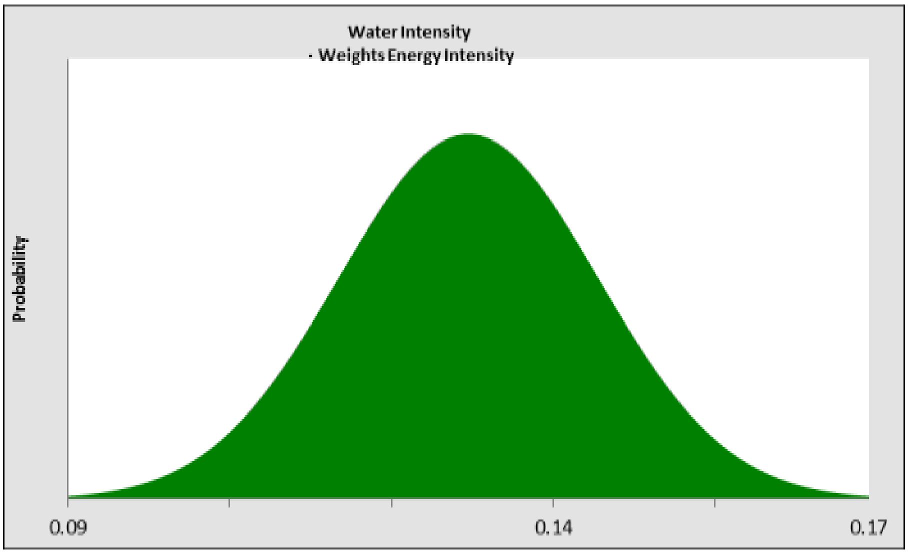


Assumption: Water Intensity

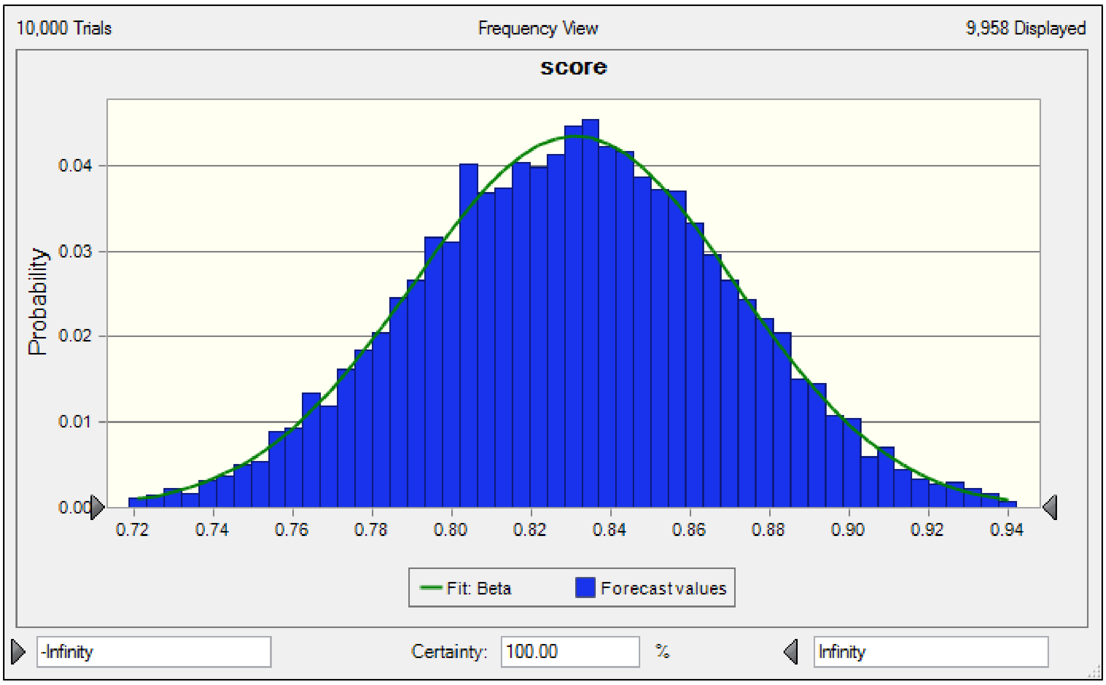
Normal distribution with parameters:

Mean 0.13

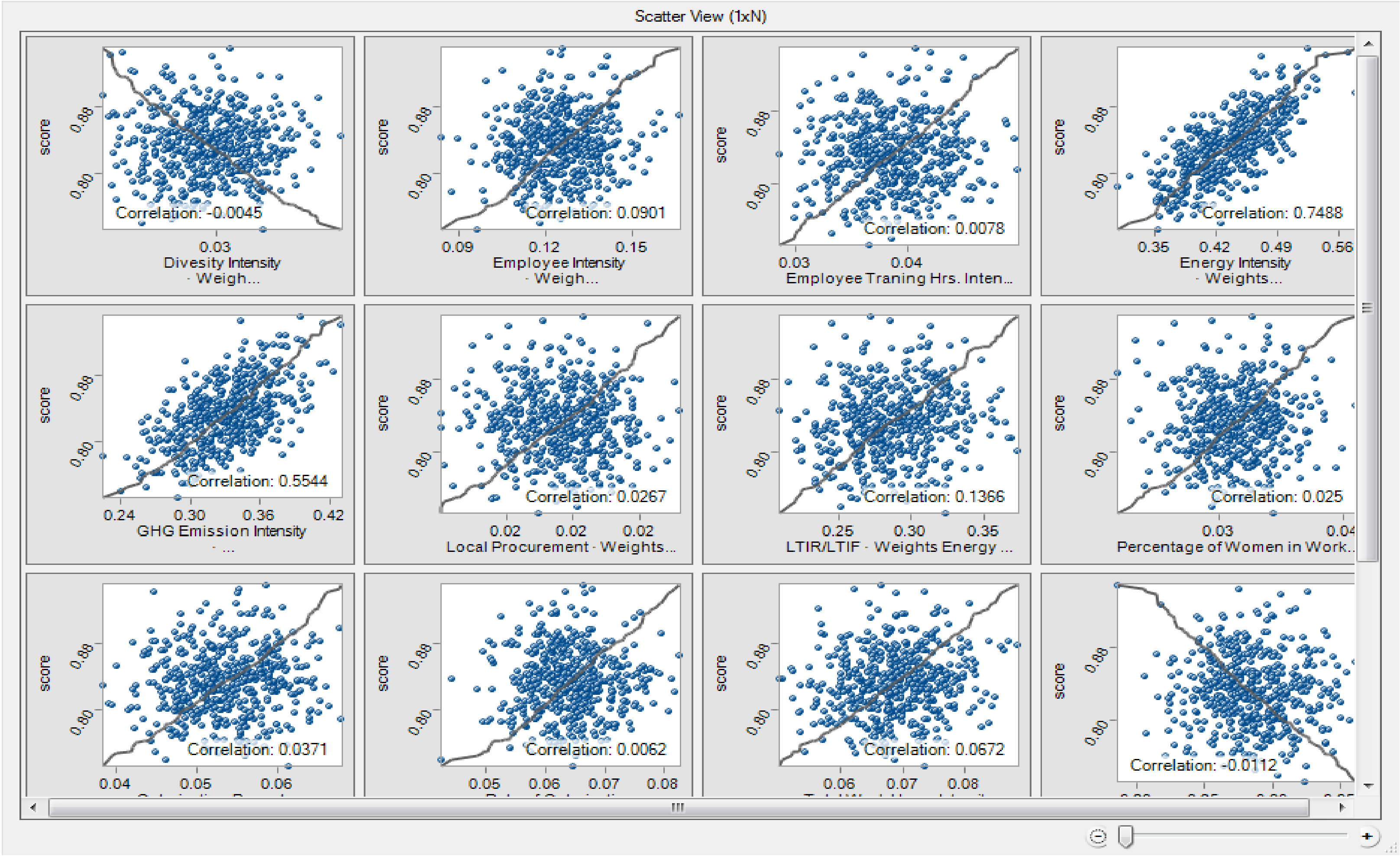
Std. Dev. 0.01



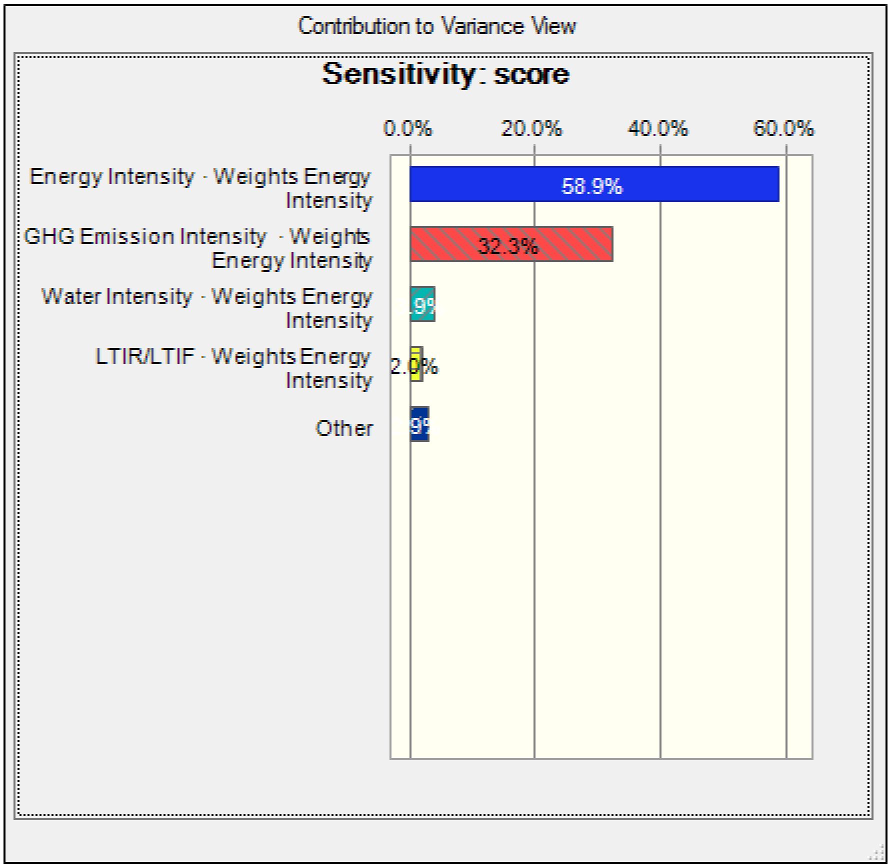
Forecasted scores



Scatter Chart



Sensitivity chart



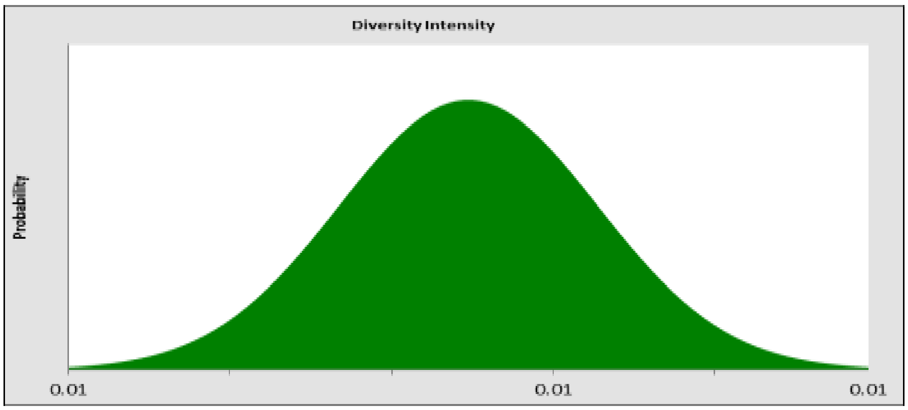
Maersk Oil: sub criteria scores

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

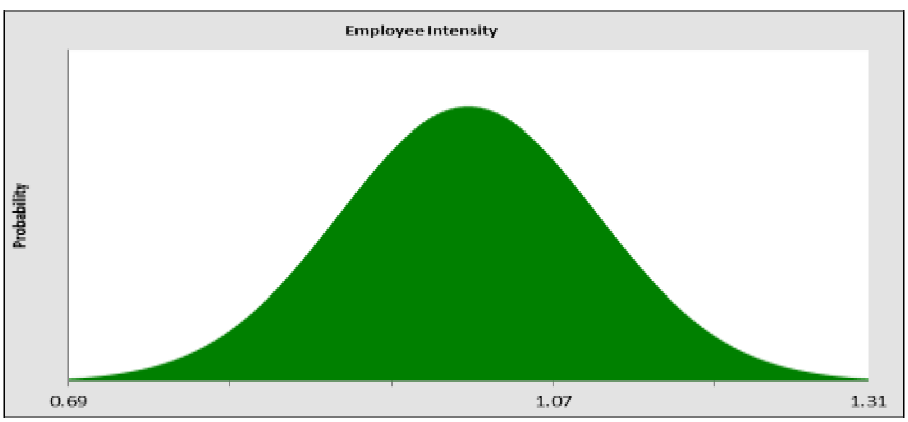
Mean	0.01
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	1.00
Std. Dev.	0.10

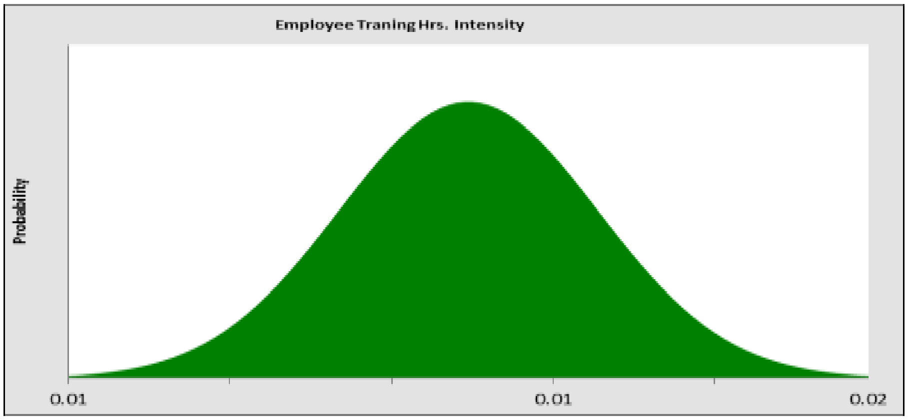


Assumption: Employee Traning Hrs. Intensity

Normal distribution with parameters:

Mean 0.01

Std. Dev. 0.00

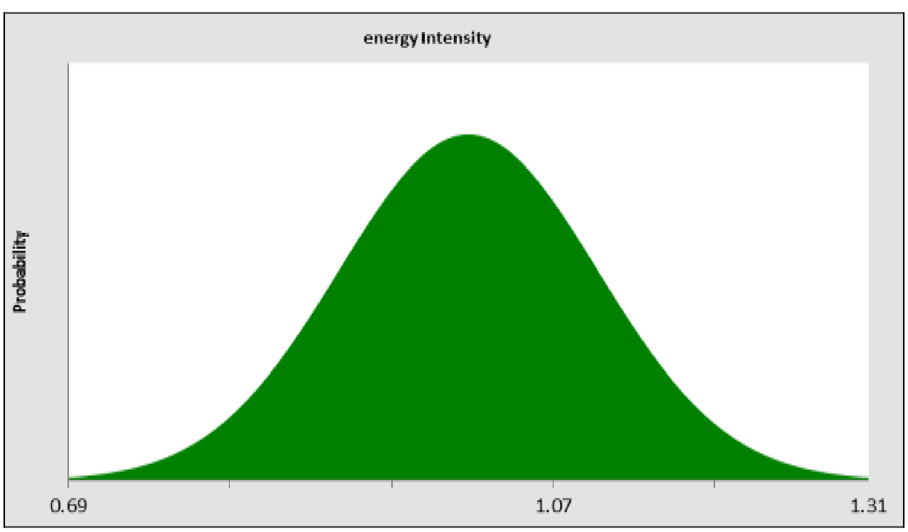


Assumption: energy Intensity

Normal distribution with parameters:

Mean 1.00

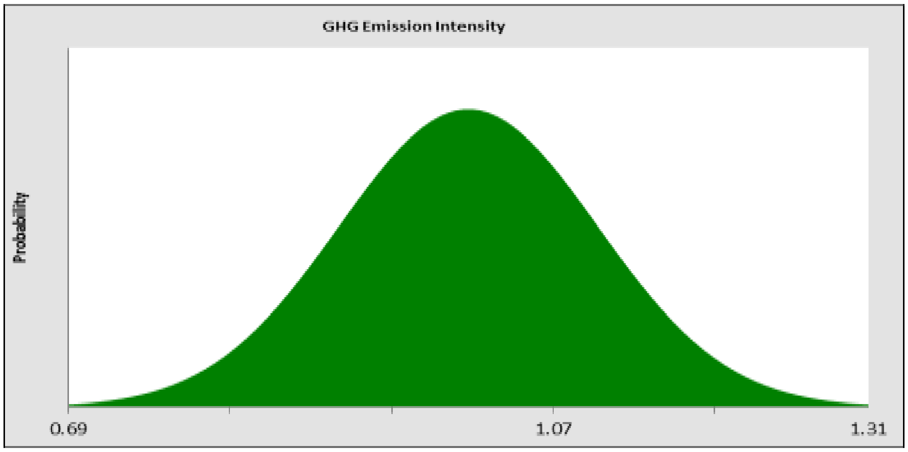
Std. Dev. 0.10



Assumption: GHG Emission Intensity

Normal distribution with parameters:

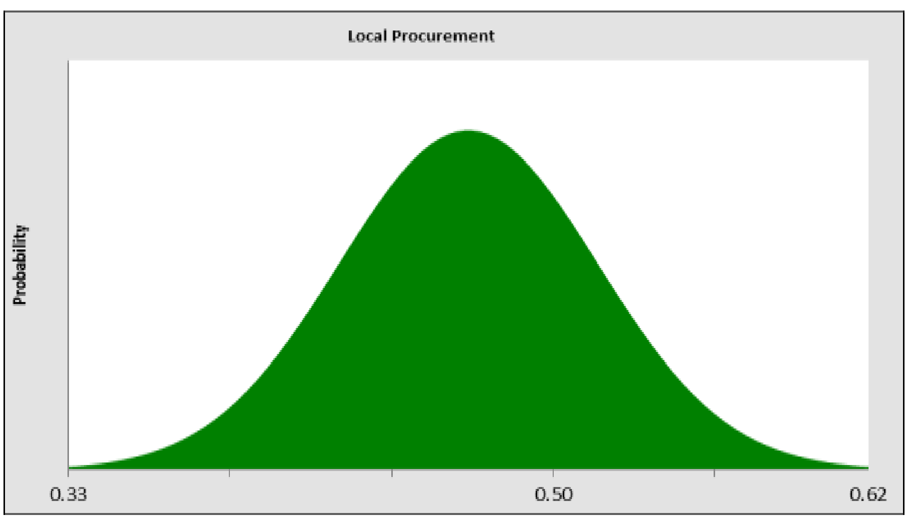
Mean	1.00
Std. Dev.	0.10



Assumption: Local Procurement

Normal distribution with parameters:

Mean	0.47
Std. Dev.	0.05

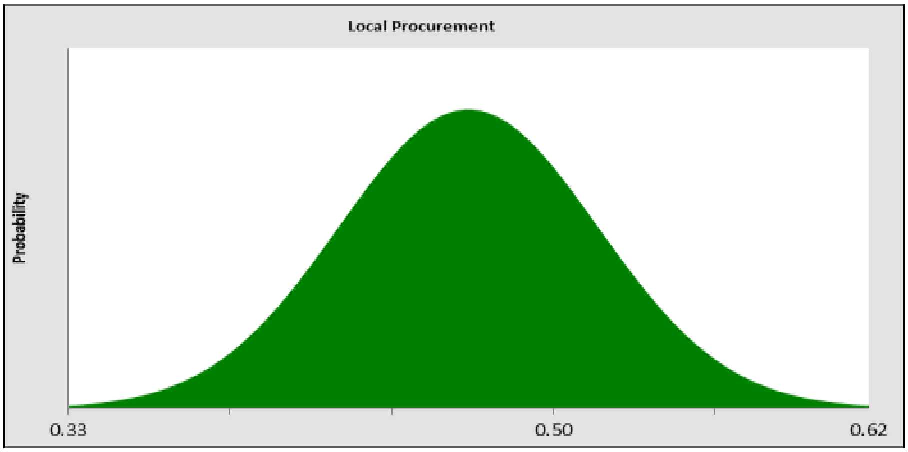


Assumption: LTIR

Normal distribution with parameters:

Mean 0.69

Std. Dev. 0.07

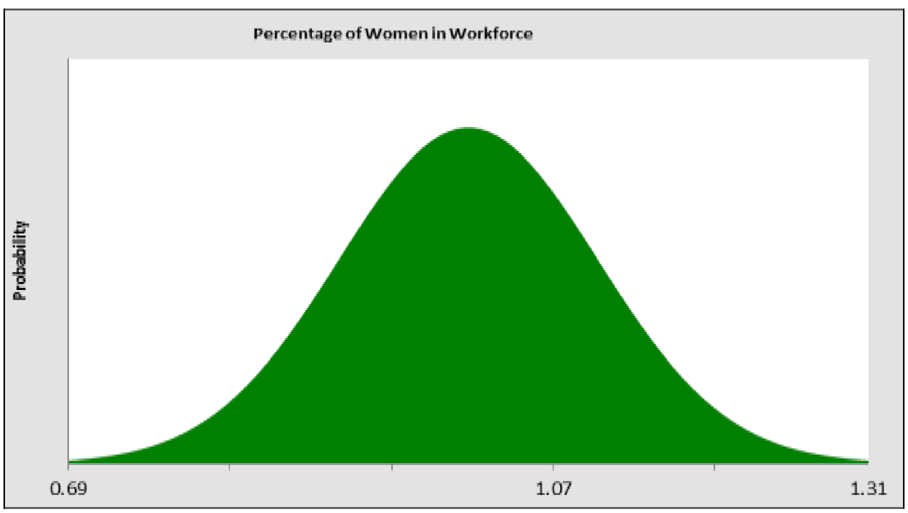


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 1.00

Std. Dev. 0.10

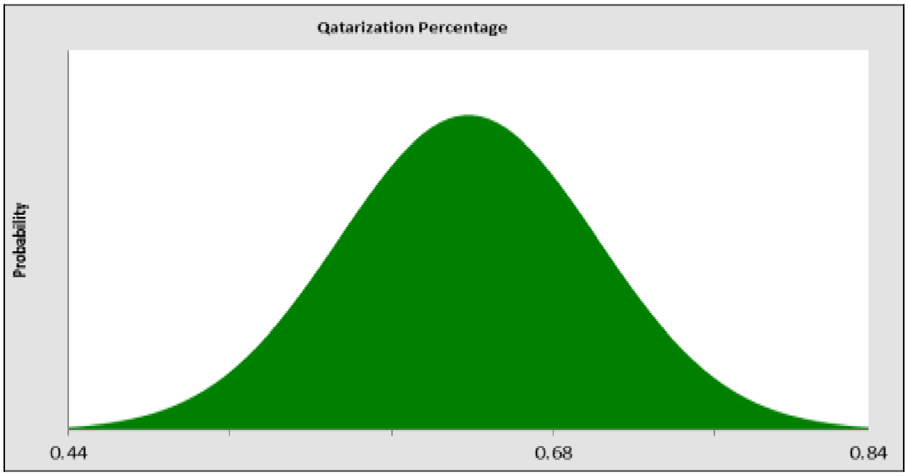


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.64

Std. Dev. 0.06

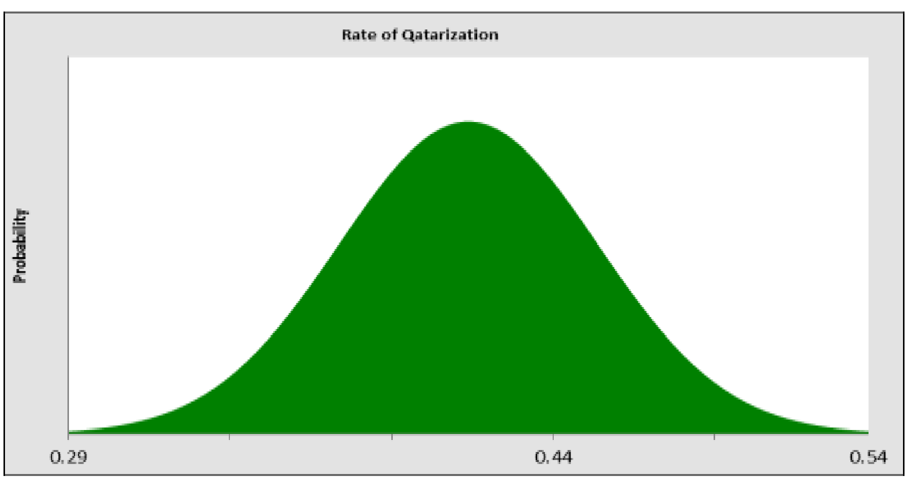


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.41

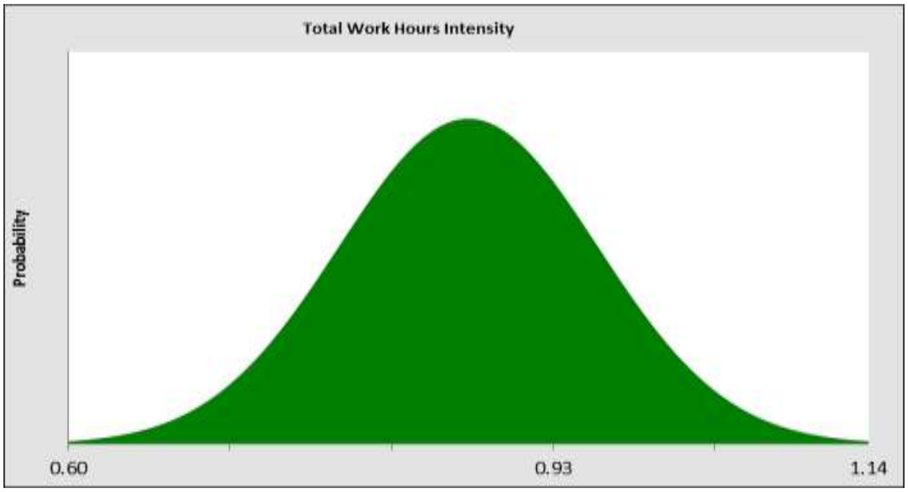
Std. Dev. 0.04



Assumption: Total Work Hours Intensity

Normal distribution with parameters:

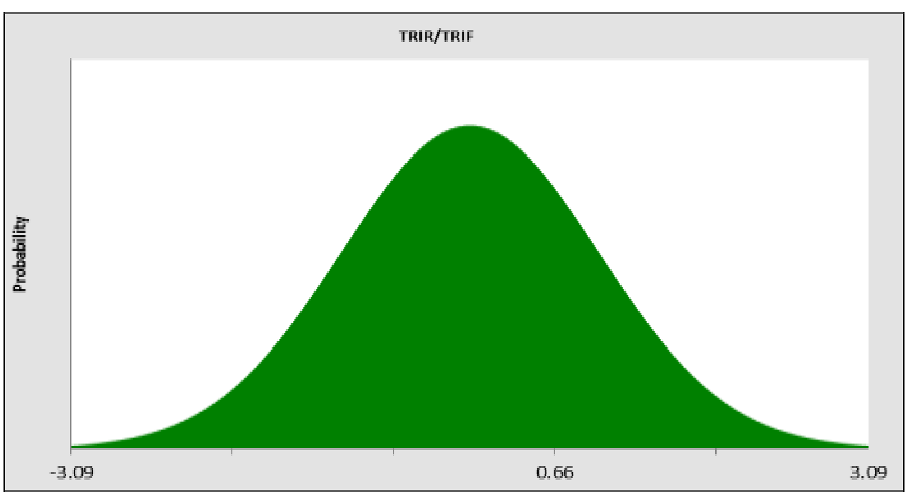
Mean	0.87
Std. Dev.	0.09



Assumption: TRIR

Normal distribution with parameters:

Mean	0.00
Std. Dev.	1.00

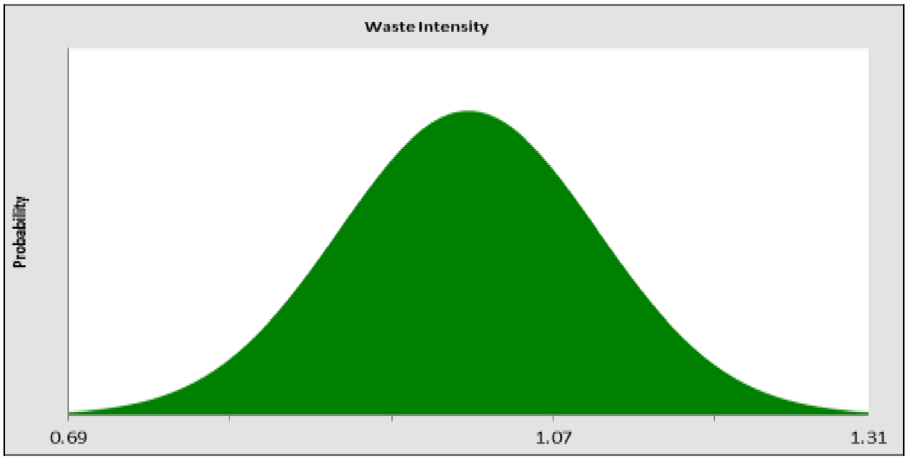


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 1.00

Std. Dev. 0.10

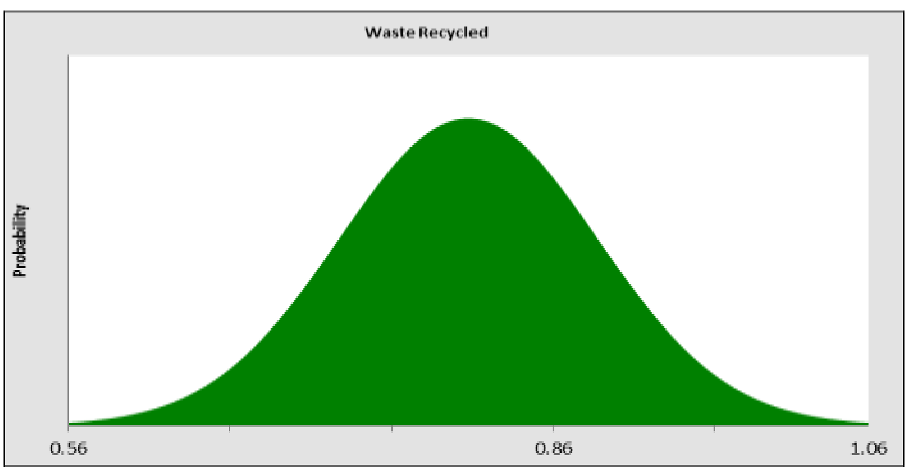


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.81

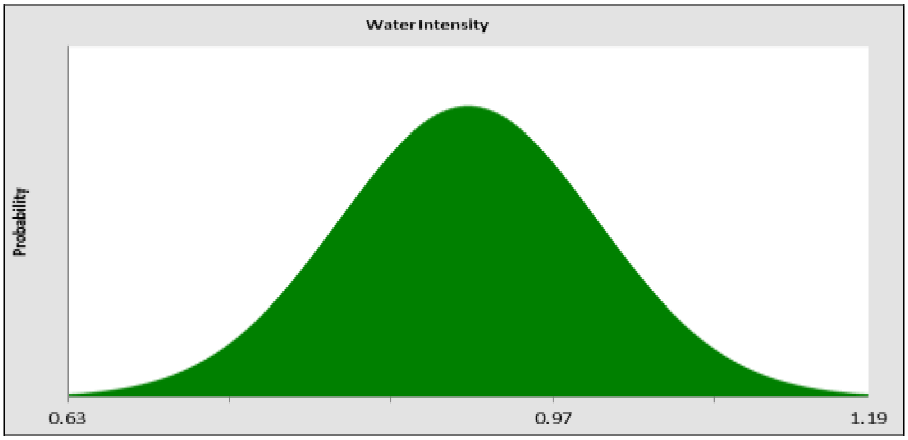
Std. Dev. 0.08



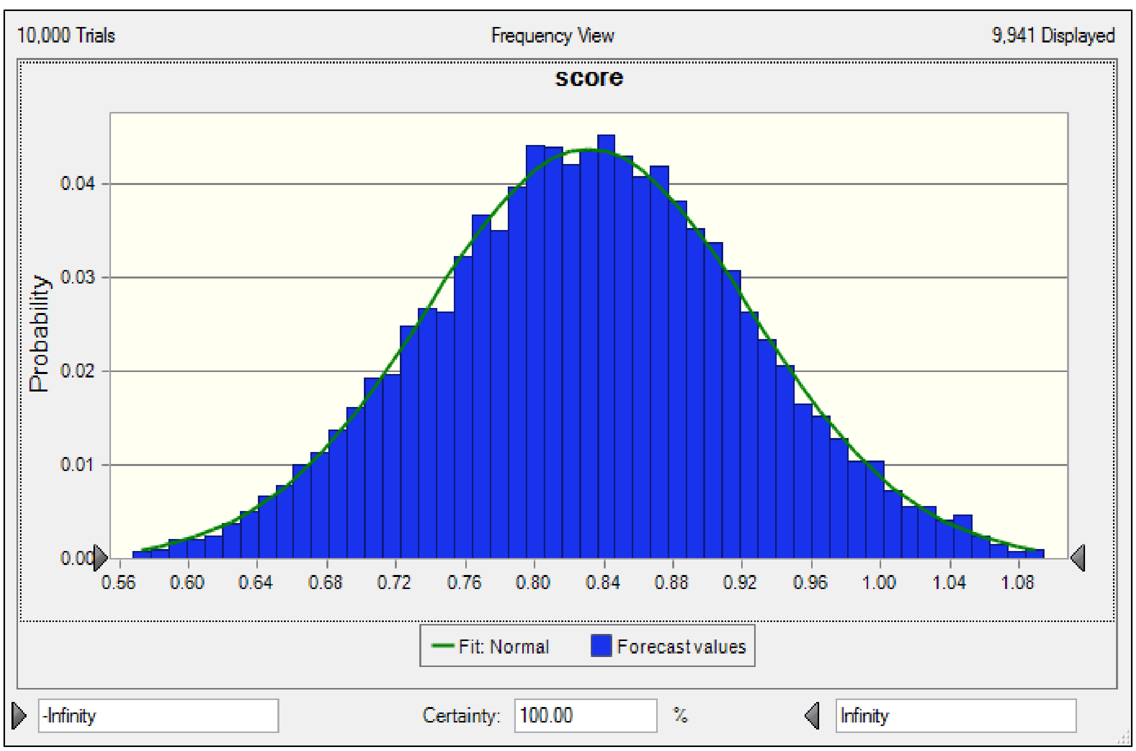
Assumption: Water Intensity

Normal distribution with parameters:

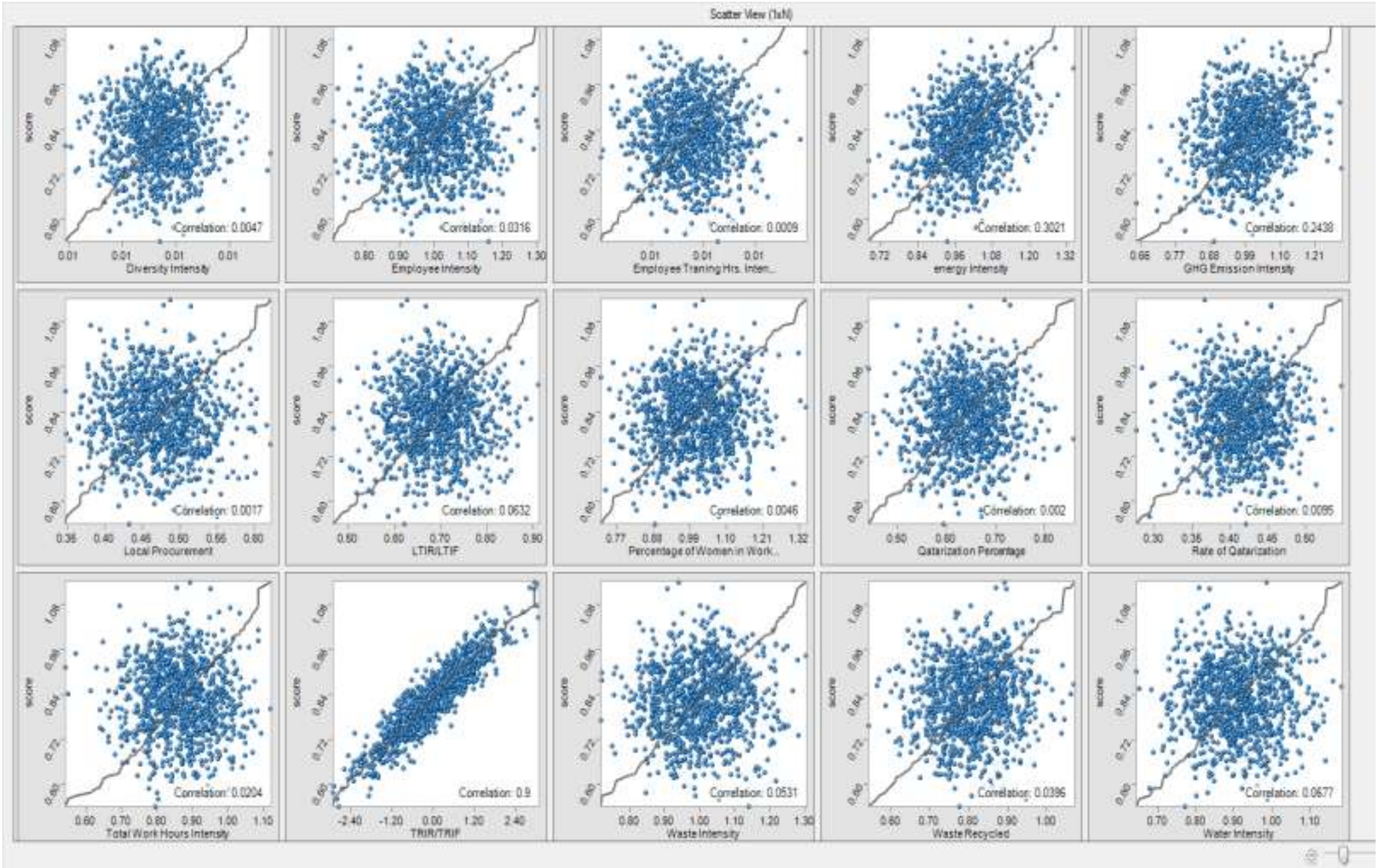
Mean	0.91
Std. Dev.	0.09



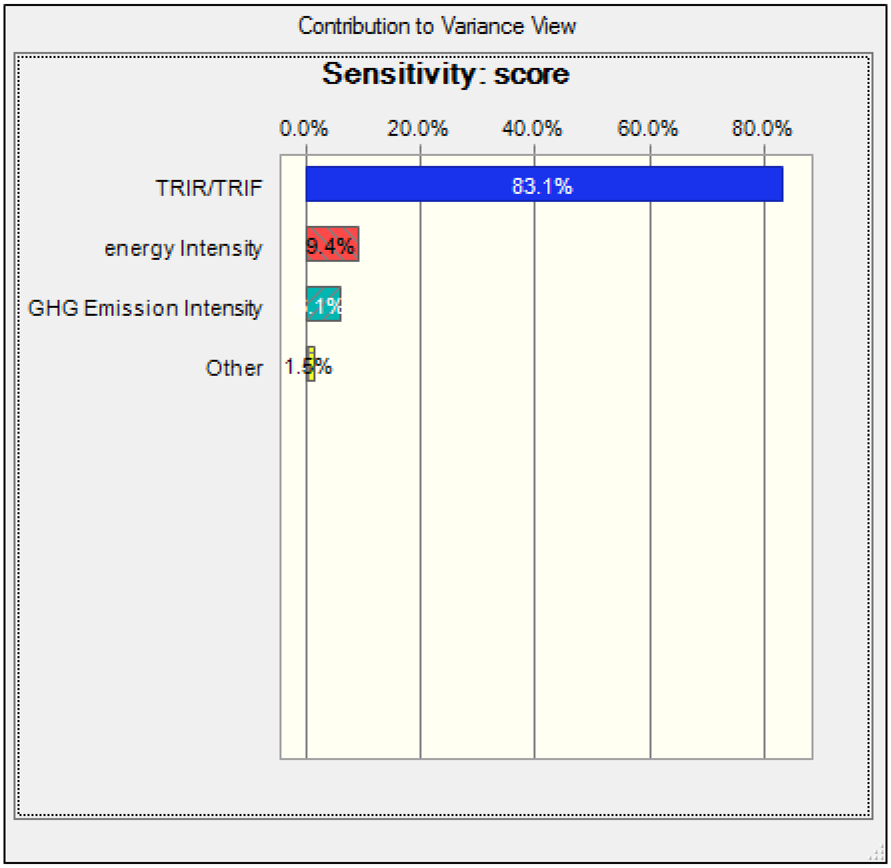
Forecasted score



Scatter Chart

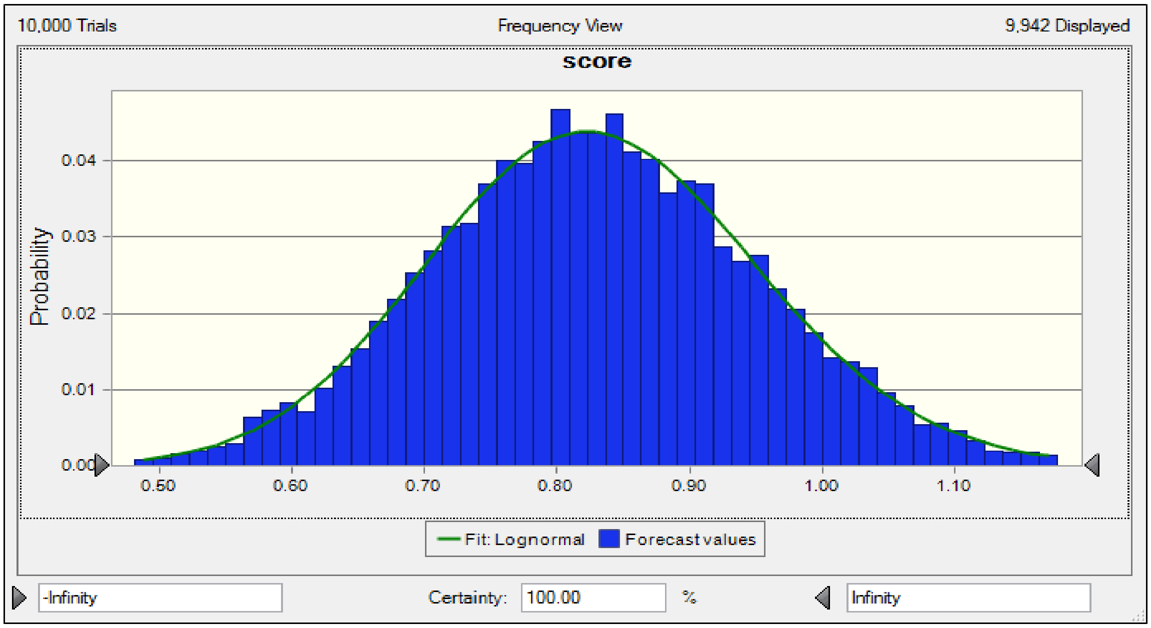


Sensitivity chart

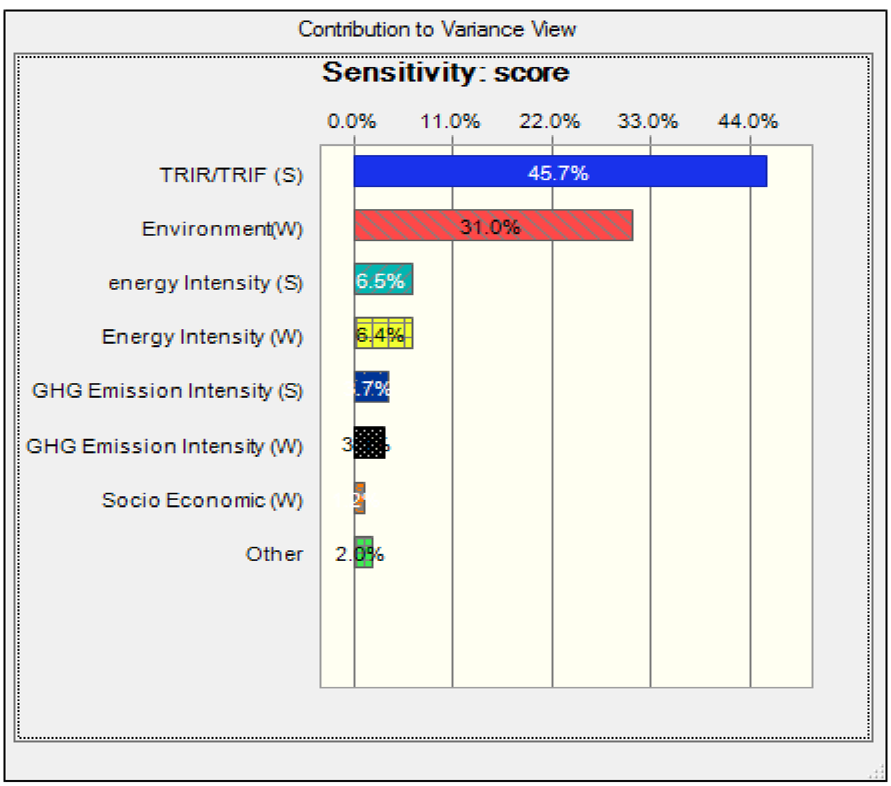


Maersk Oil: All Uncertainties (Weights and Scores)

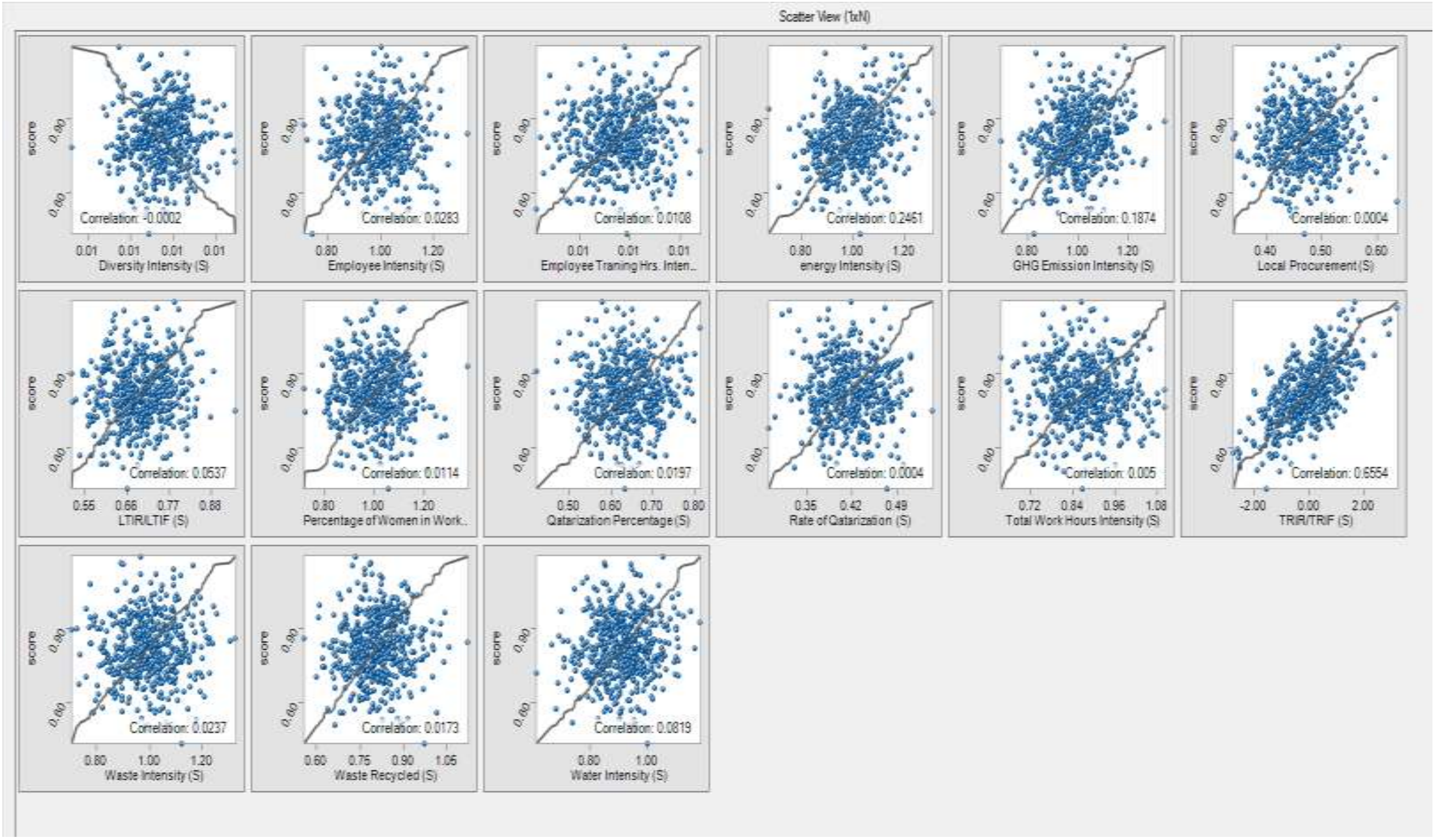
Forecasted scores

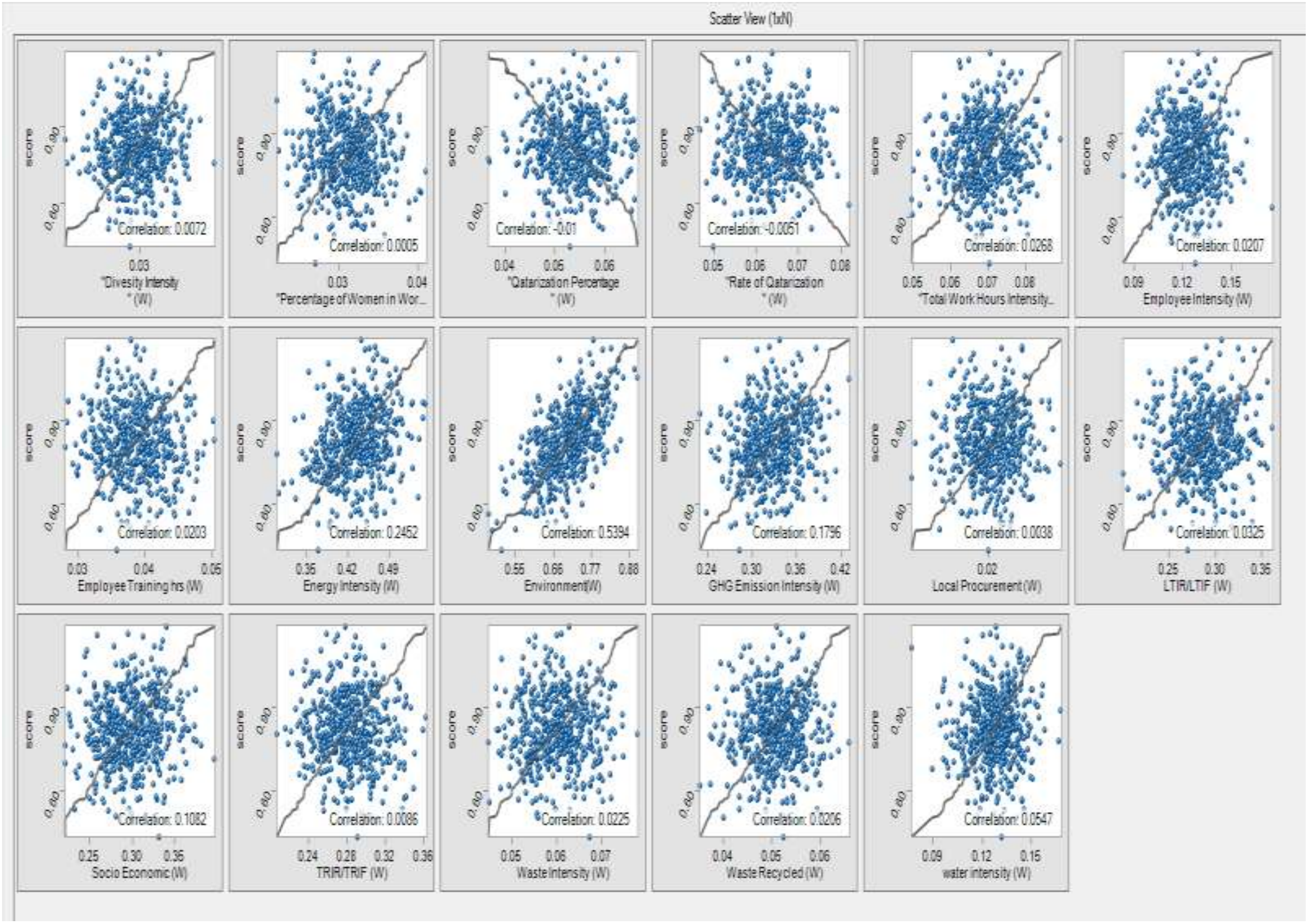


Sensitivity Chart

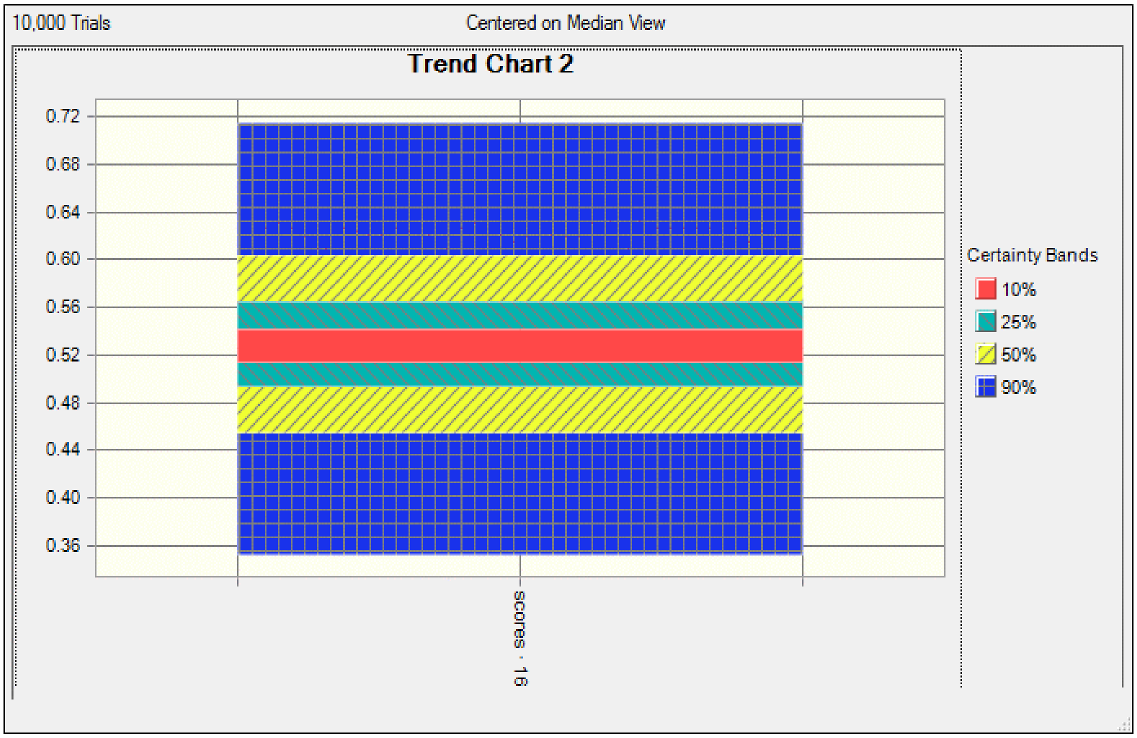


Scatter Charts




Scatter View (1xN)
Correlation: 0.0072
"Divesity Intensity
" (W)
Correlation: 0.0005
"Percentage of Women in Wor...
Correlation: -0.01
"Qatarization Percentage
" (W)
Correlation: -0.0051
"Rate of Qatarization
" (W)
Correlation: 0.0268
"Total Work Hours Intensity...
Correlation: 0.0207
Employee Intensity (W)
Correlation: 0.0203
Employee Training hrs (W)
Correlation: 0.2452
Energy Intensity (W)
Correlation: 0.5394
Environment(W)
Correlation: 0.1796
GHG Emission Intensity (W)
Correlation: 0.0038
Local Procurement (W)
Correlation: 0.0325
LTIR/LTIF (W)
Correlation: 0.1082
Socio Economic (W)
Correlation: 0.0086
TRIR/TRIF (W)
Correlation: 0.0225
Waste Intensity (W)
Correlation: 0.0206
Waste Recycled (W)
Correlation: 0.0547
water intensity (W)

Trend Chart



10,000 Trials
Centered on Median View
Trend Chart 2
0.72
0.68
0.64
0.60
0.56
0.52
0.48
0.44
0.40
0.36
scores - 16
Certainty Bands
10%
25%
50%
90%

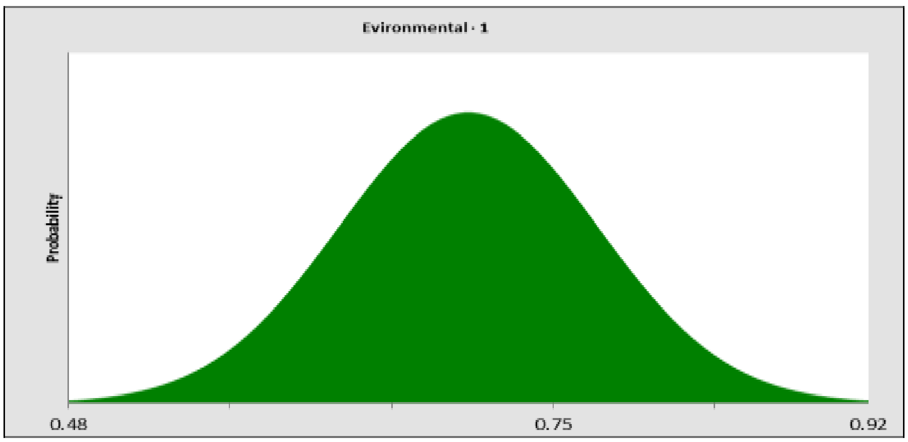
ORYX GTL: Main criteria Weights

Assumptions

Assumption: Environmental · 1

Normal distribution with parameters:

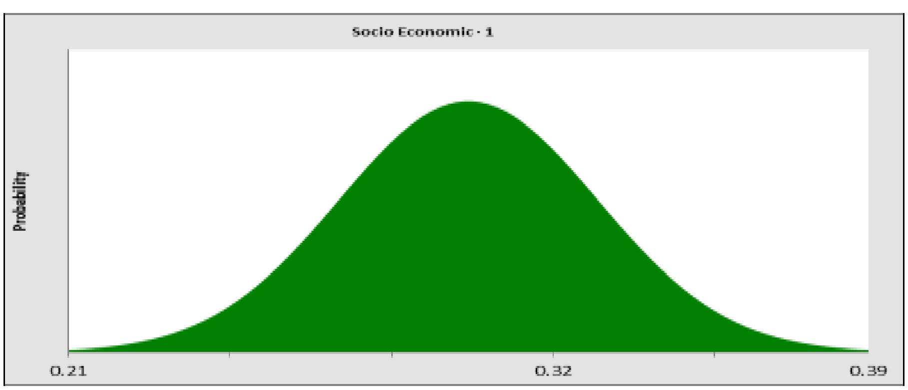
Mean	0.70
Std. Dev.	0.07



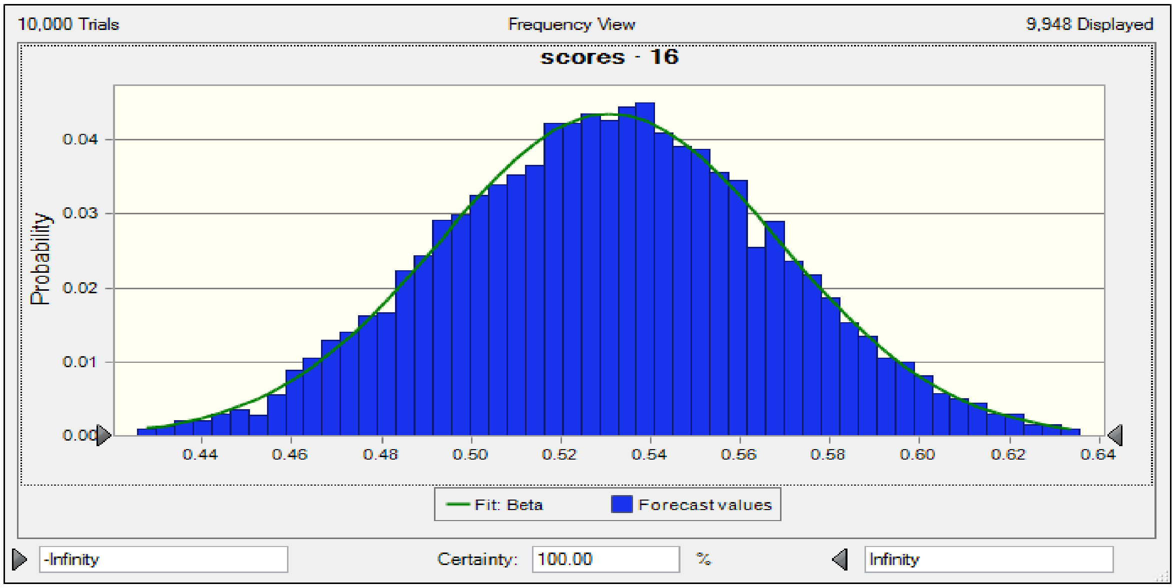
Assumption: Socio Economic · 1

Normal distribution with parameters:

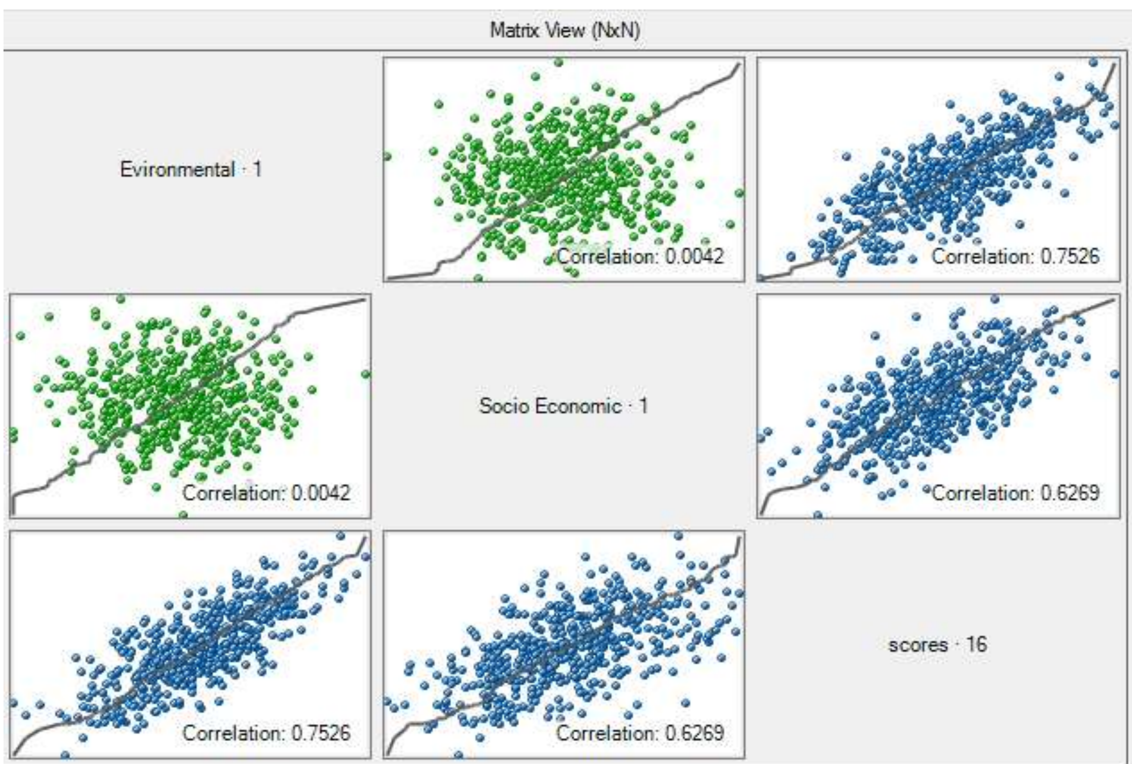
Mean	0.30
Std. Dev.	0.03



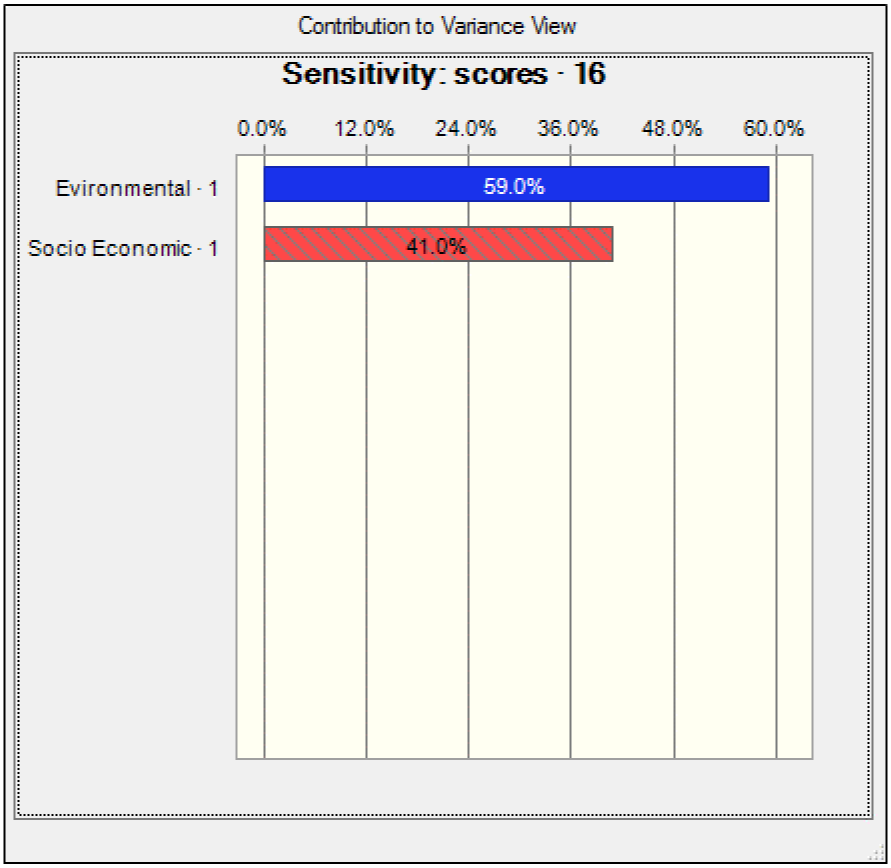
Forecasted Scores:



Scatter Charts



Sensitivity Chart



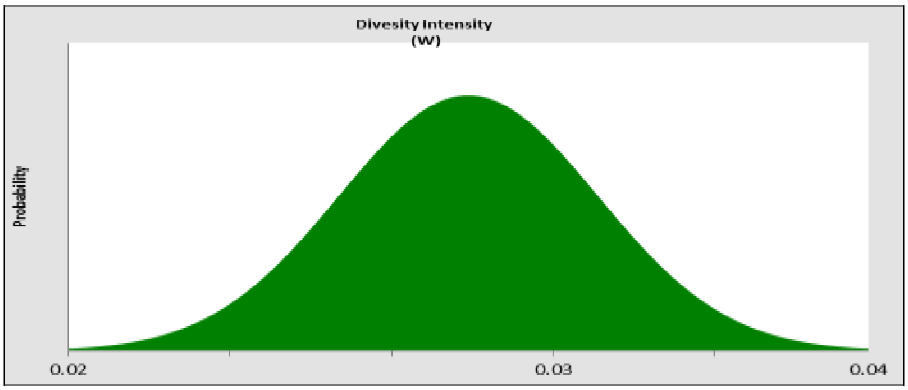
ORYX GTL: Sub Criteria Weights

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

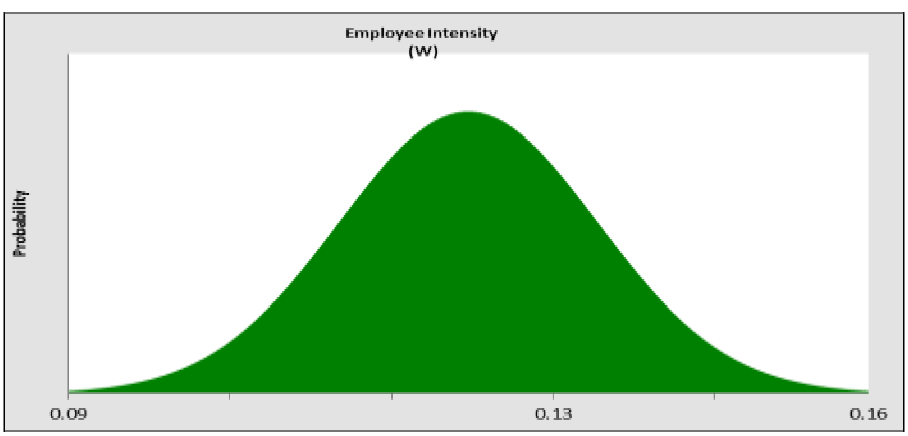
Mean	0.03
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

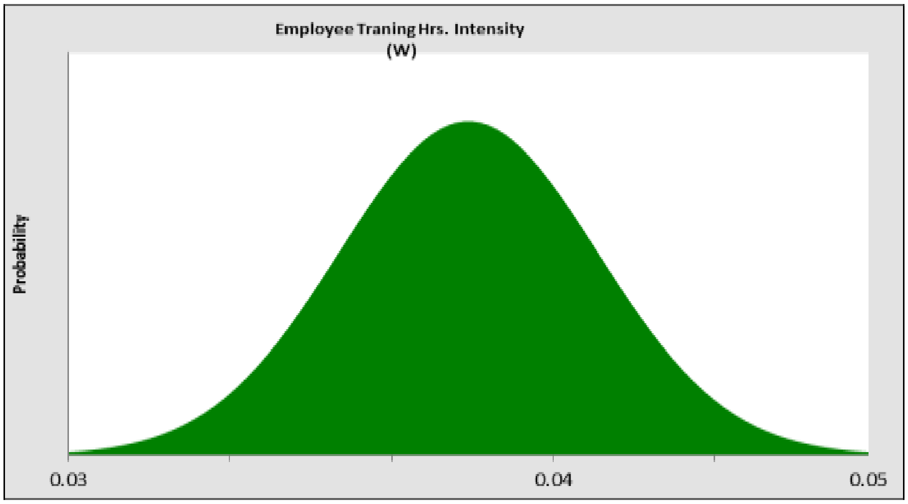
Mean	0.12
Std. Dev.	0.01



Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

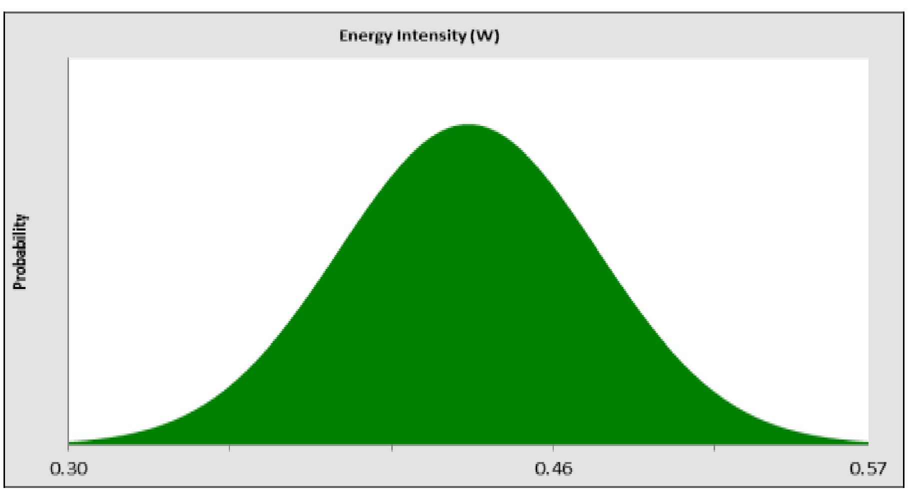
Mean	0.04
Std. Dev.	0.00



Assumption: Energy Intensity

Normal distribution with parameters:

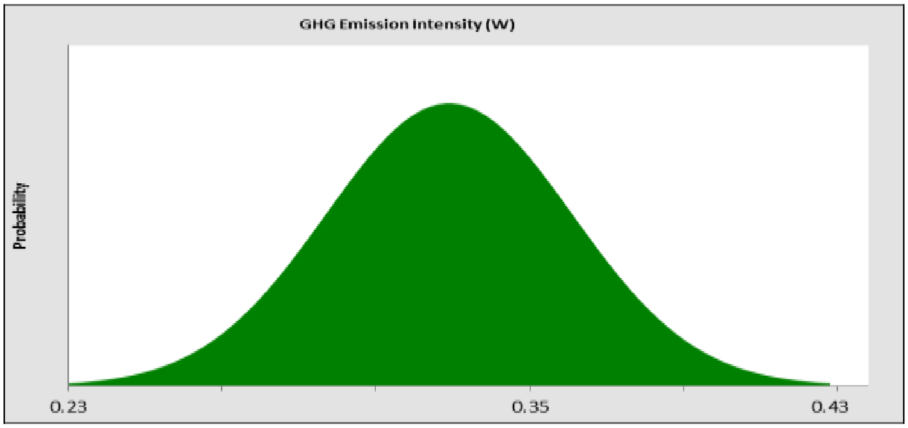
Mean	0.43
Std. Dev.	0.04



Assumption: GHG Emission Intensity

Normal distribution with parameters:

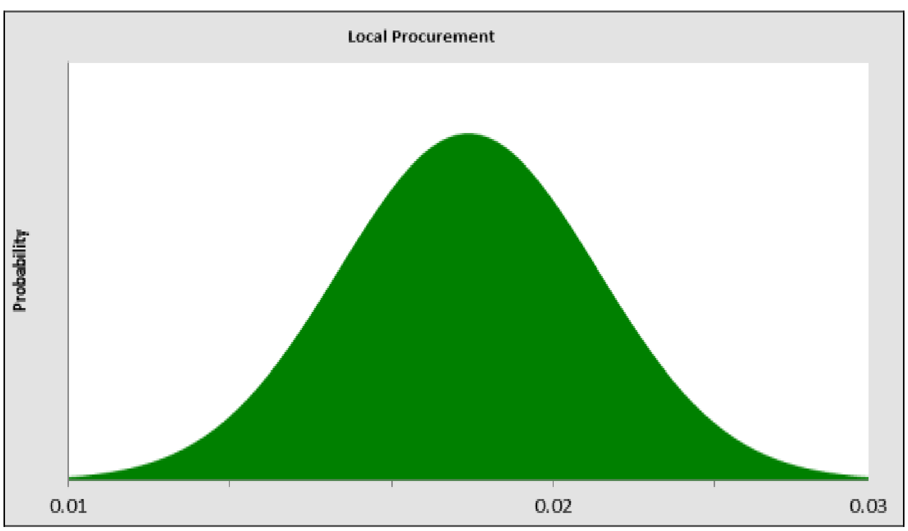
Mean	0.33
Std. Dev.	0.03



Assumption: Local Procurement

Normal distribution with parameters:

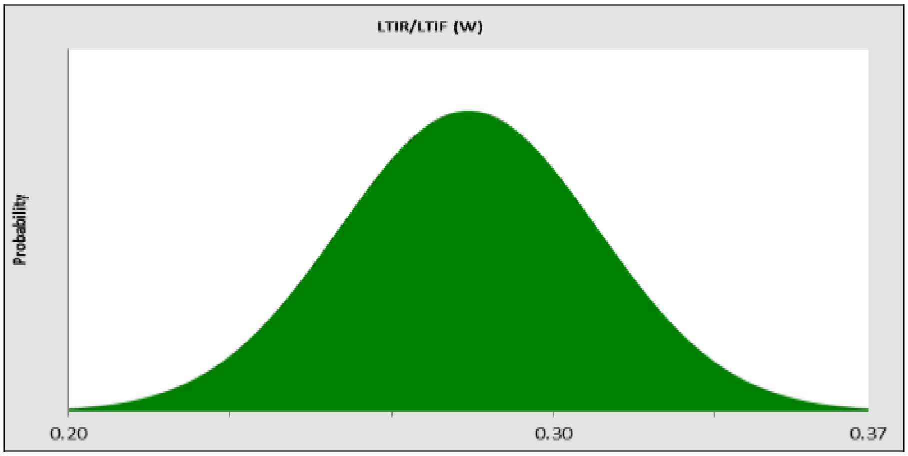
Mean	0.02
Std. Dev.	0.00



Assumption: LTIR

Normal distribution with parameters:

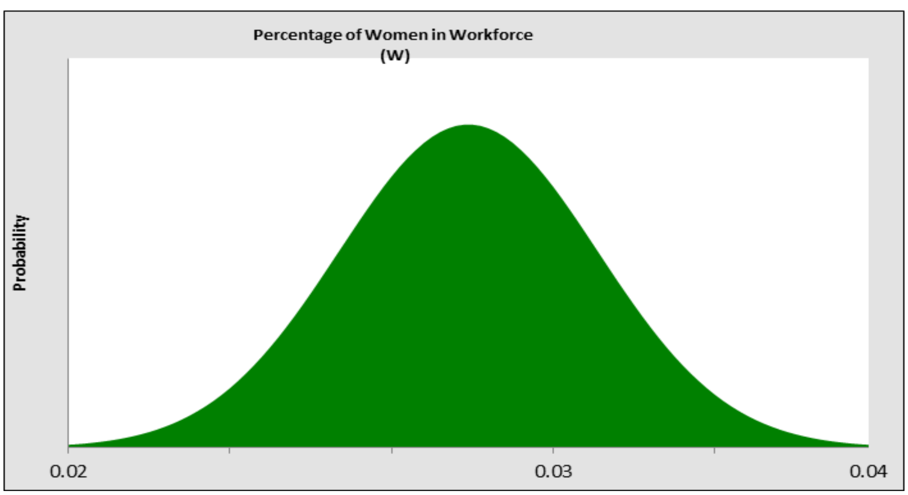
Mean	0.28
Std. Dev.	0.03



Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean	0.03
Std. Dev.	0.00

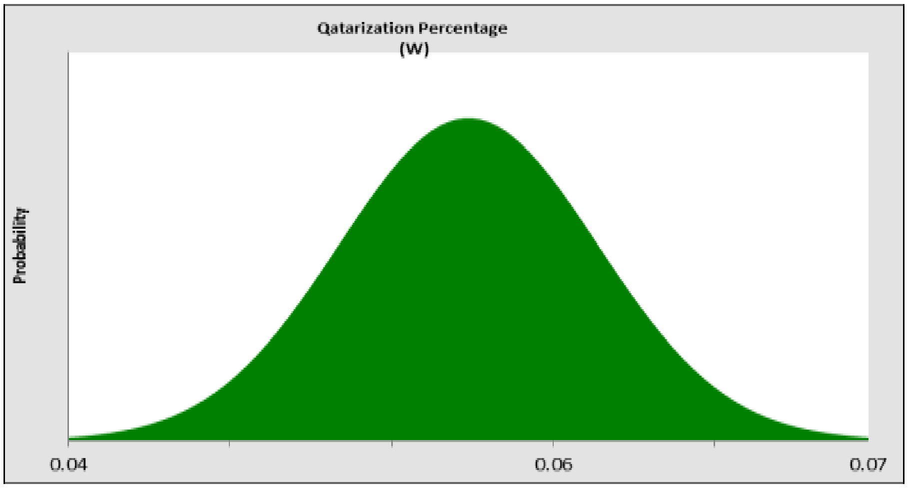


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.05

Std. Dev. 0.01

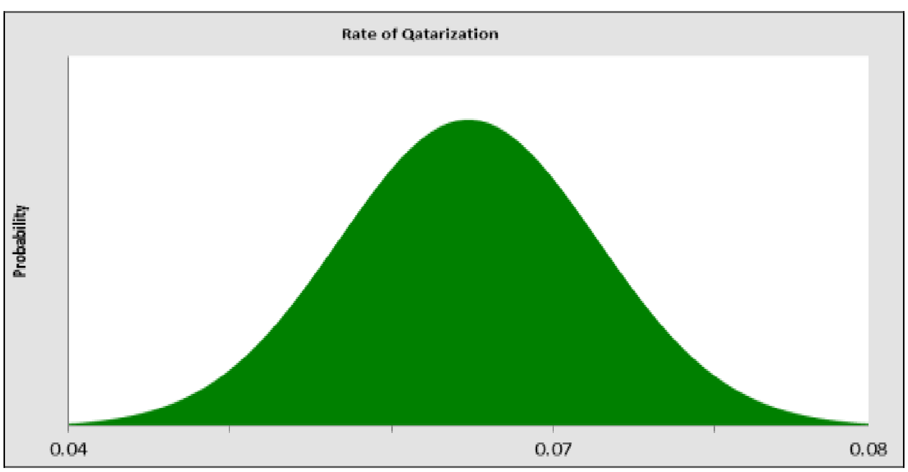


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

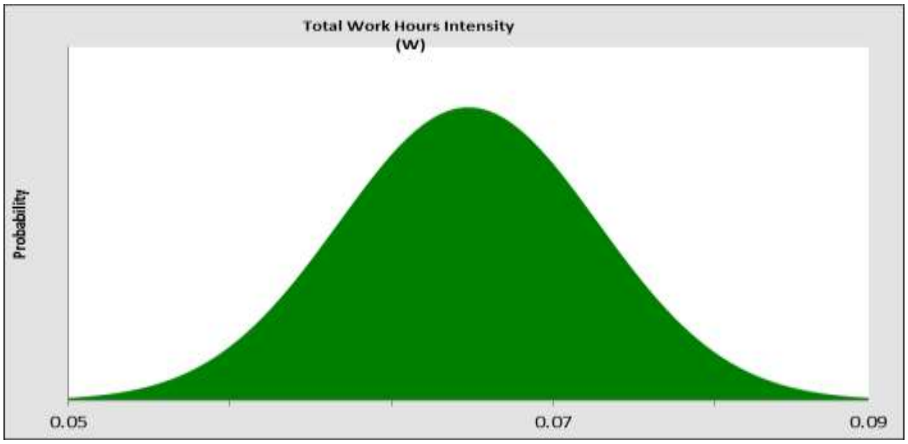


Assumption: Total Work Hours Intensity

Normal distribution with parameters:

Mean 0.07

Std. Dev. 0.01

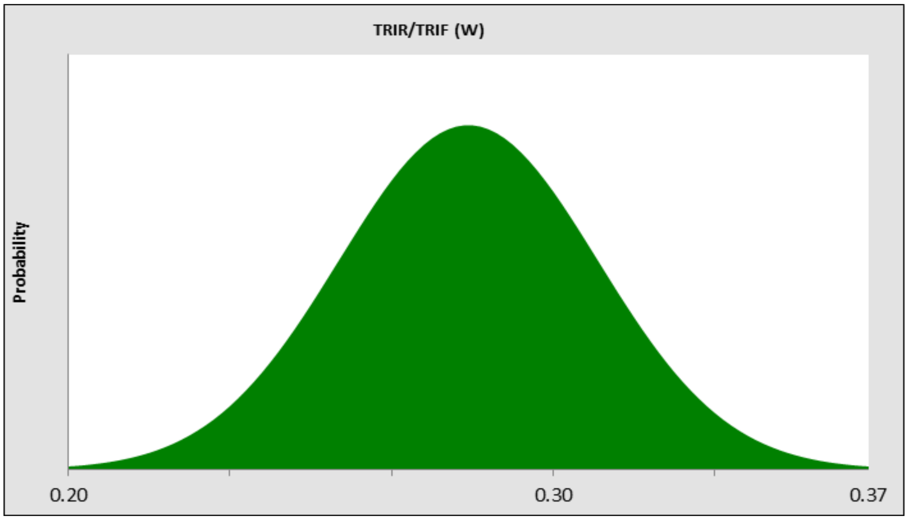


Assumption: TRIR

Normal distribution with parameters:

Mean 0.28

Std. Dev. 0.03

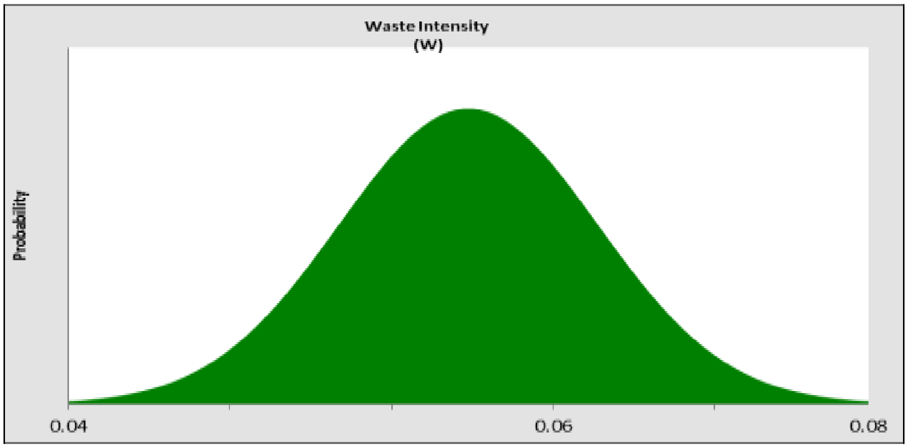


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

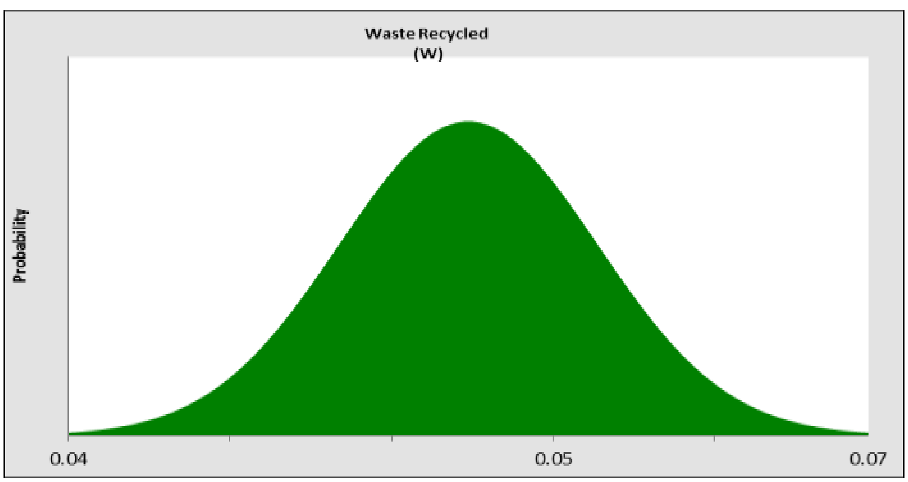


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.05

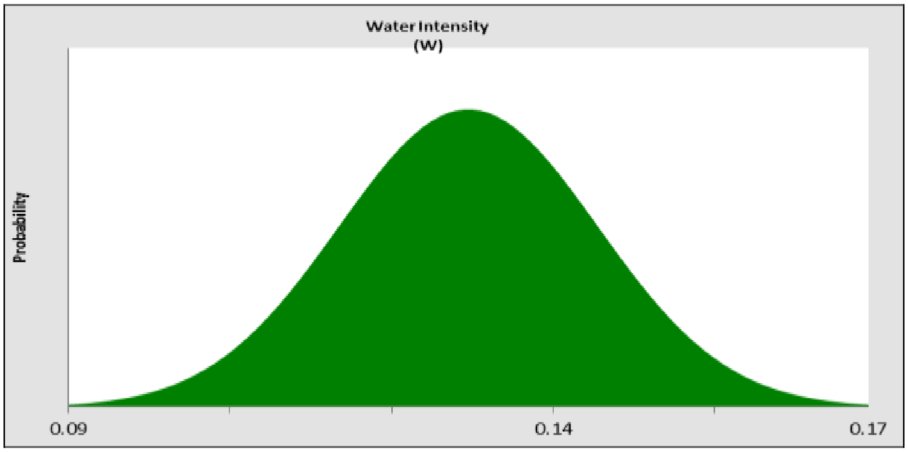
Std. Dev. 0.01



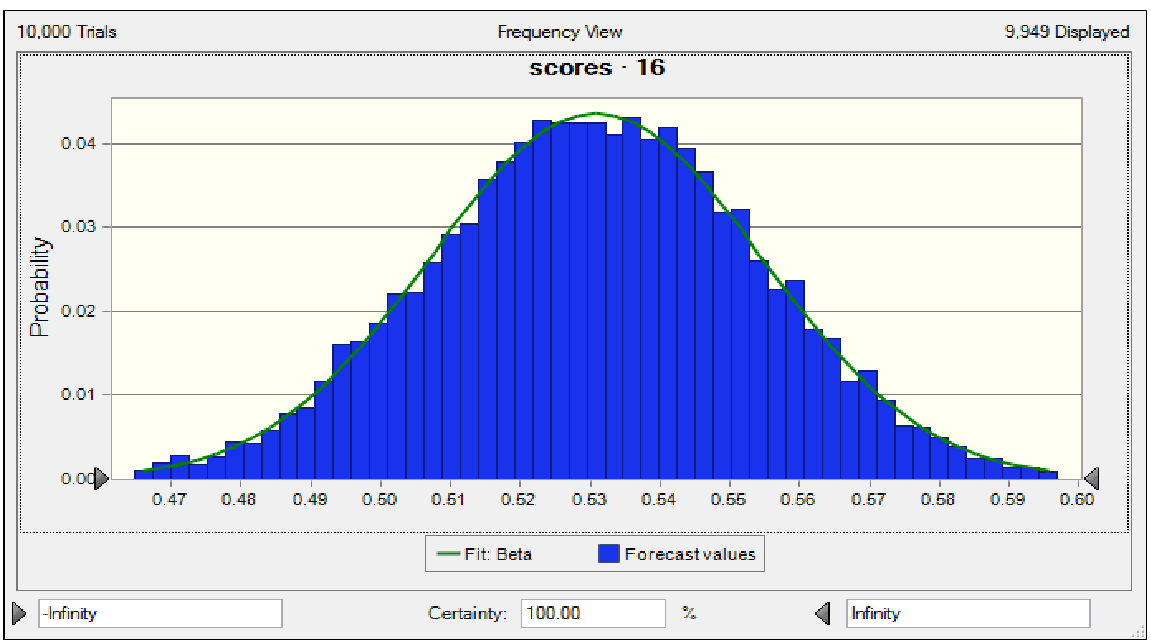
Assumption: Water Intensity

Normal distribution with parameters:

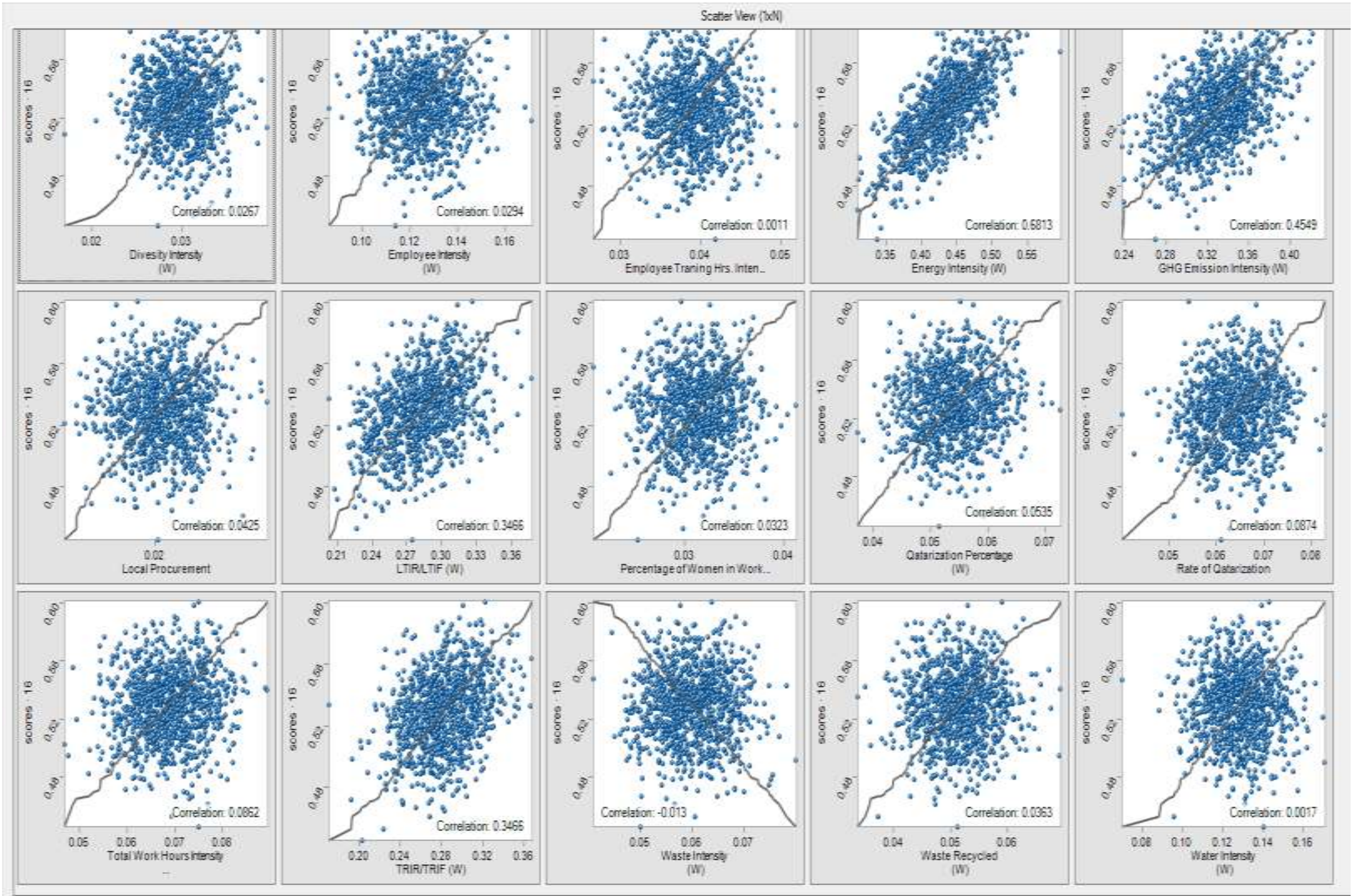
Mean	0.13
Std. Dev.	0.01



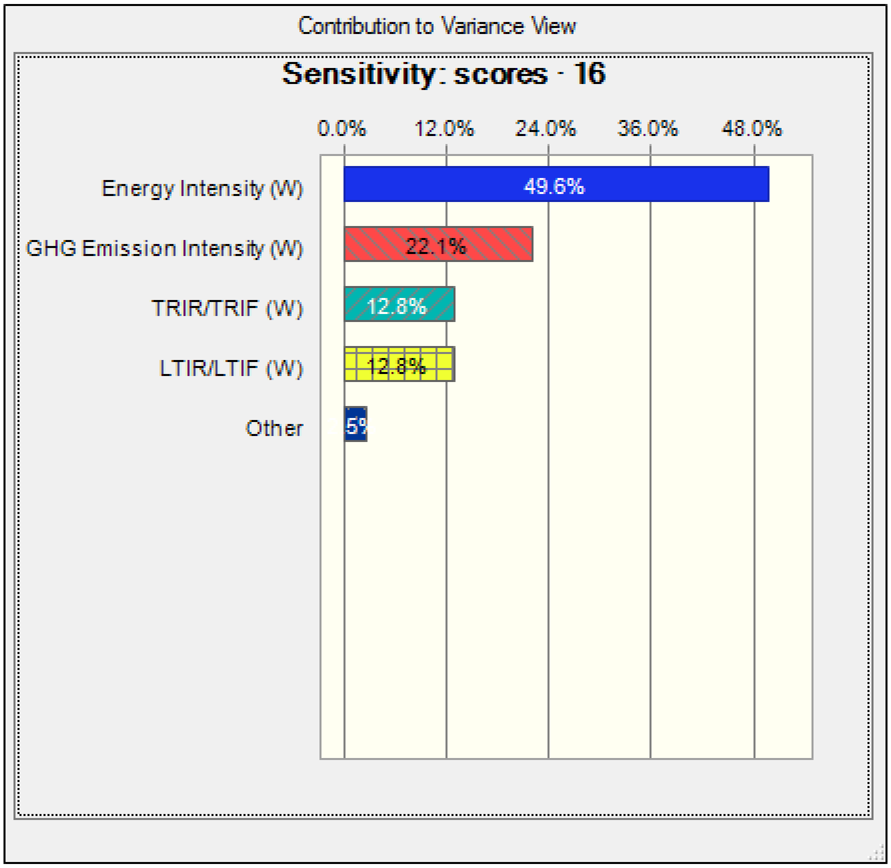
Forecasted Scores:



Scatter Charts



Sensitivity Chart



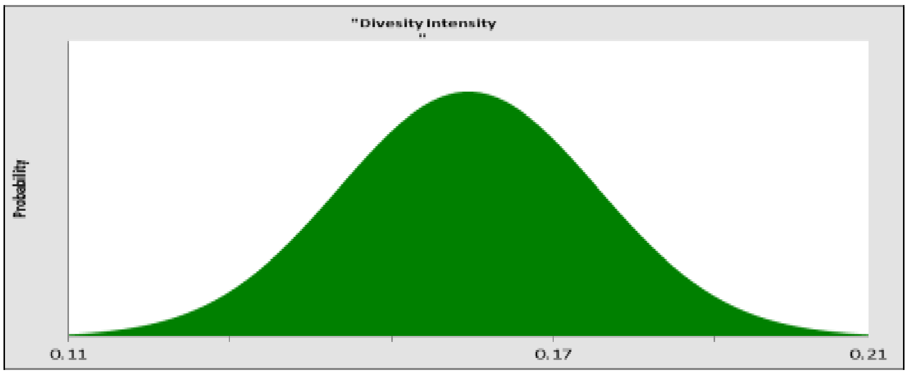
ORYX GTL: Sub Criteria Scores

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

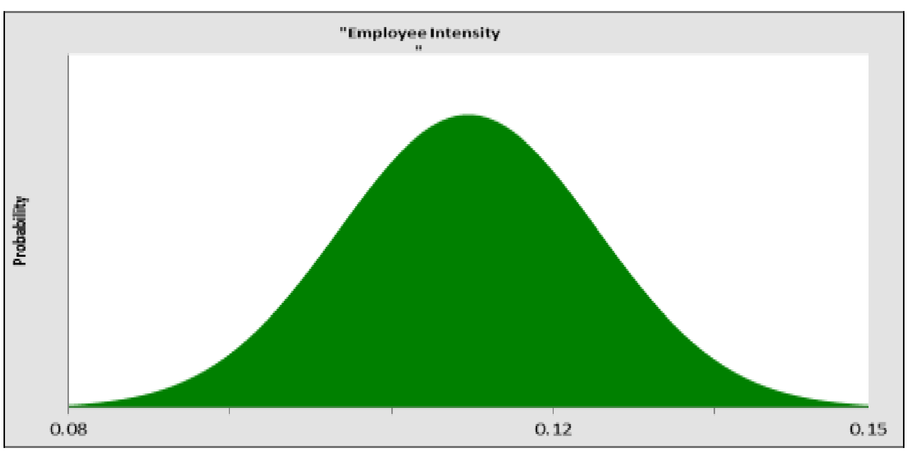
Mean	0.16
Std. Dev.	0.02



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	0.11
Std. Dev.	0.01

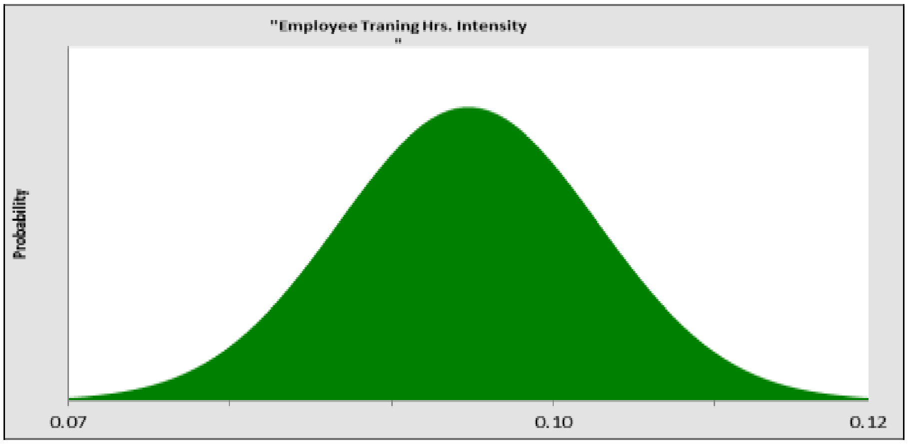


Assumption: Employee Training Hours Intensity

Normal distribution with parameters:

Mean 0.10

Std. Dev. 0.01

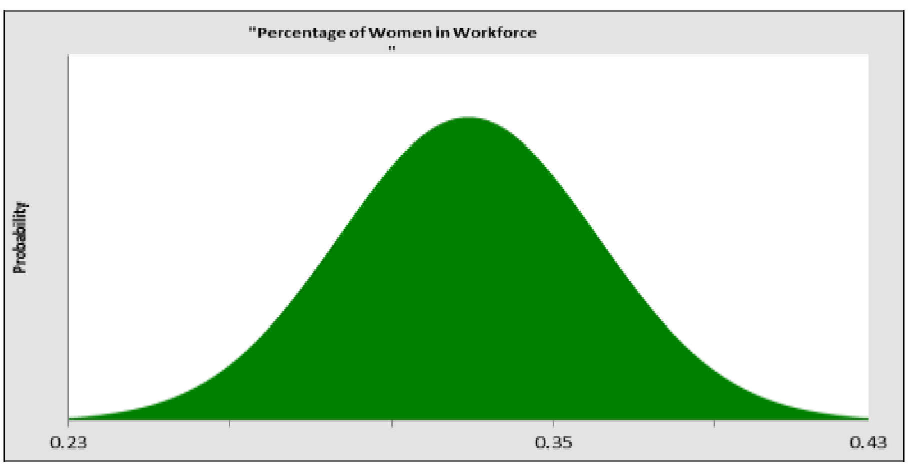


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 0.33

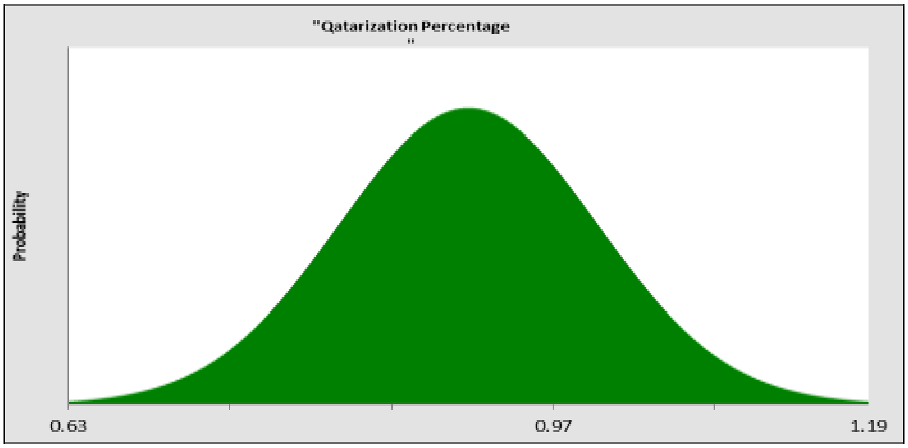
Std. Dev. 0.03



Assumption: Qatarization Percentage

Normal distribution with parameters:

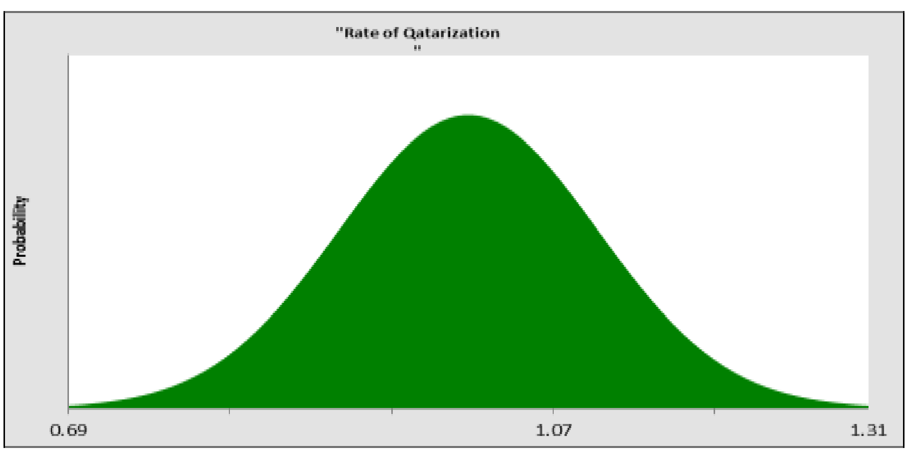
Mean	0.91
Std. Dev.	0.09



Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean	1.00
Std. Dev.	0.10

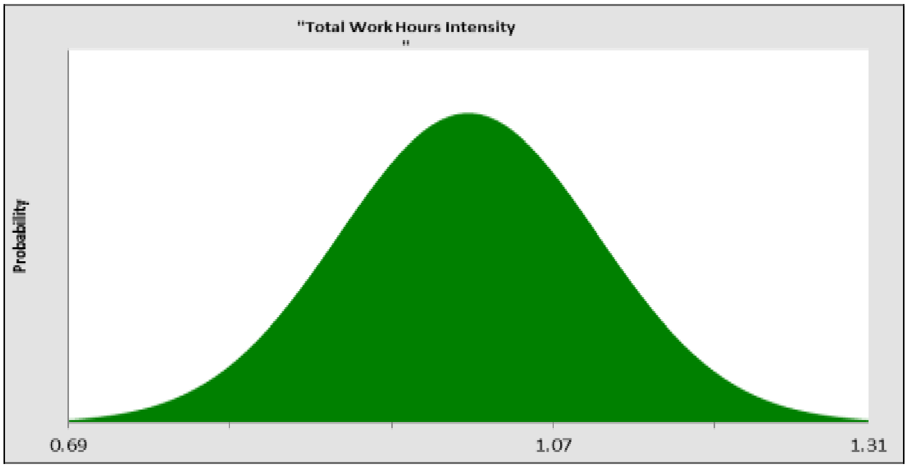


Assumption: Total Work Hours Intensity

Normal distribution with parameters:

Mean 1.00

Std. Dev. 0.10

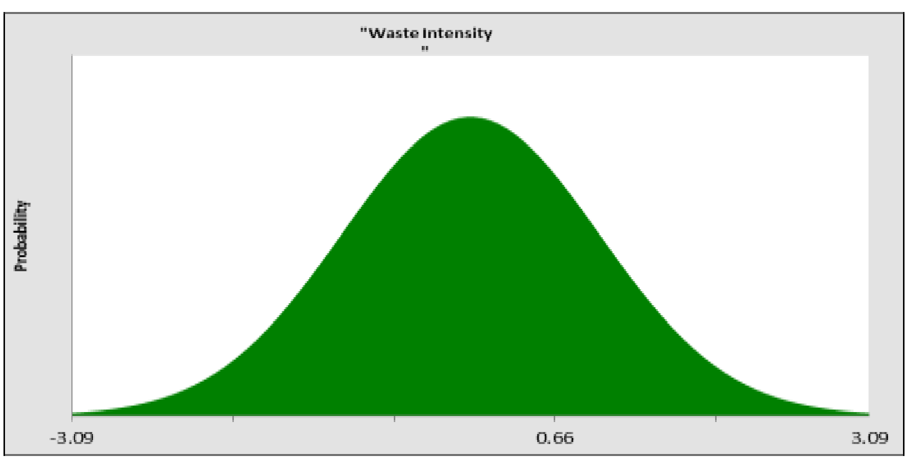


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

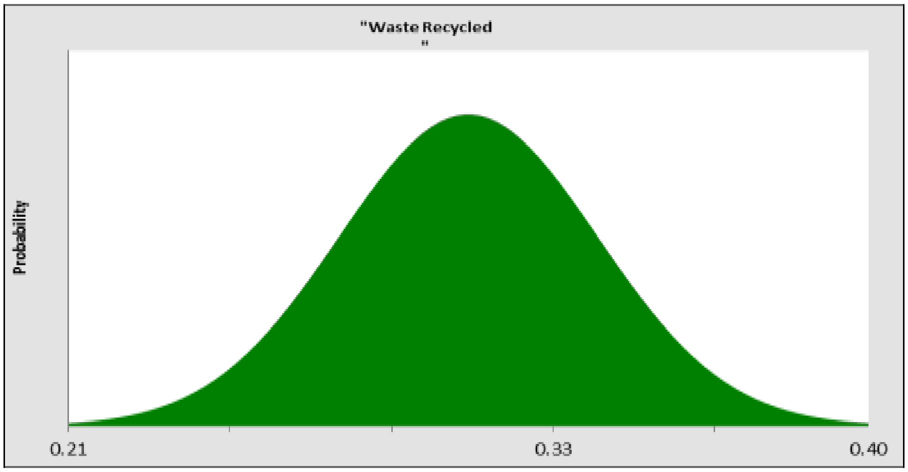


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.31

Std. Dev. 0.03

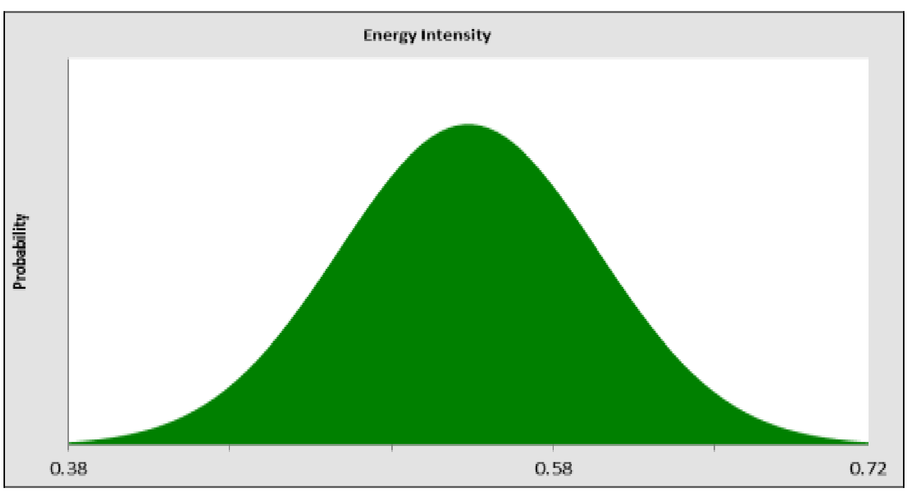


Assumption: Energy Intensity

Normal distribution with parameters:

Mean 0.00

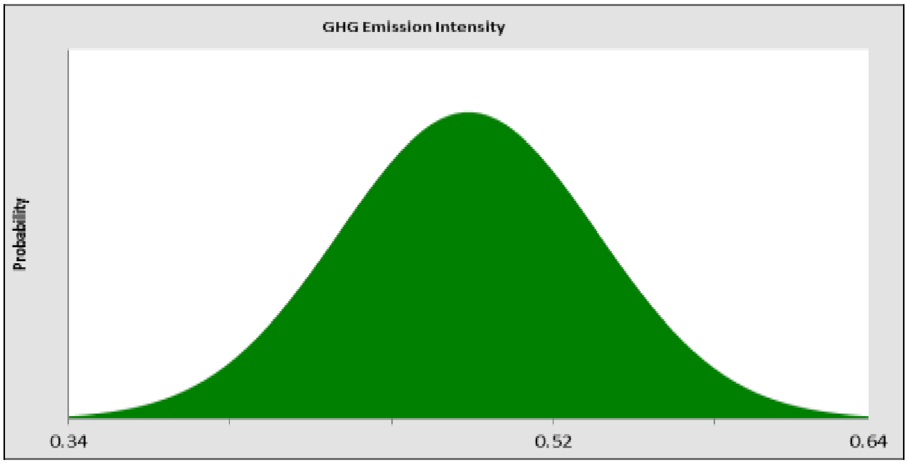
Std. Dev. 1.00



Assumption: GHG Emission Intensity

Normal distribution with parameters:

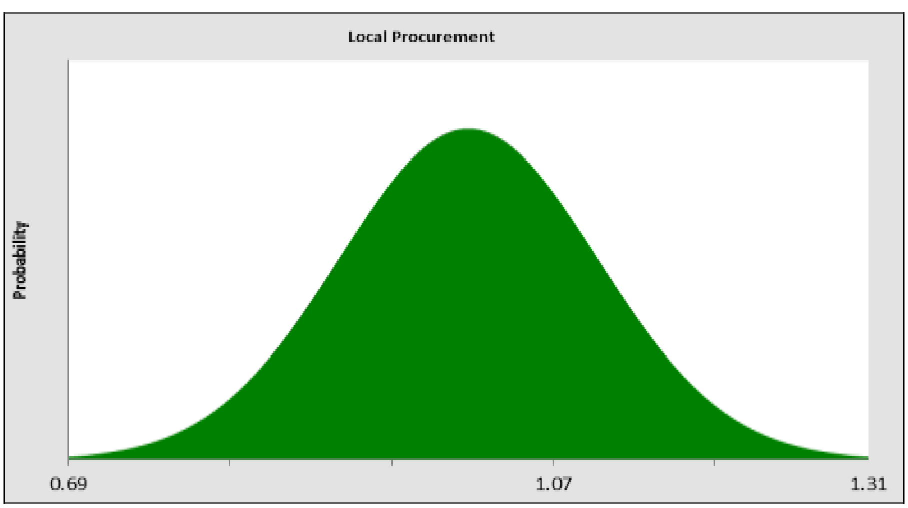
Mean	0.49
Std. Dev.	0.05



Assumption: Local Procurement

Normal distribution with parameters:

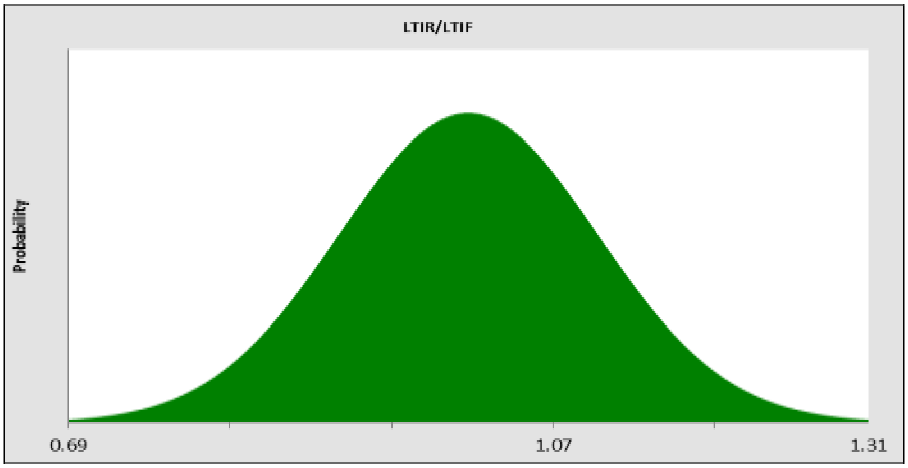
Mean	1.00
Std. Dev.	0.10



Assumption: LTIR

Normal distribution with parameters:

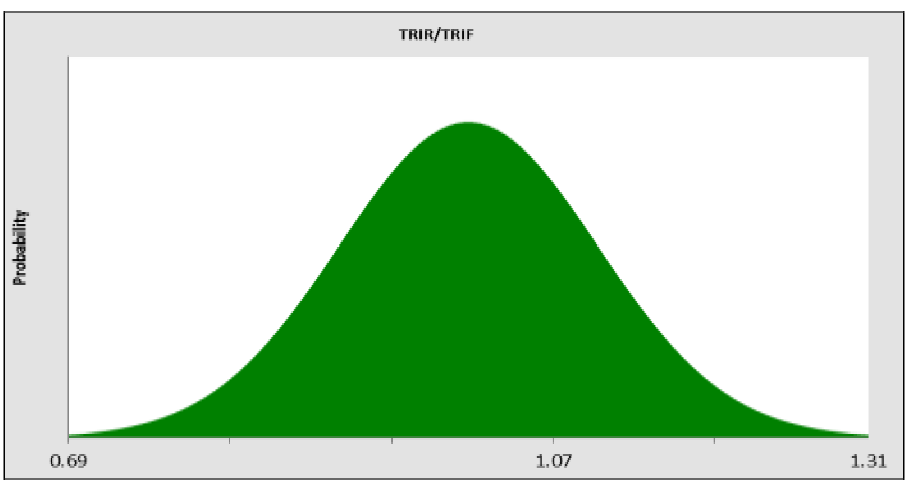
Mean	1.00
Std. Dev.	0.10



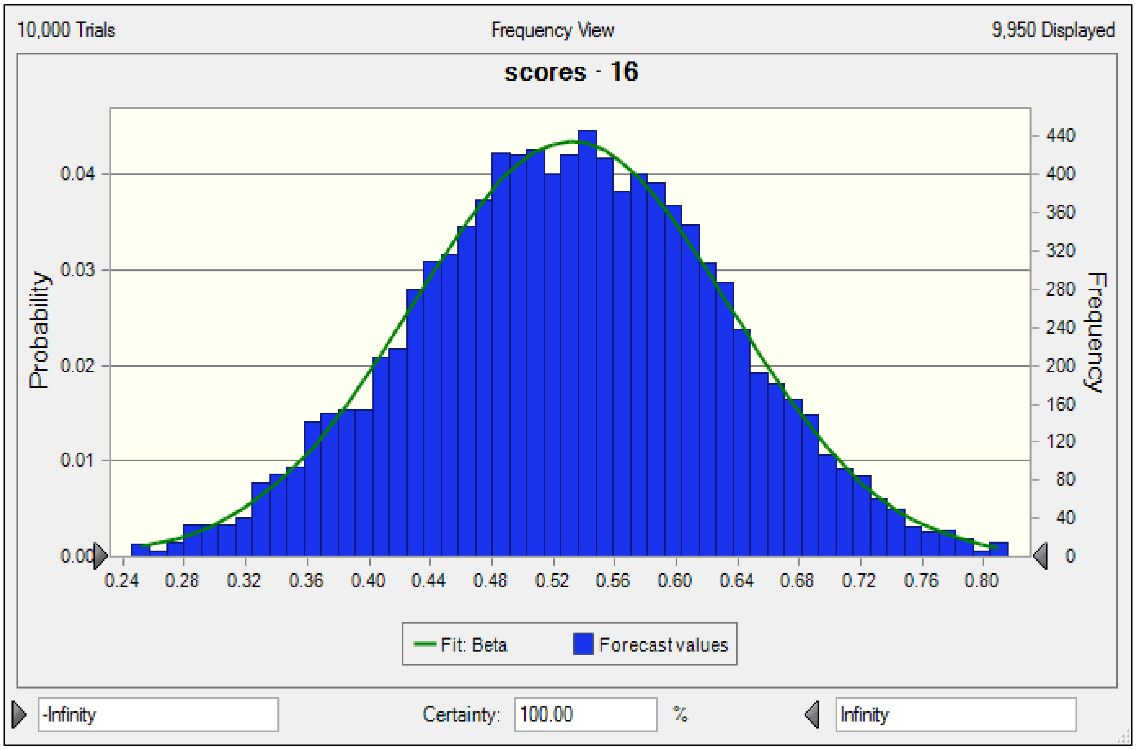
Assumption: TRIR

Normal distribution with parameters:

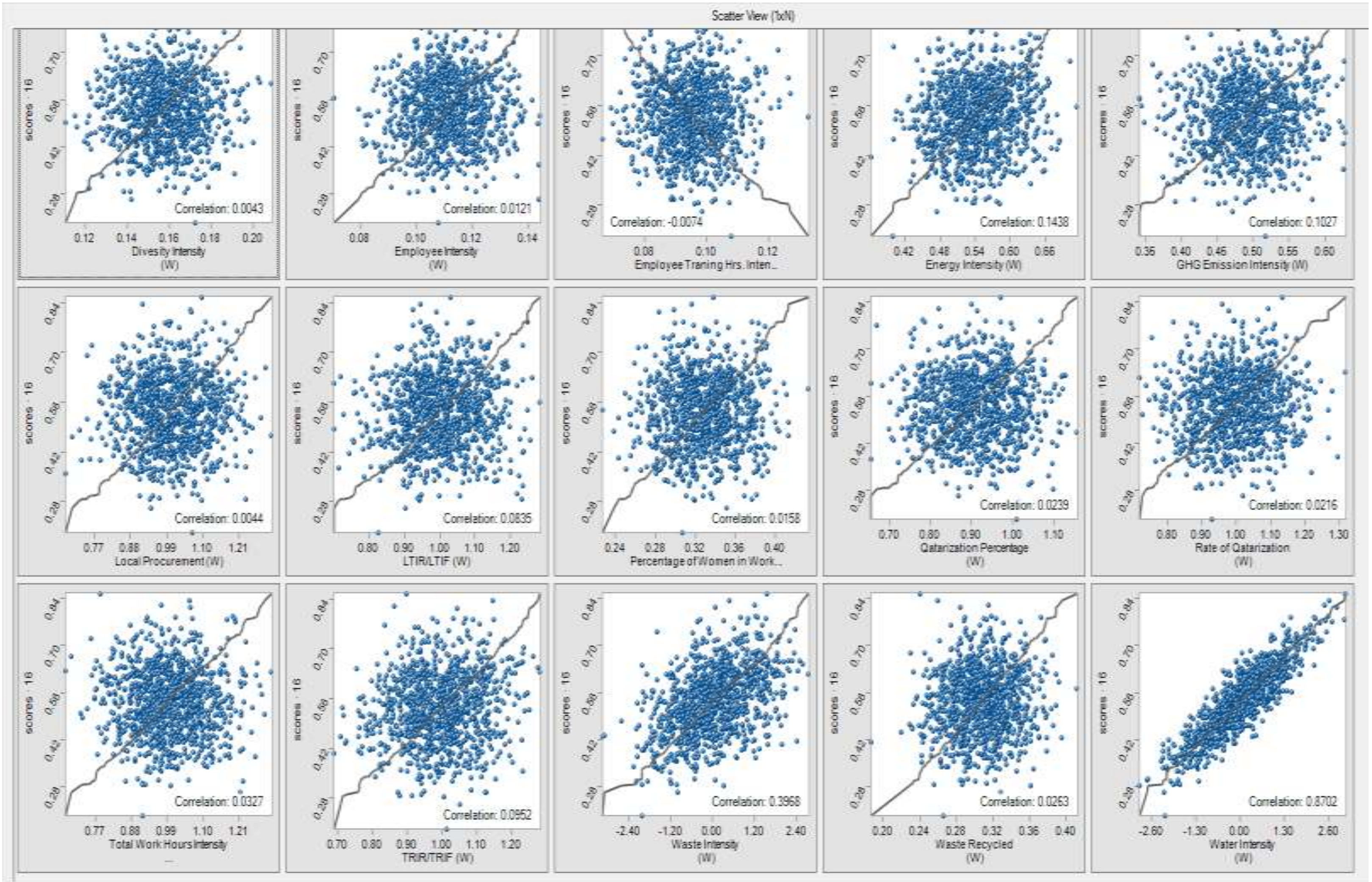
Mean	1.00
Std. Dev.	0.10



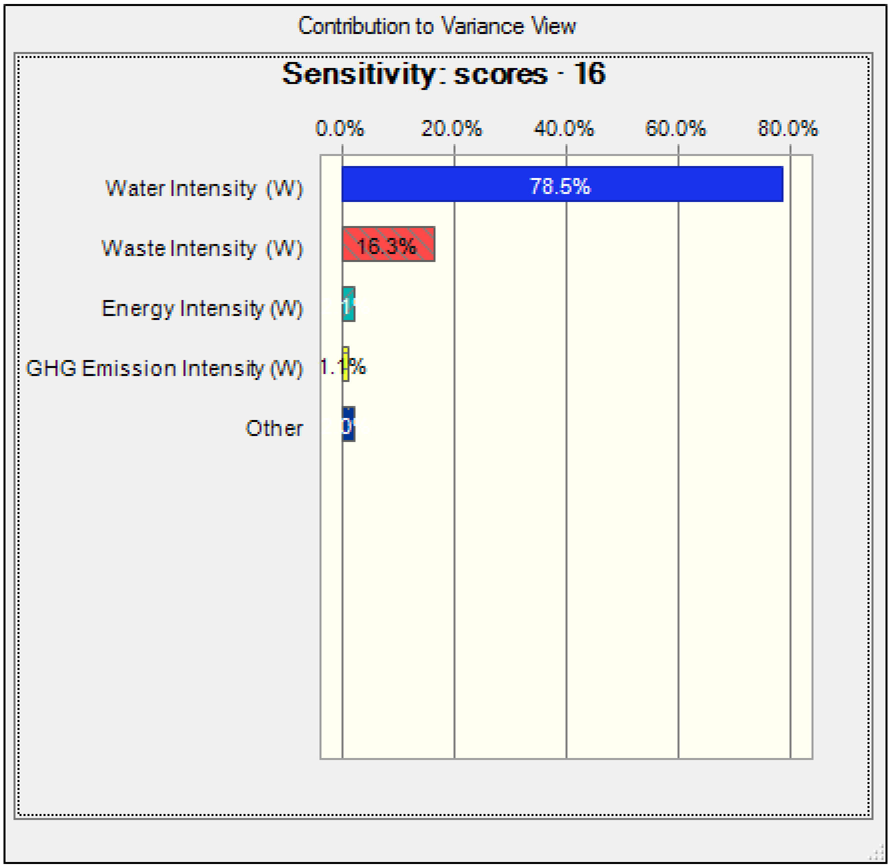
Forecasted Scores



Scatter Charts

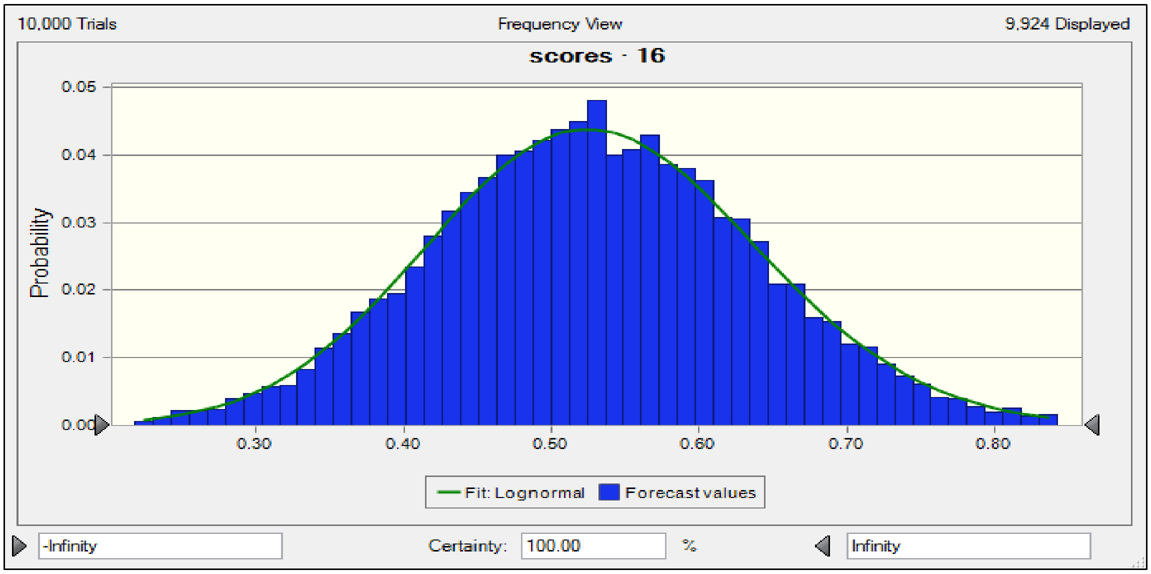


Sensitivity Chart

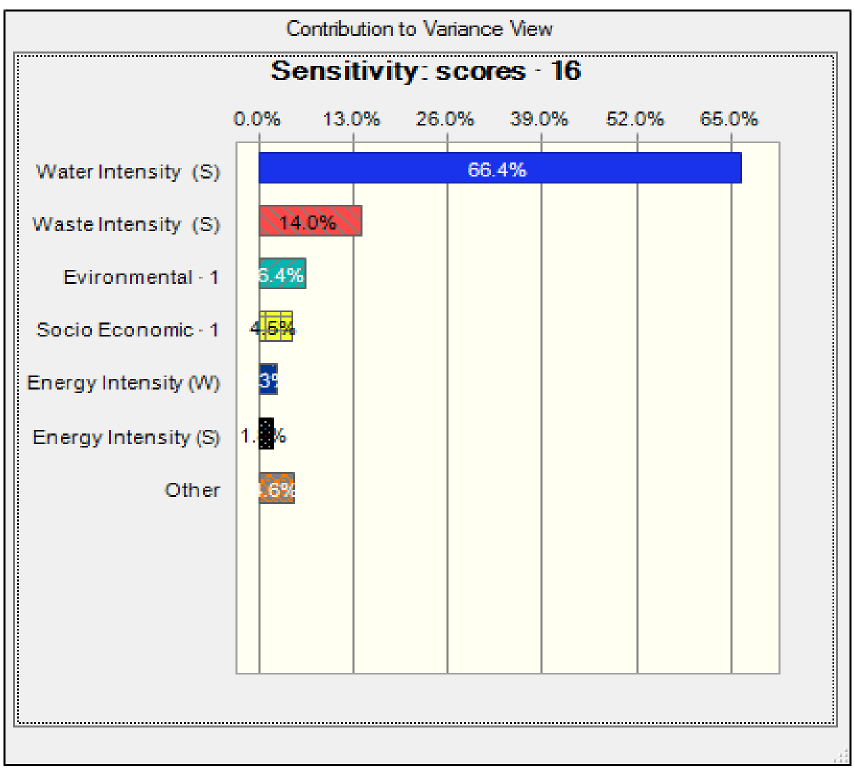


ORYX GTL: All Uncertainties (Weights and Scores)

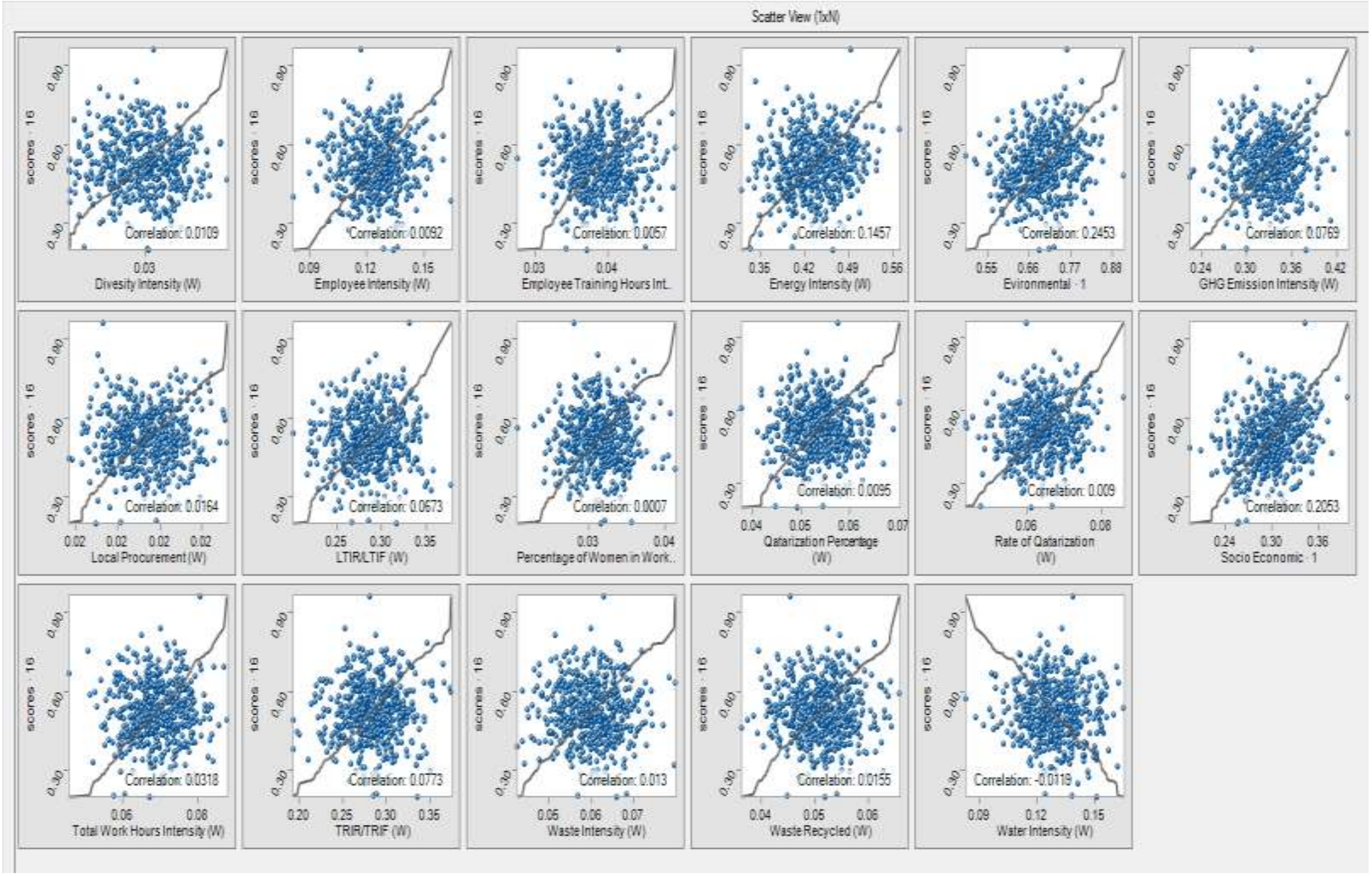
Forecasted Scores

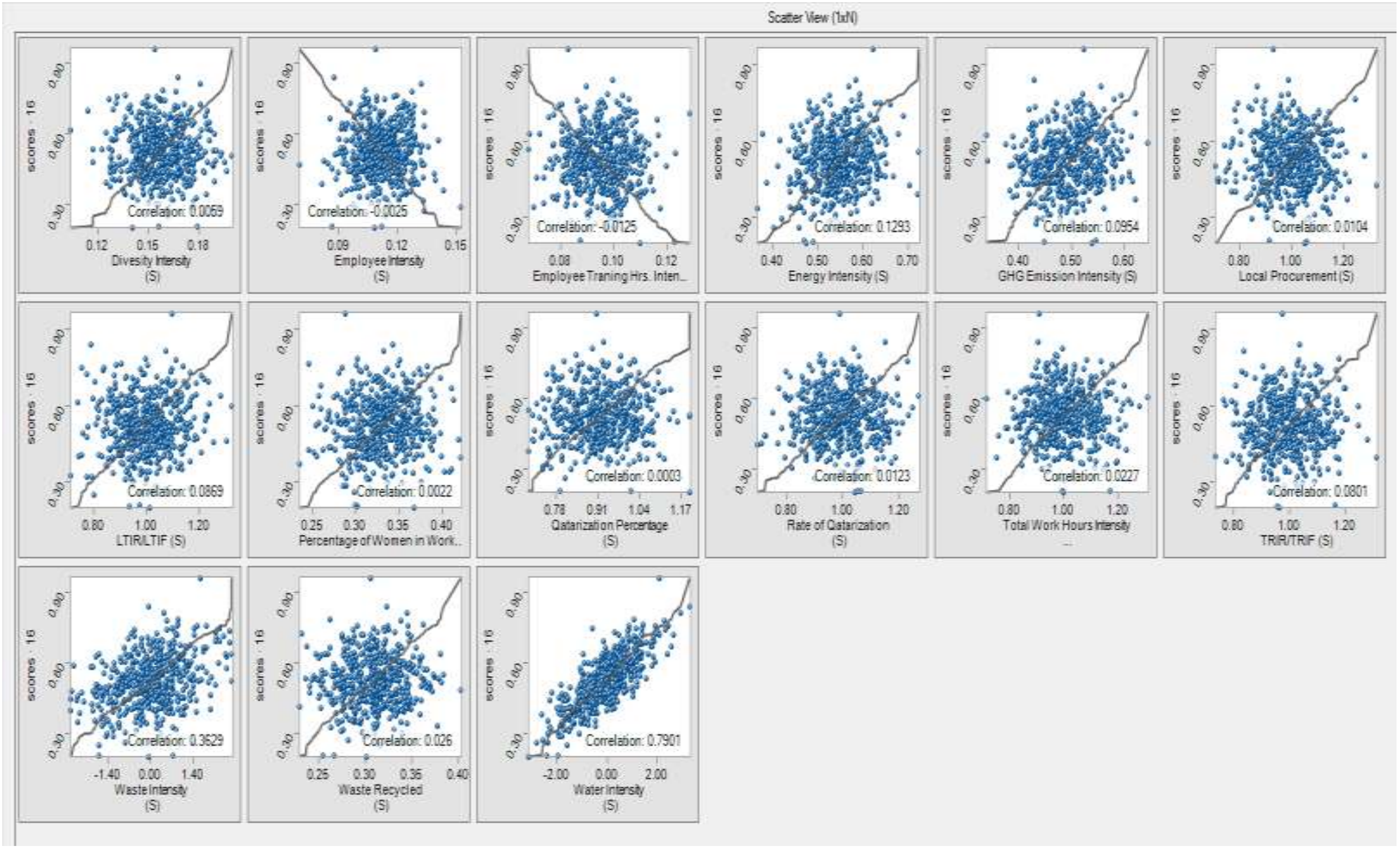


Sensitivity Chart

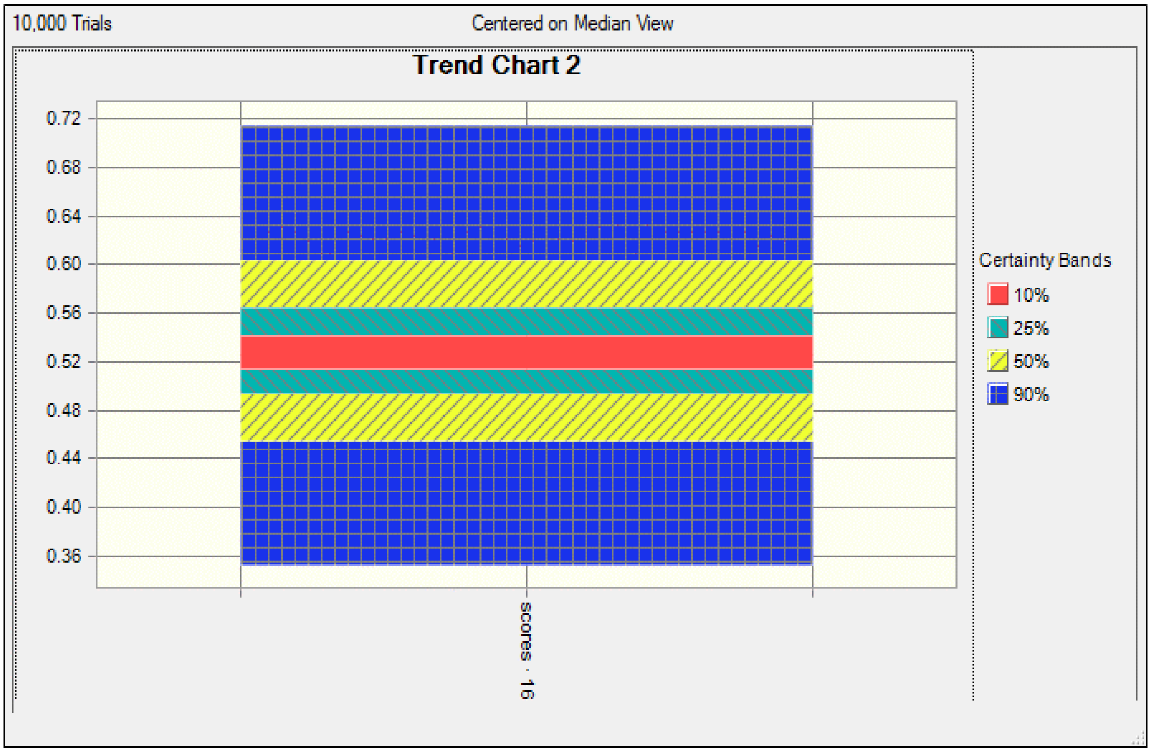


Scatter charts




Scatter View (1xN)
Correlation: 0.0069
Diversity Intensity (S)
Correlation: -0.0025
Employee Intensity (S)
Correlation: -0.0125
Employee Traning Hrs. Inten...
Correlation: 0.1293
Energy Intensity (S)
Correlation: 0.0954
GHG Emission Intensity (S)
Correlation: 0.0104
Local Procurement (S)
Correlation: 0.0869
LTIR/LTIF (S)
Correlation: 0.0022
Percentage of Women in Work...
Correlation: 0.0003
Qatarization Percentage (S)
Correlation: 0.0123
Rate of Qatarization (S)
Correlation: 0.0227
Total Work Hours Intensity
Correlation: 0.0801
TRIR/TRIF (S)
Correlation: 0.3629
Waste Intensity (S)
Correlation: 0.026
Waste Recycled (S)
Correlation: 0.7901
Water Intensity (S)

Trend Chart



10,000 Trials
Centered on Median View
Trend Chart 2
0.72
0.68
0.64
0.60
0.56
0.52
0.48
0.44
0.40
0.36
scores · 16
Certainty Bands
10%
25%
50%
90%

Number of trial runs (Monte Carlo Simulation) 10,000

Confidence Level: 95%

Qatar Gas: Main criteria Weights

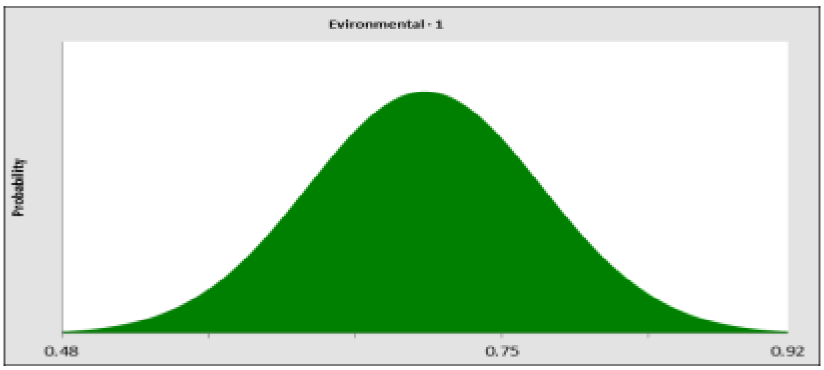
Assumptions

Assumption: Environmental · 1

Normal distribution with parameters:

Mean 0.70

Std. Dev. 0.07

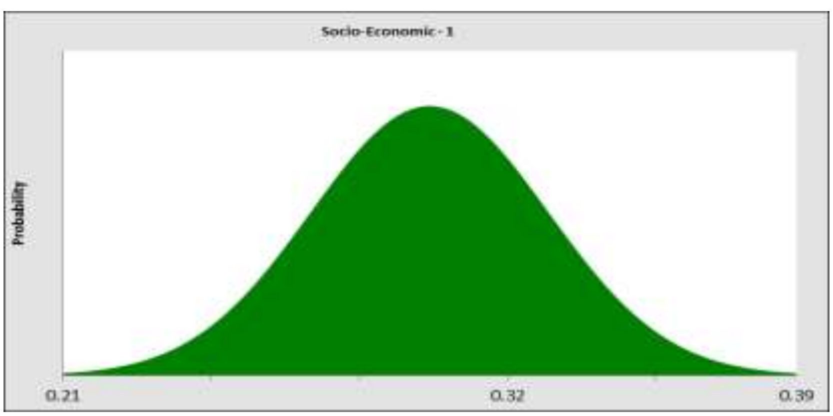


Assumption: Socio-Economic · 1

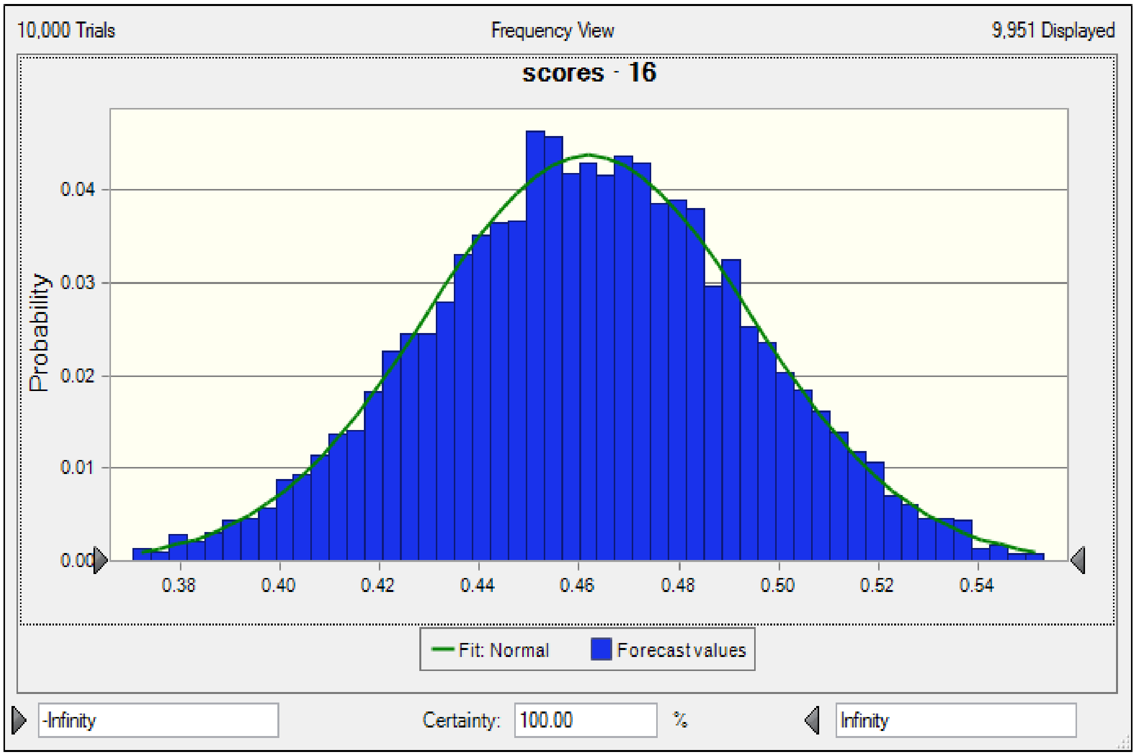
Normal distribution with parameters:

Mean 0.30

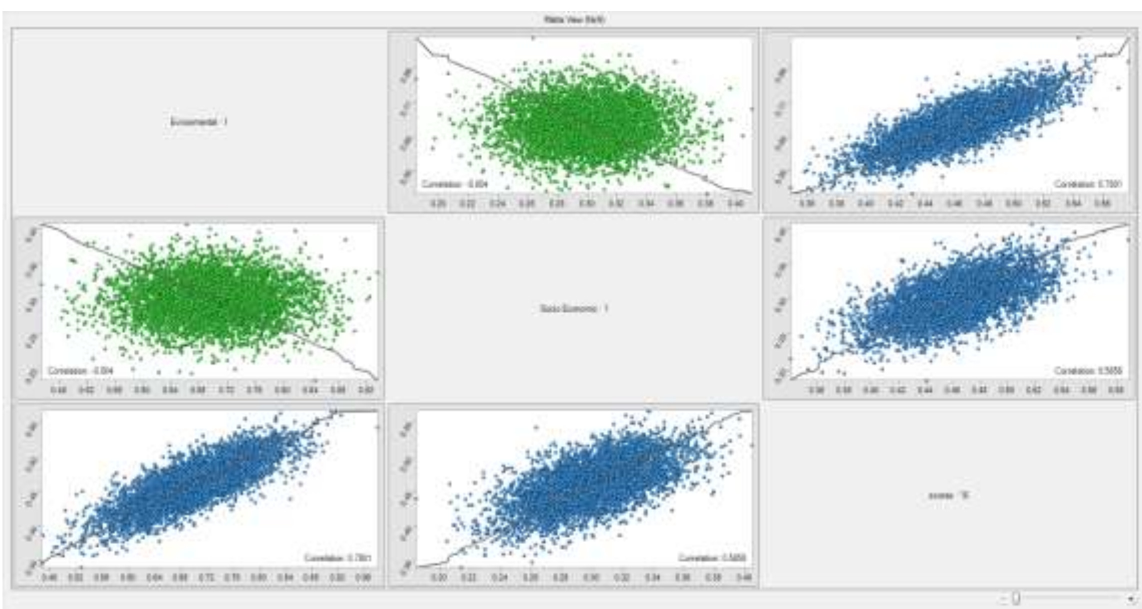
Std. Dev. 0.03



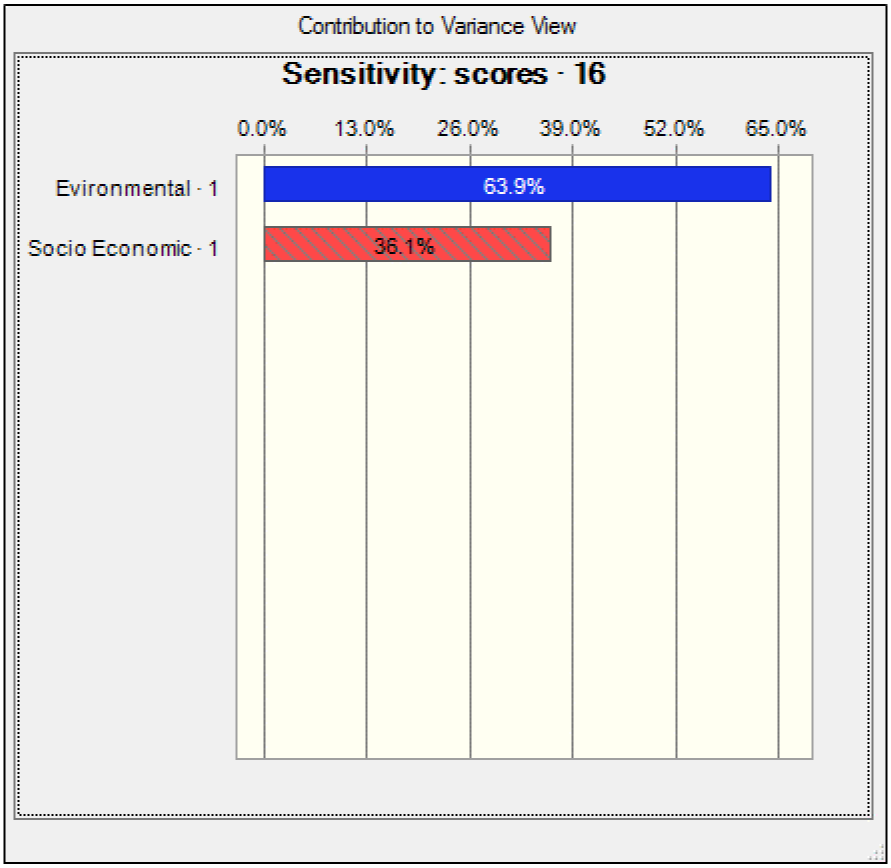
Forecasted scores



Scatter Chart



Sensitivity Chart



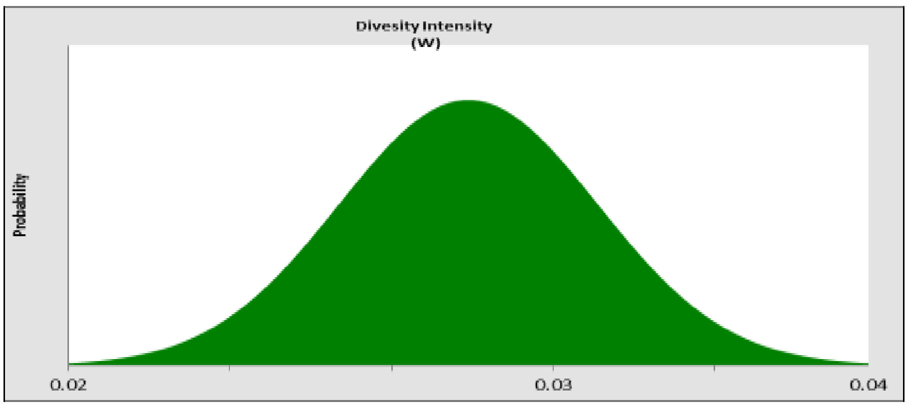
Qatar Gas: Sub Criteria Weights

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

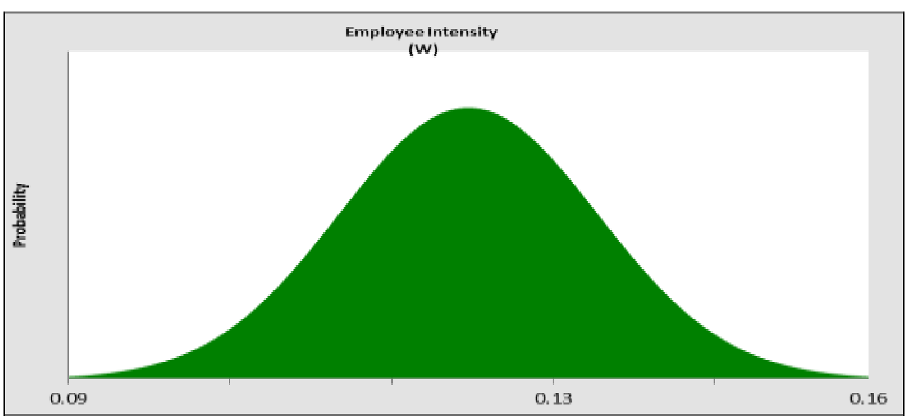
Mean	0.03
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

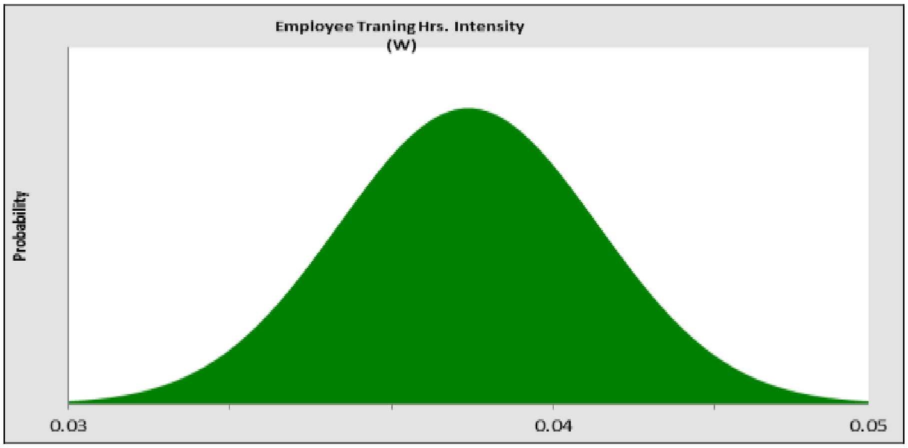
Mean	0.12
Std. Dev.	0.01



Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

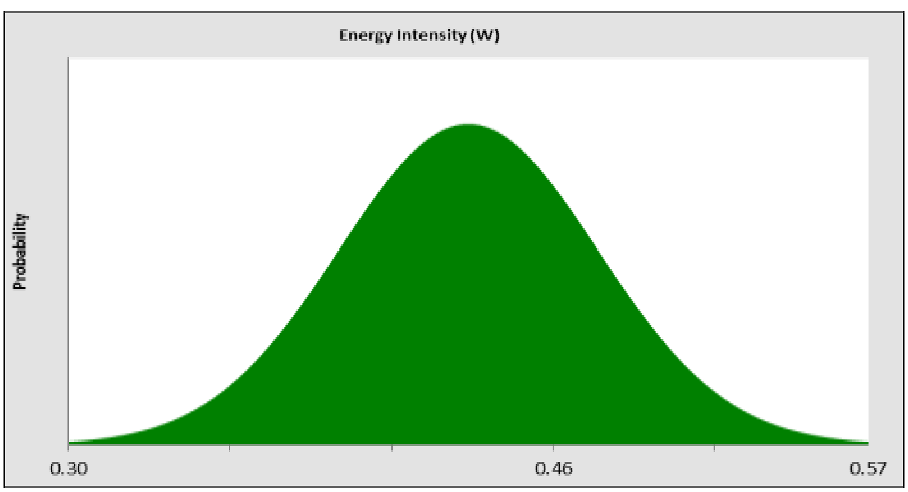
Mean	0.04
Std. Dev.	0.00



Assumption: Energy Intensity

Normal distribution with parameters:

Mean	0.43
Std. Dev.	0.04

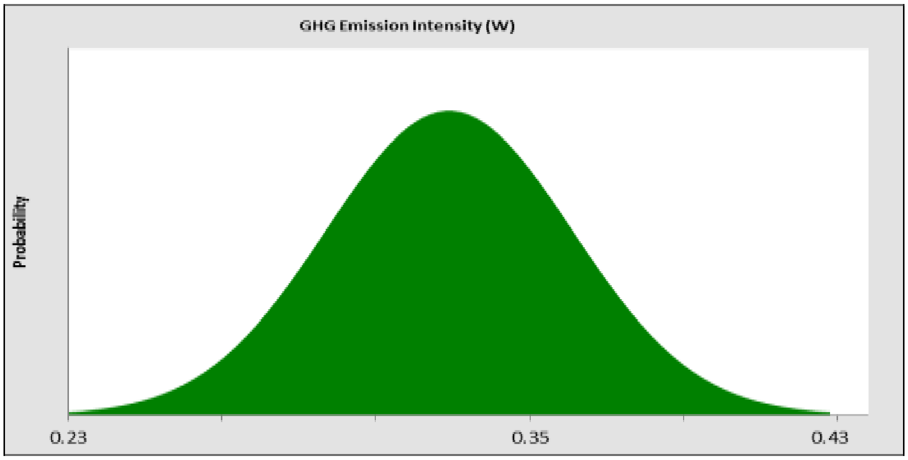


Assumption: GHG Emission Intensity

Normal distribution with parameters:

Mean 0.33

Std. Dev. 0.03

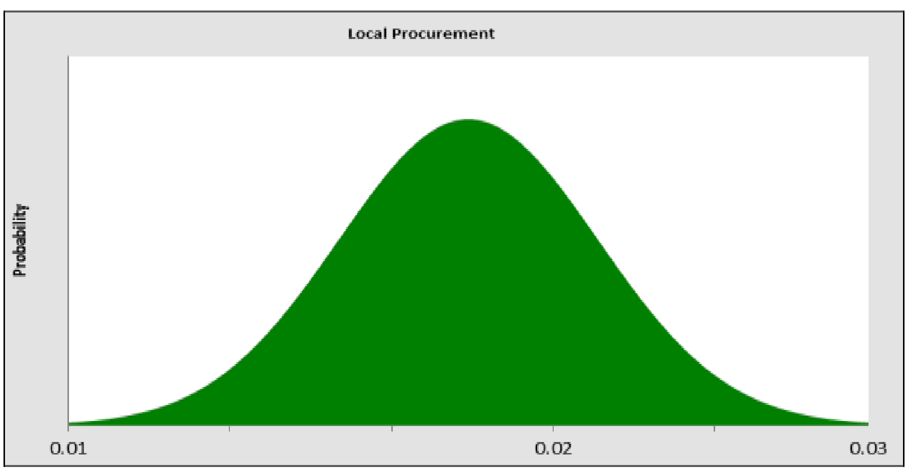


Assumption: Local Procurement

Normal distribution with parameters:

Mean 0.02

Std. Dev. 0.00

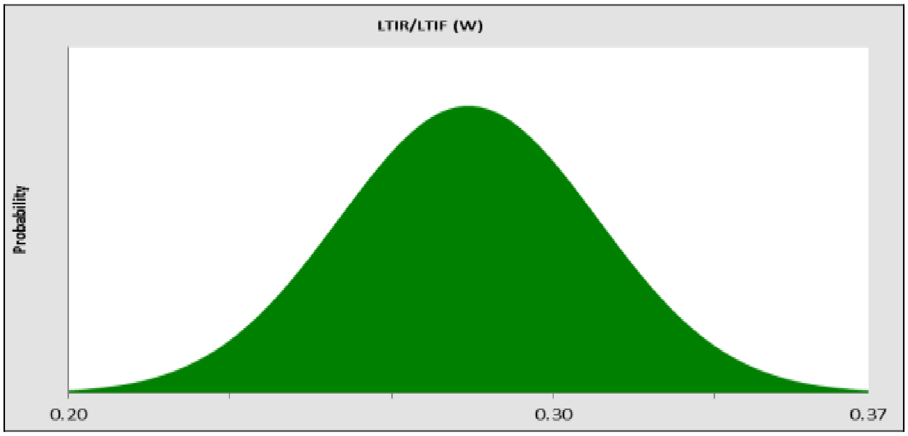


Assumption: LTIR

Normal distribution with parameters:

Mean 0.28

Std. Dev. 0.03

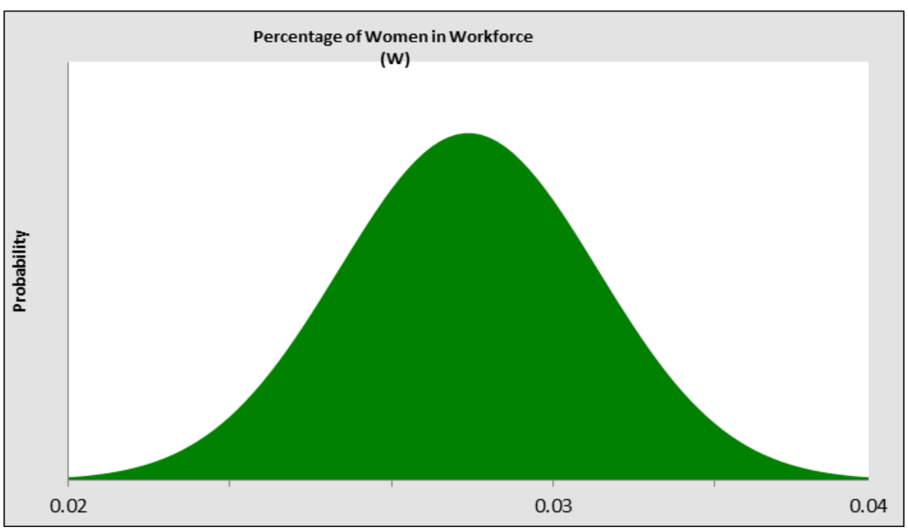


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 0.03

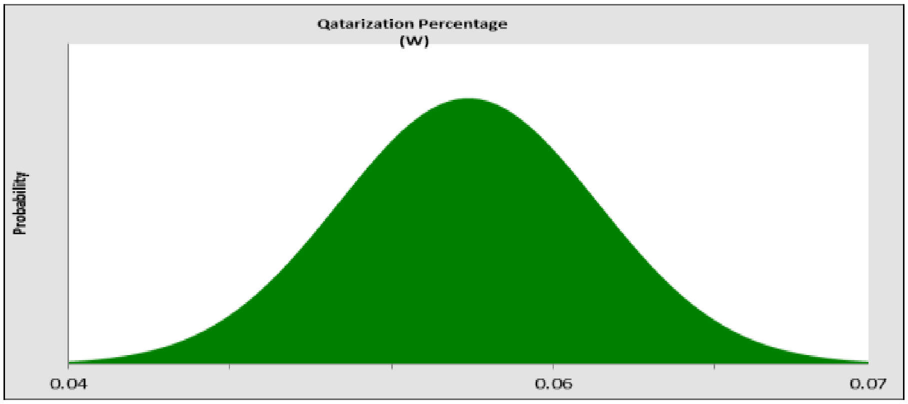
Std. Dev. 0.00



Assumption: Qatarization Percentage

Normal distribution with parameters:

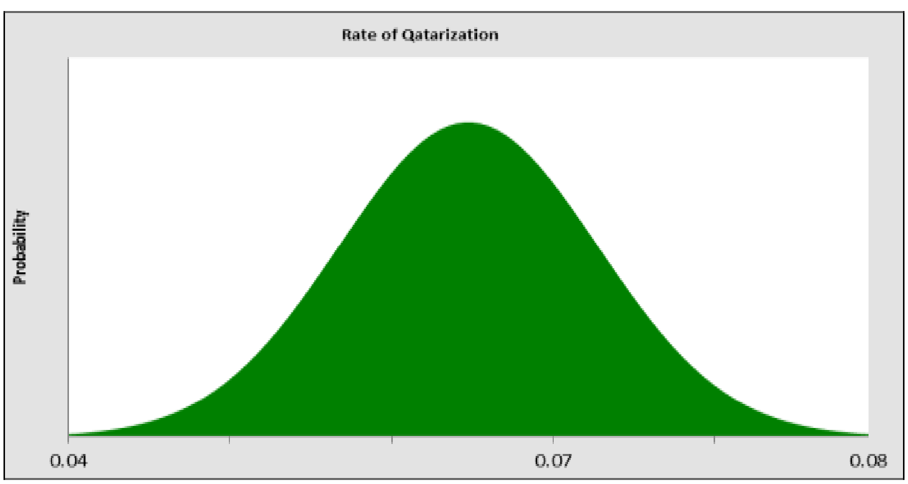
Mean	0.05
Std. Dev.	0.01



Assumption: Rate of Qatarization

Normal distribution with parameters:

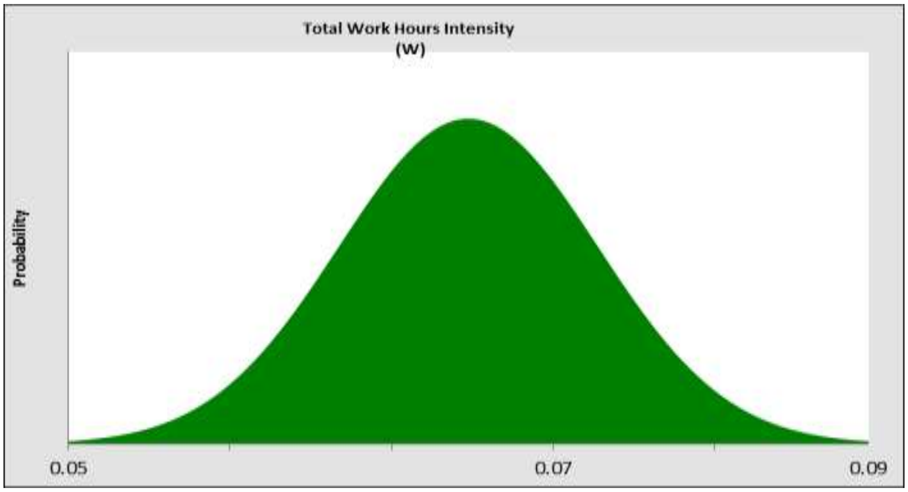
Mean	0.06
Std. Dev.	0.01



Assumption: Total Work Hours Intensity

Normal distribution with parameters:

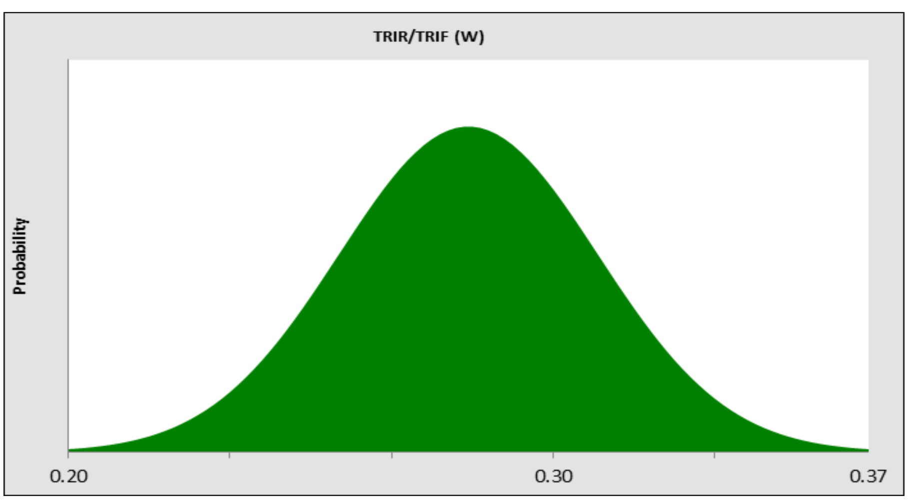
Mean	0.07
Std. Dev.	0.01



Assumption: TRIR

Normal distribution with parameters:

Mean	0.28
Std. Dev.	0.03

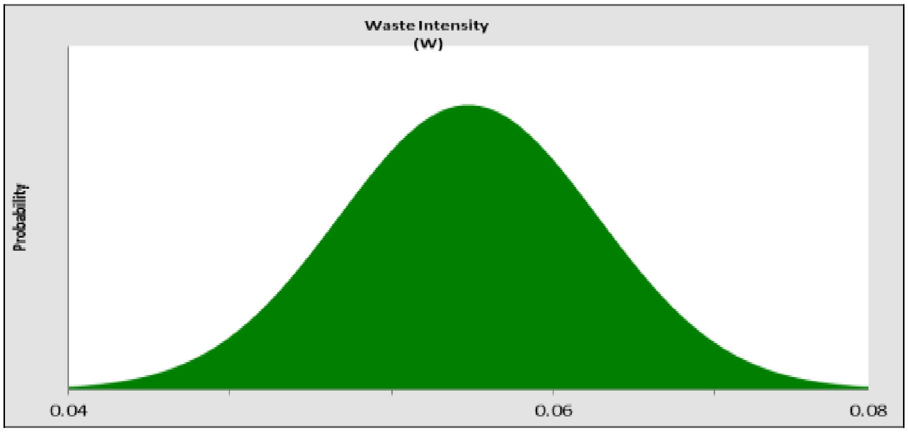


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

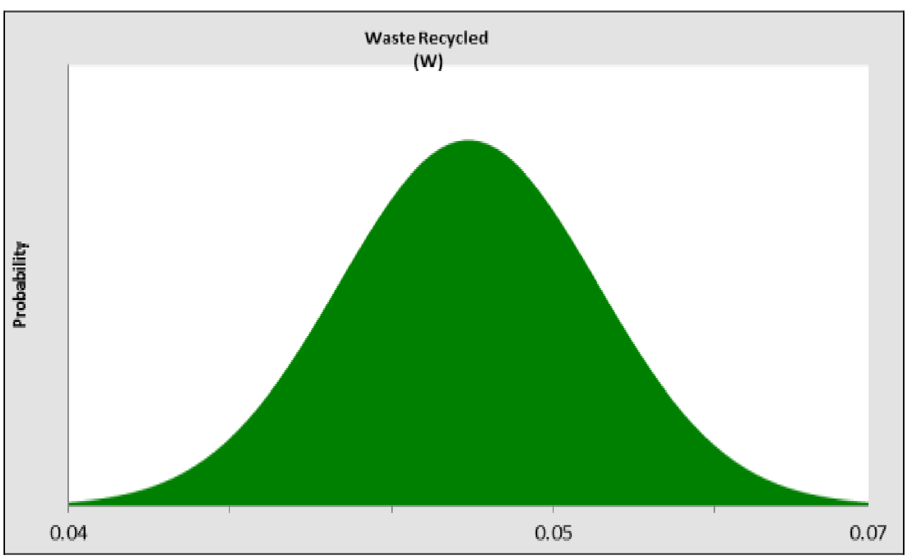


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.05

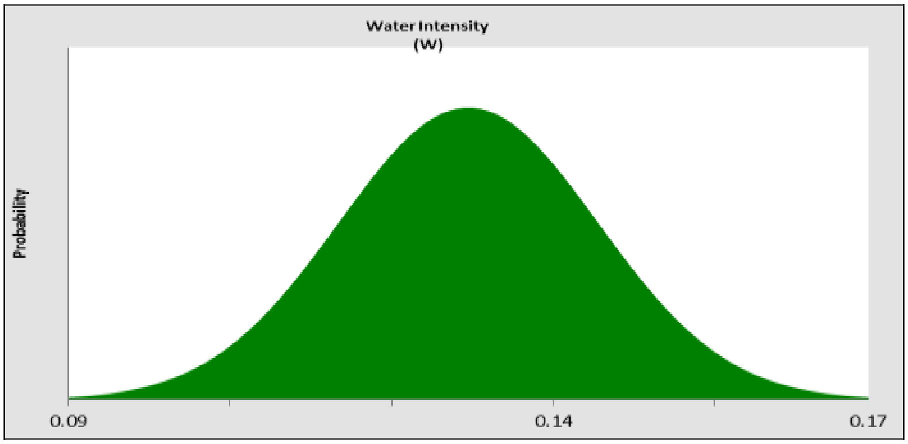
Std. Dev. 0.01



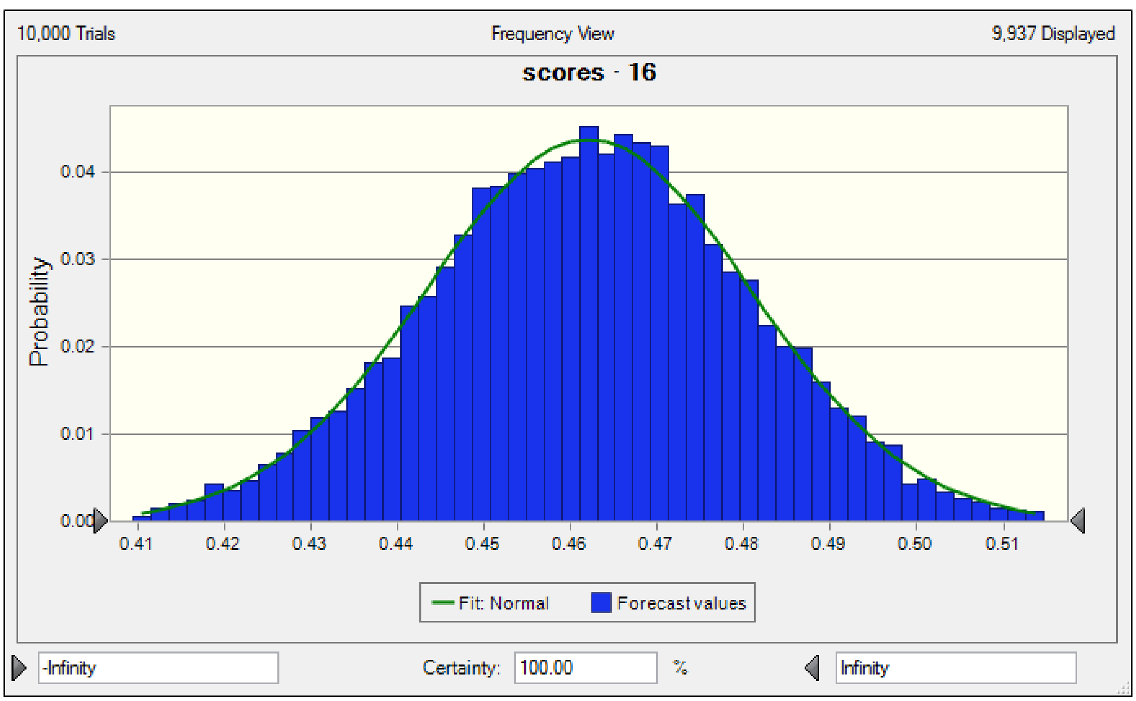
Assumption: Water Intensity

Normal distribution with parameters:

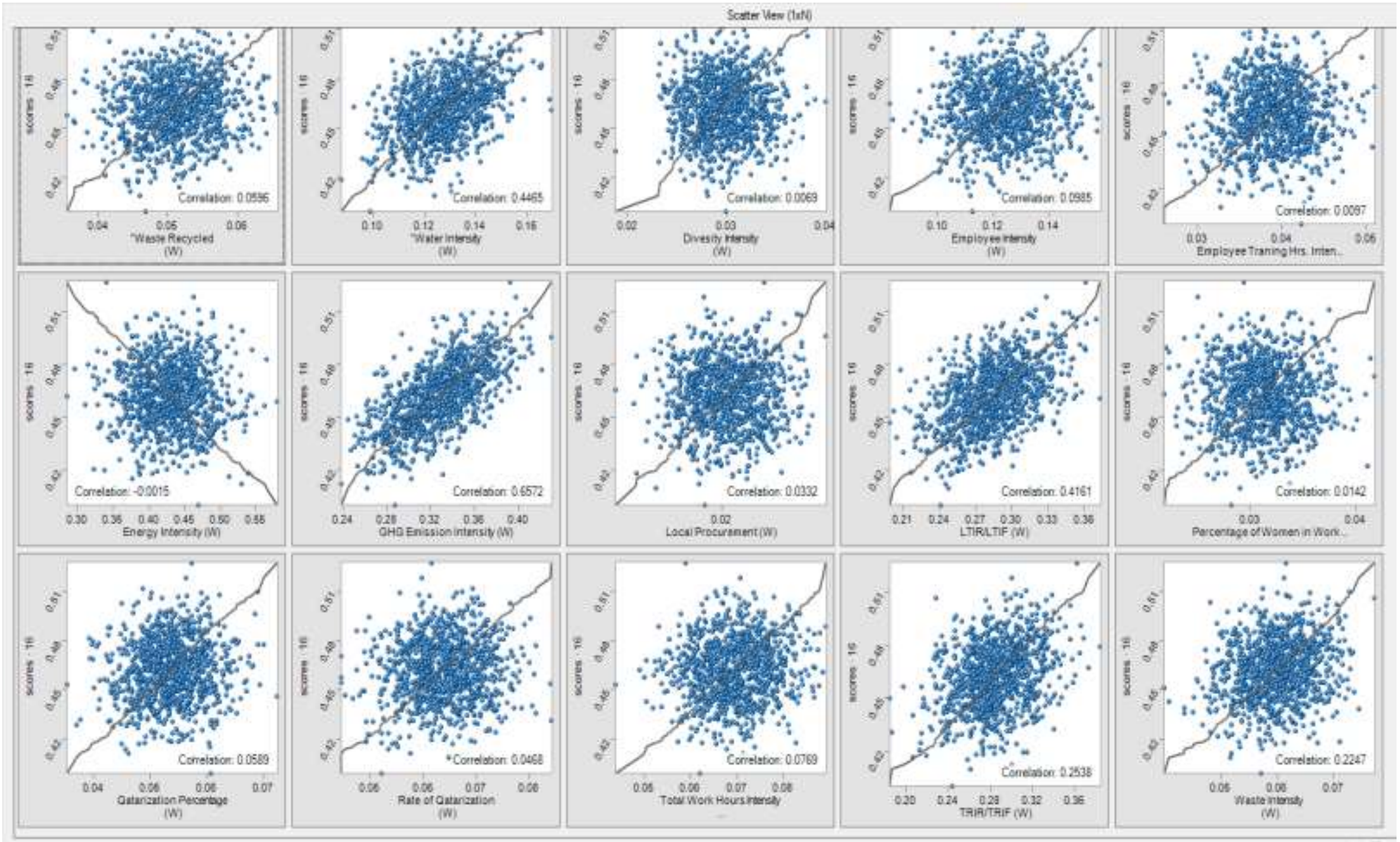
Mean	0.13
Std. Dev.	0.01



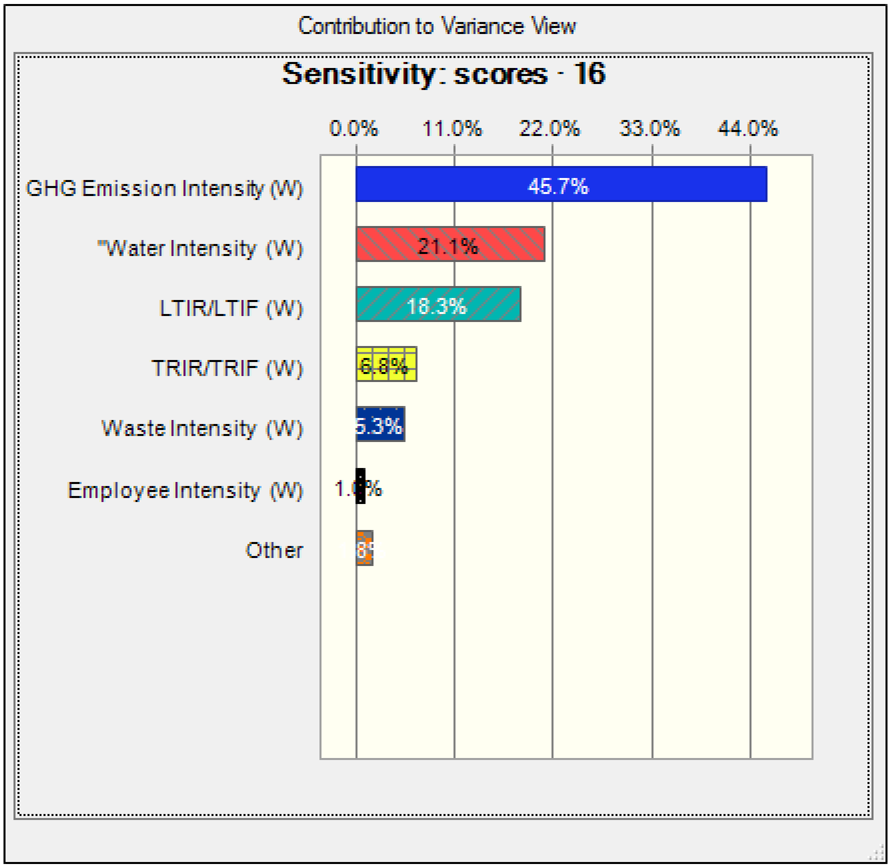
Forecasted Scores



Scatter Charts



Sensitivity Chart



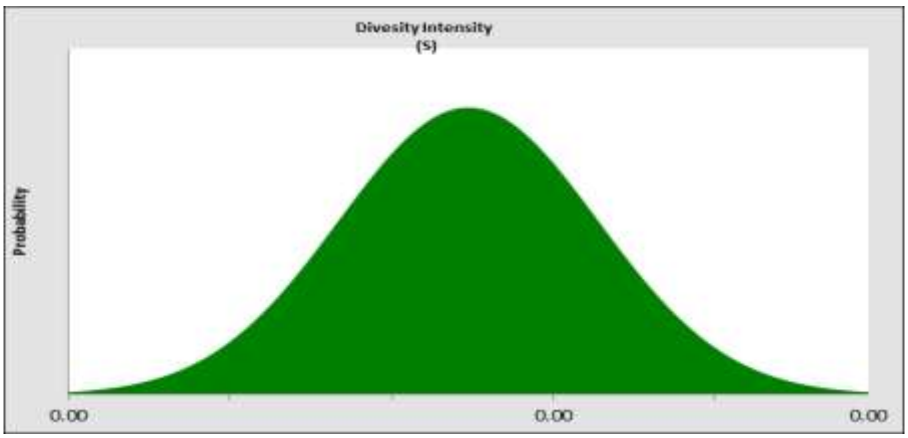
Qatar Gas: Sub Criteria Scores

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

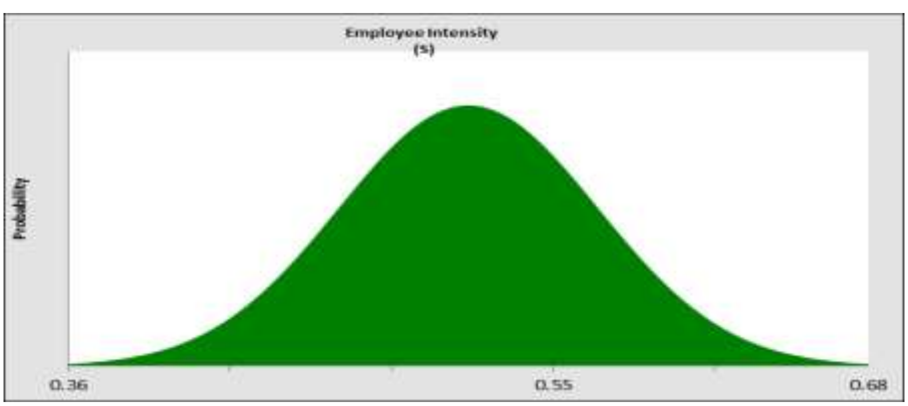
Mean	0.00
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	0.52
Std. Dev.	0.05



Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

Mean 0.01

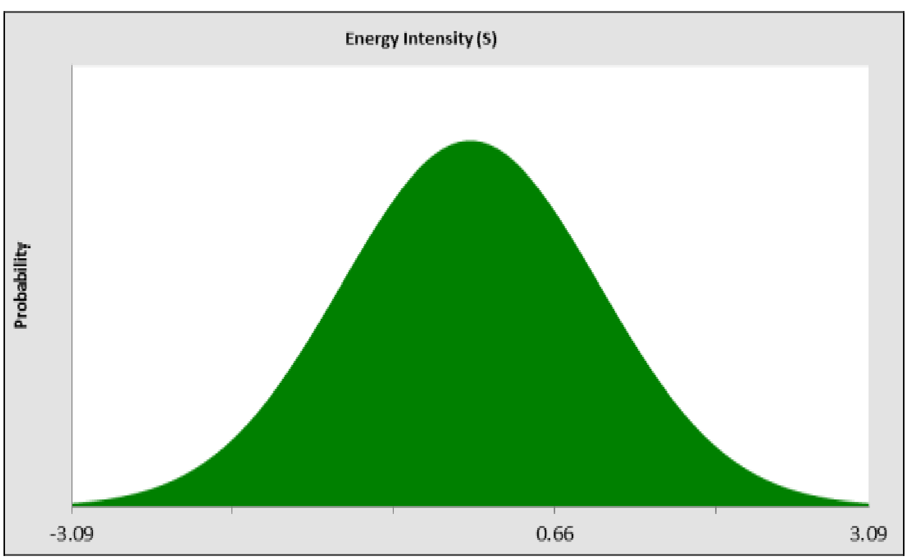
Std. Dev. 0.00

Assumption: Energy Intensity

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

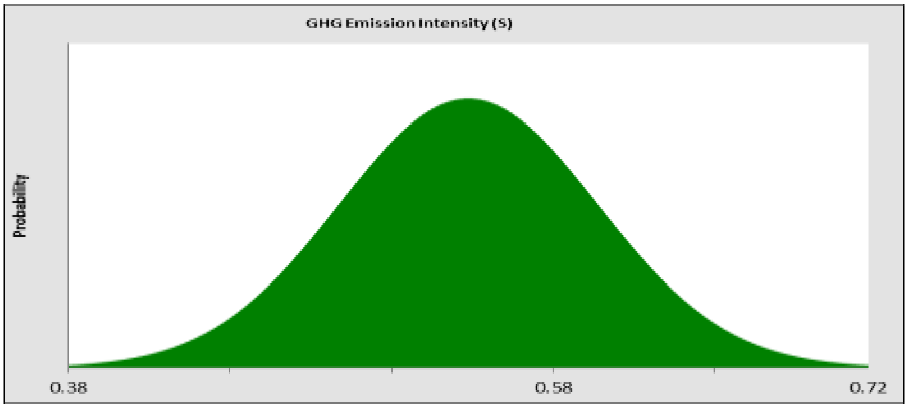


Assumption: GHG Emission Intensity

Normal distribution with parameters:

Mean 0.55

Std. Dev. 0.05

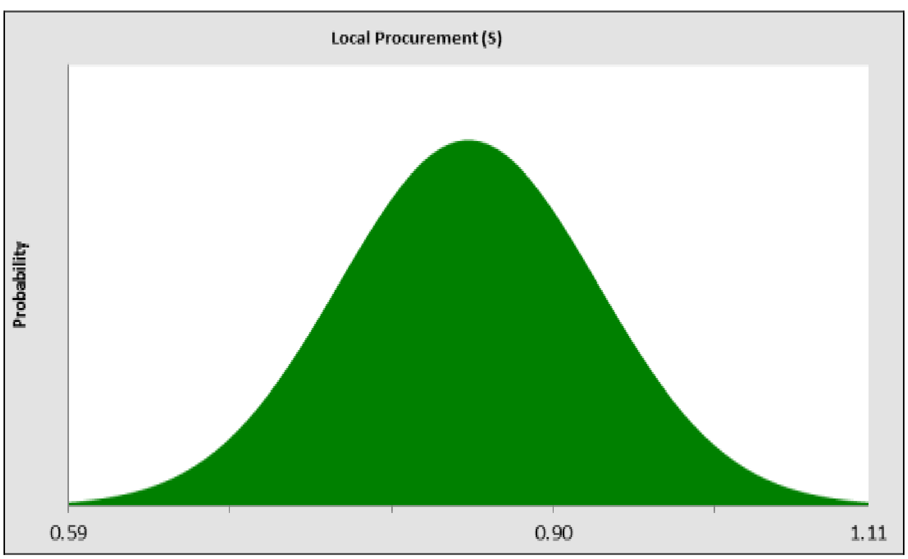


Assumption: Local Procurement

Normal distribution with parameters:

Mean 0.85

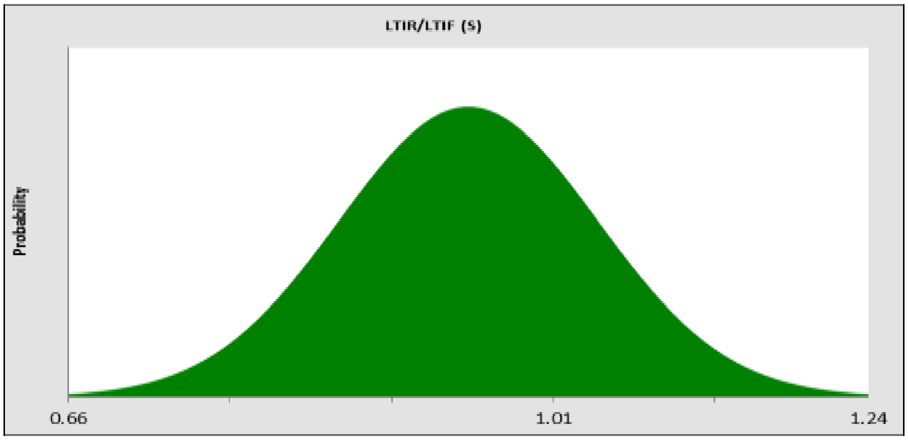
Std. Dev. 0.08



Assumption: LTIR

Normal distribution with parameters:

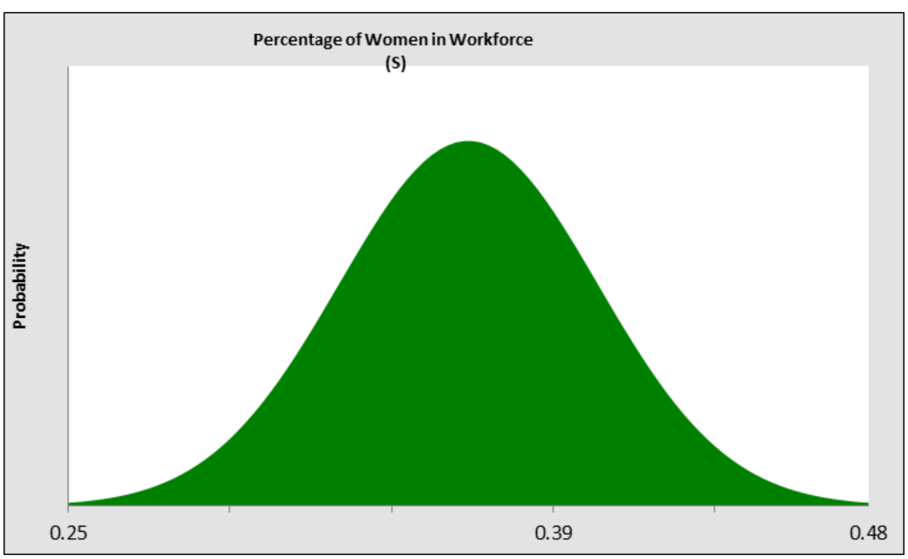
Mean	0.95
Std. Dev.	0.09



Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean	0.37
Std. Dev.	0.04

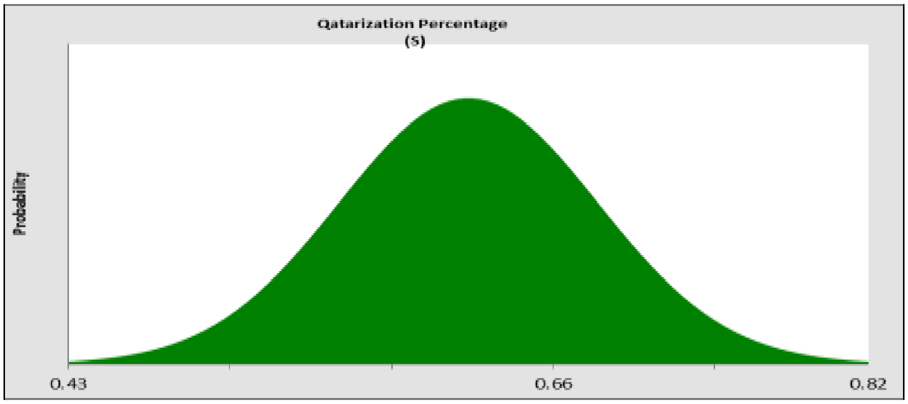


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.62

Std. Dev. 0.06

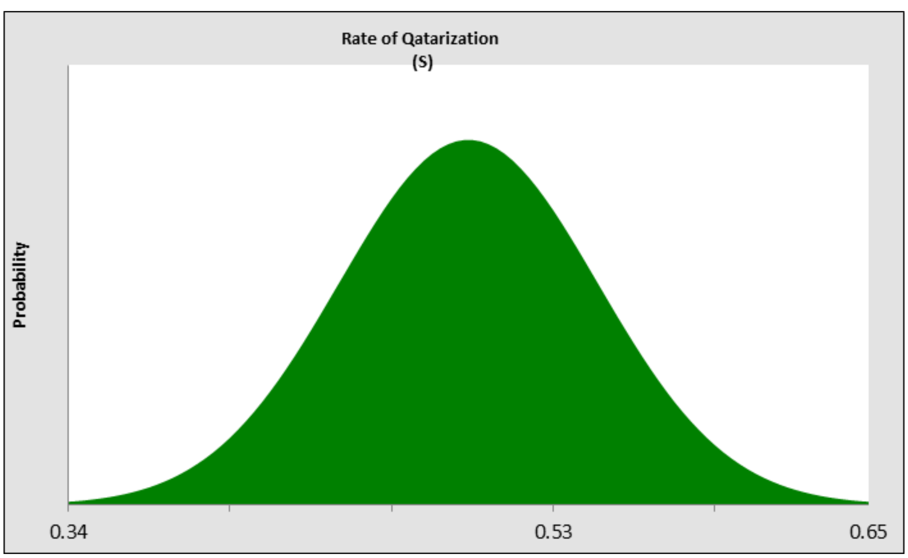


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.49

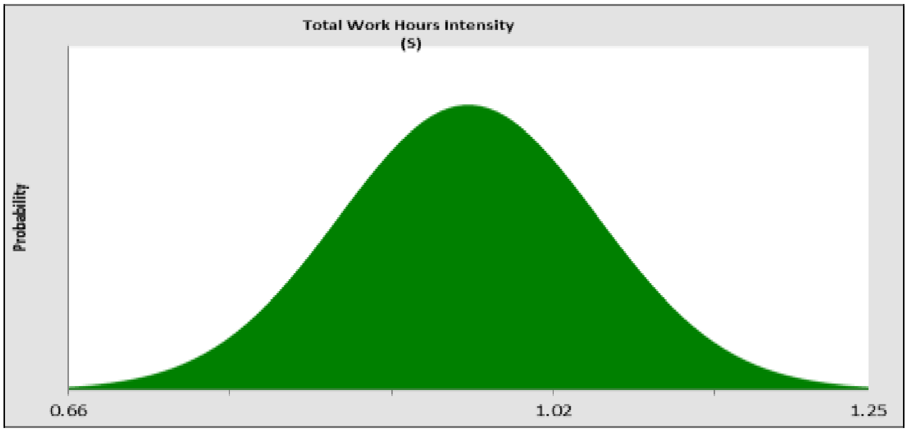
Std. Dev. 0.05



Assumption: Total Work Hrs. Intensity

Normal distribution with parameters:

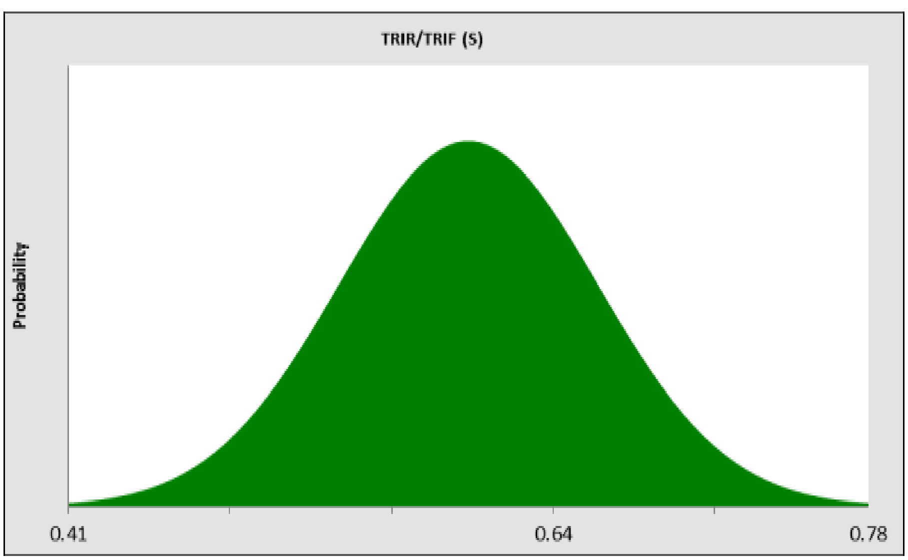
Mean	0.95
Std. Dev.	0.10



Assumption: TRIR

Normal distribution with parameters:

Mean	0.60
Std. Dev.	0.06

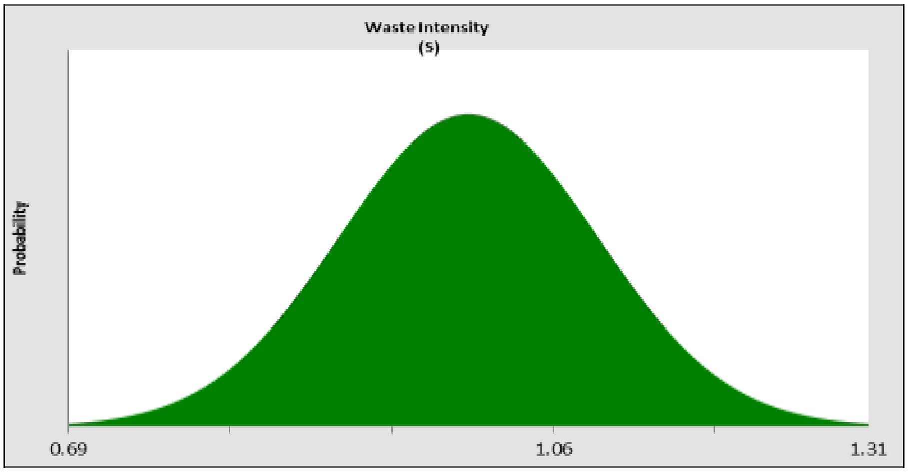


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 1.00

Std. Dev. 0.10

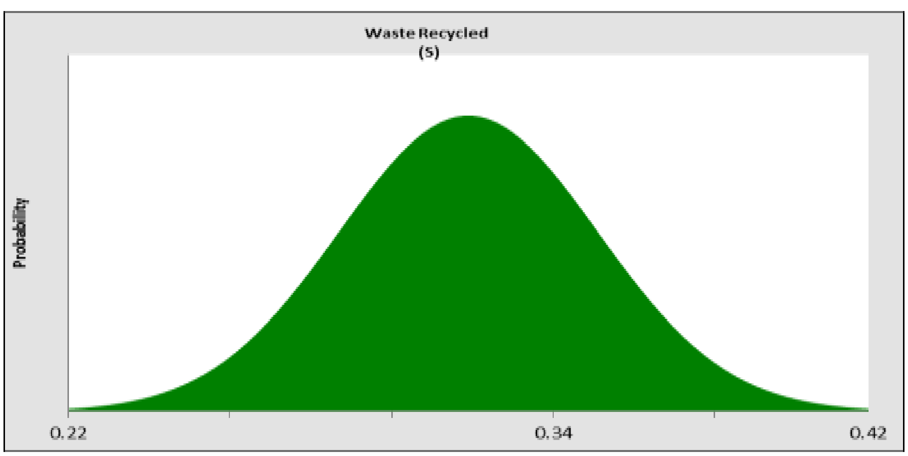


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.32

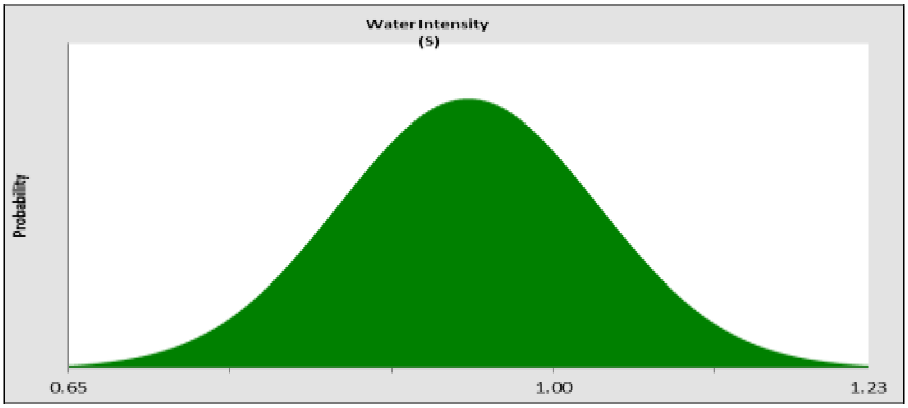
Std. Dev. 0.03



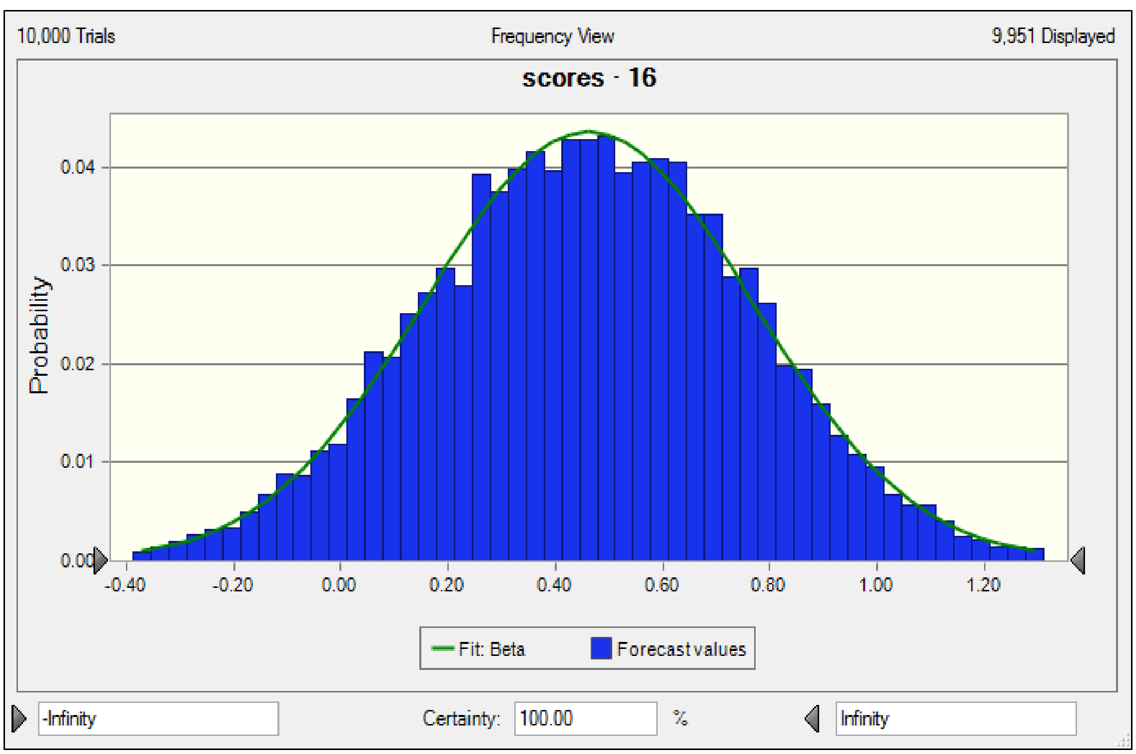
Assumption: Waste Intensity

Normal distribution with parameters:

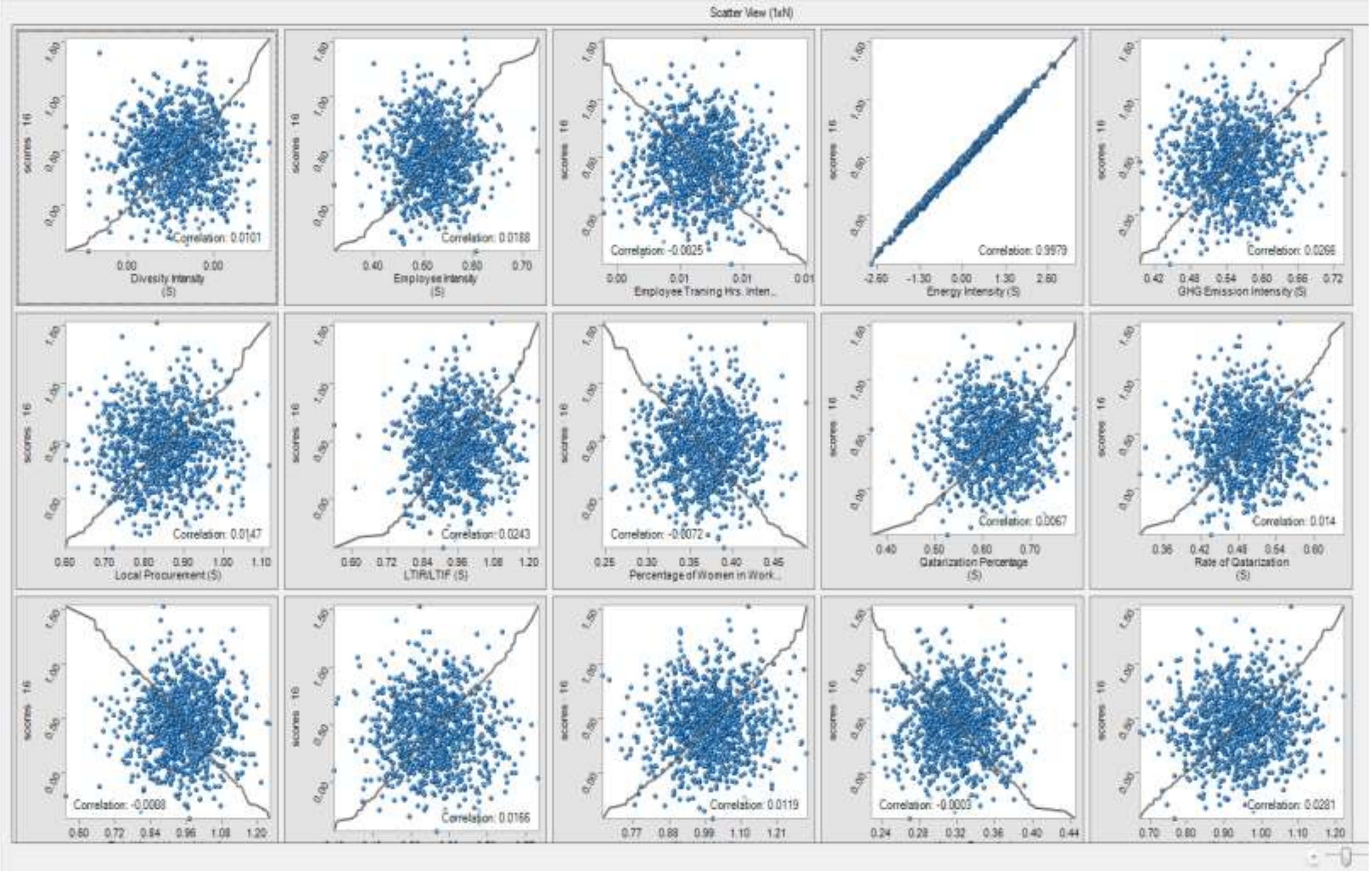
Mean	0.94
Std. Dev.	0.09



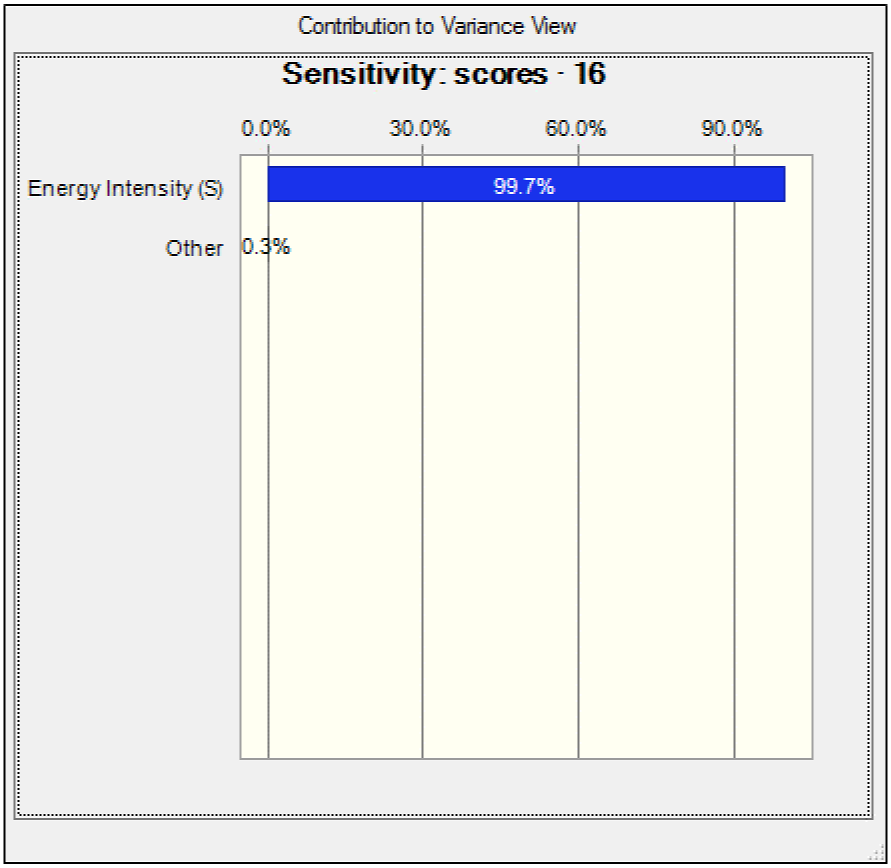
Forecasted Scores



Scatter Charts

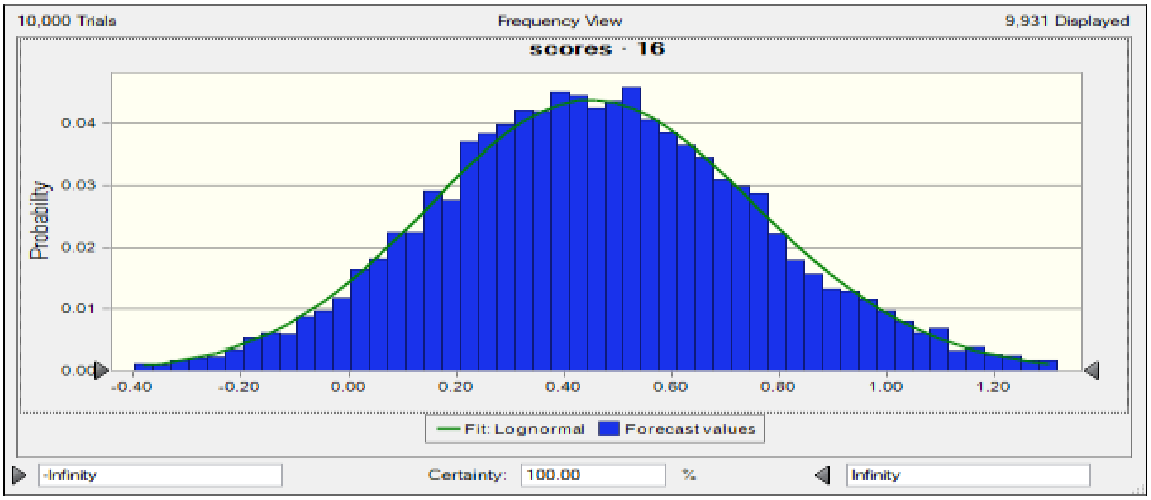


Sensitivity Chart

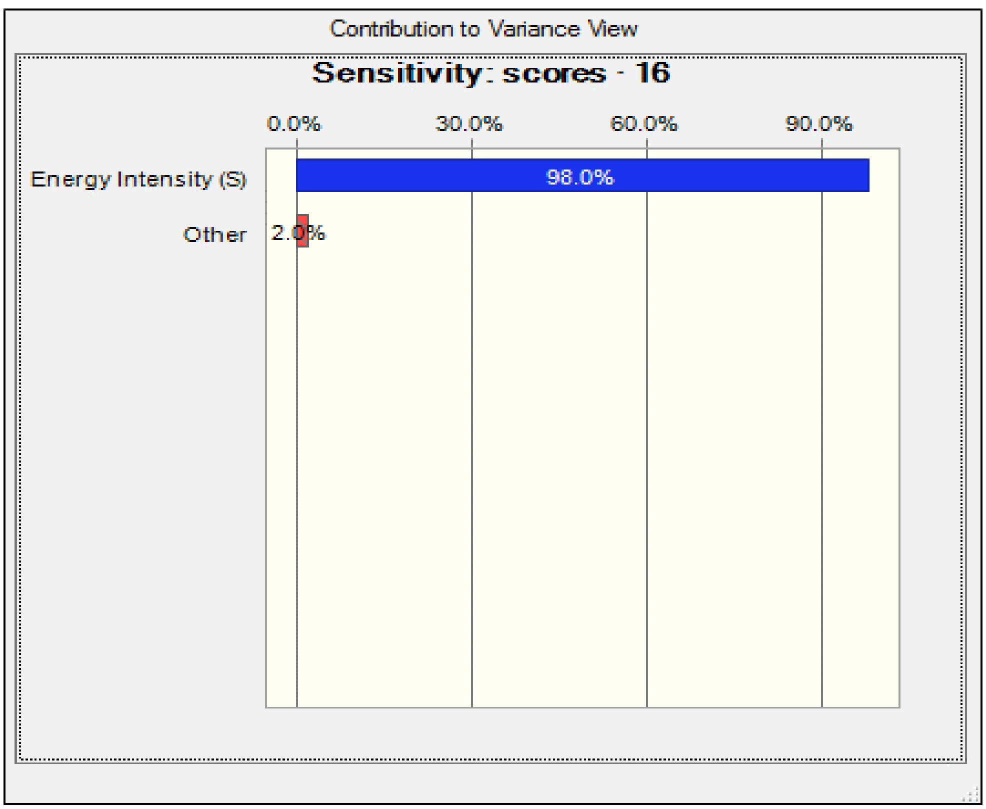


Qatar Gas: All Uncertainties

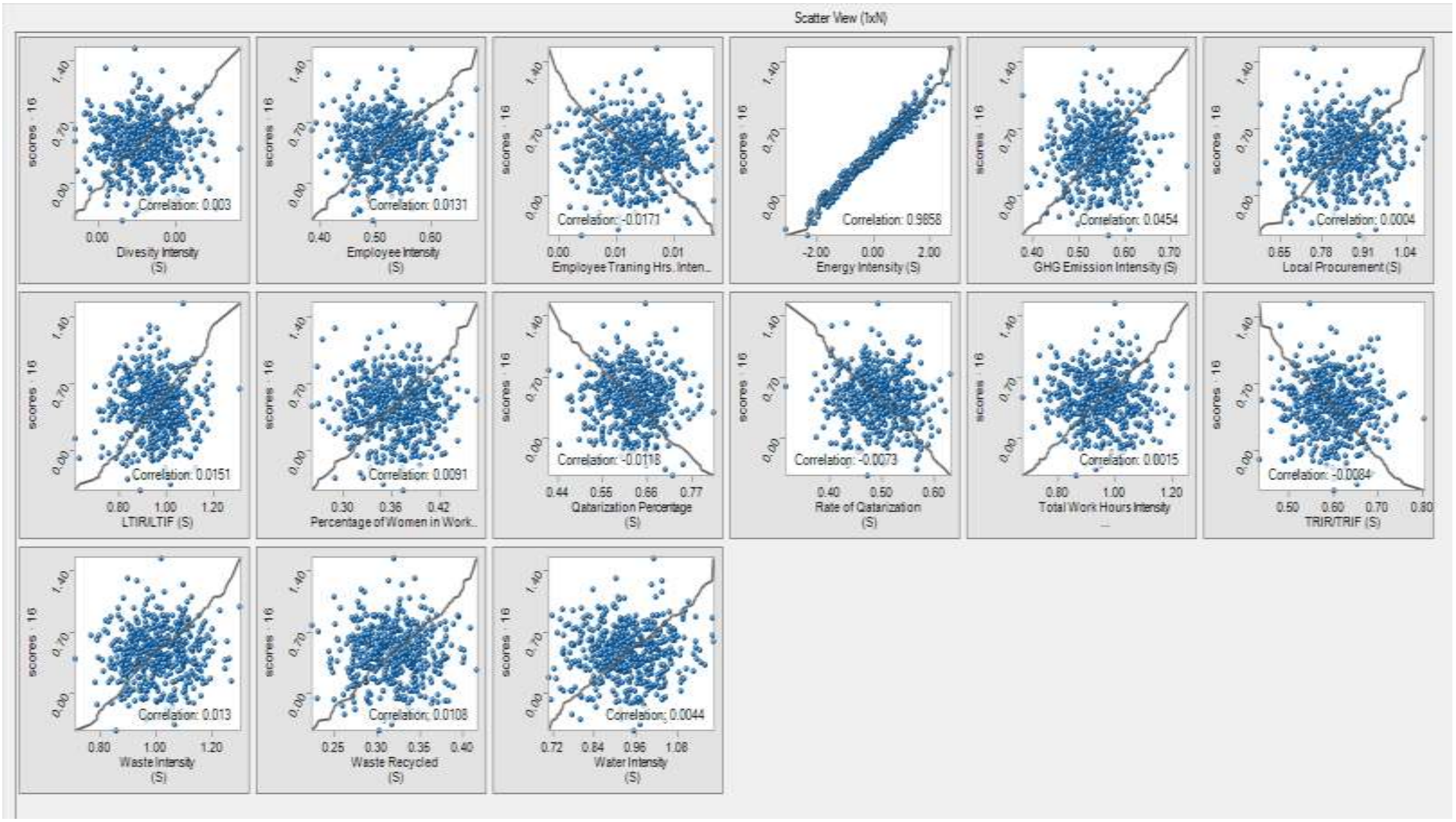
Forecasted Scores

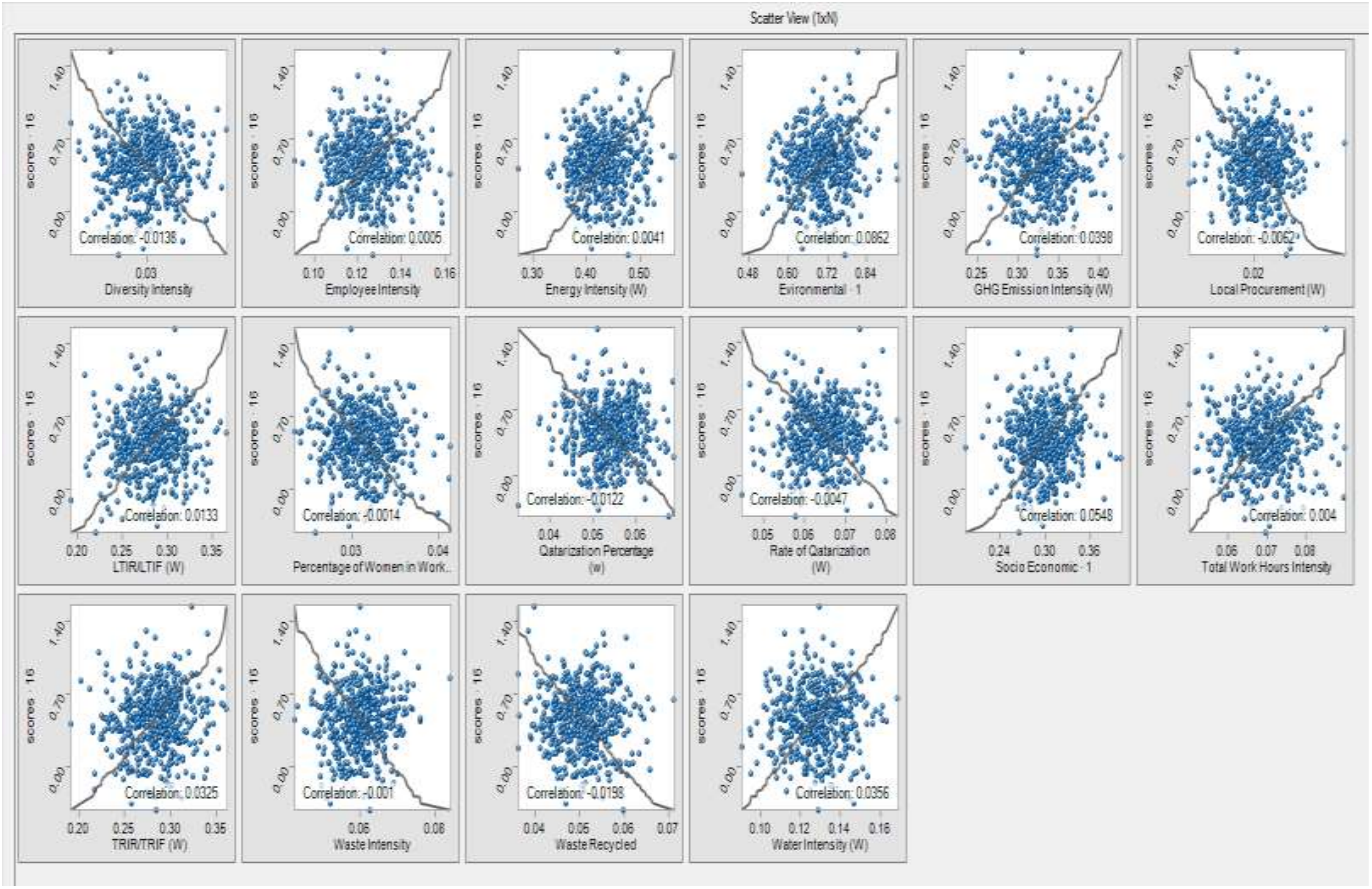


Sensitivity Chart



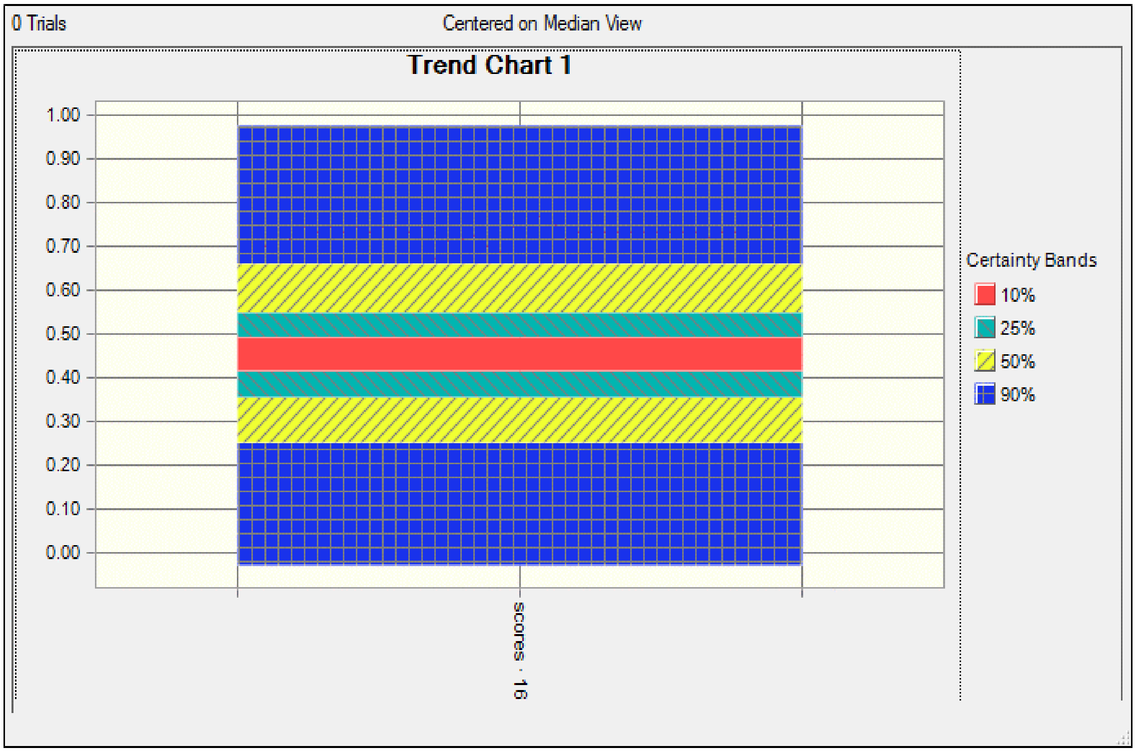
Scatter Chart





Scatter View (1xN)
Correlation: -0.0136
Diversity Intensity
Correlation: 0.0005
Employee Intensity
Correlation: 0.0041
Energy Intensity (W)
Correlation: 0.0862
Evironmental - 1
Correlation: 0.0398
GHG Emission Intensity (W)
Correlation: -0.0062
Local Procurement (W)
Correlation: 0.0133
LTIR/LTIF (W)
Correlation: -0.0014
Percentage of Women in Work..
Correlation: -0.0122
Qatarization Percentage (w)
Correlation: -0.0047
Rate of Qatarization (W)
Correlation: 0.0548
Socio Economic - 1
Correlation: 0.004
Total Work Hours Intensity
Correlation: 0.0325
TRIR/TRIF (W)
Correlation: -0.001
Waste Intensity
Correlation: -0.0198
Waste Recycled
Correlation: 0.0356
Water Intensity (W)

Trend Chart


0 Trials
Centered on Median View
Trend Chart 1
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
scores · 16
Certainty Bands
10%
25%
50%
90%

Number of trial runs (Monte Carlo Simulation) 10,000

Confidence Level: 95%

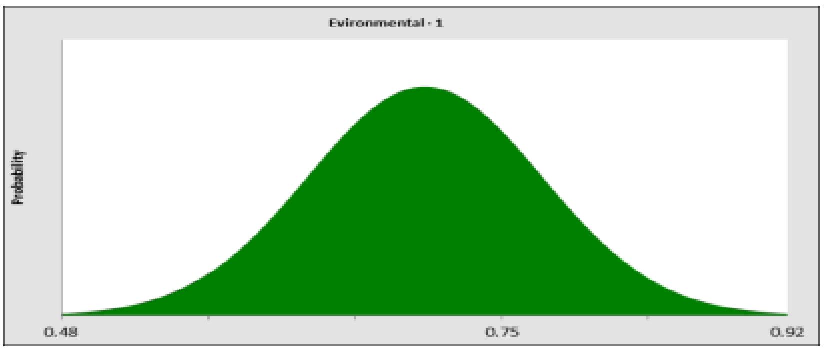
Ras Gas: Main criteria Weights

Assumptions

Assumption: Environmental · 1

Normal distribution with parameters:

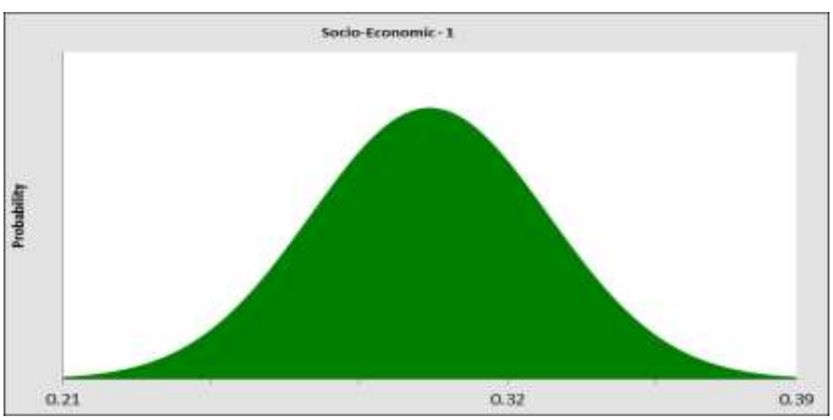
Mean	0.70
Std. Dev.	0.07



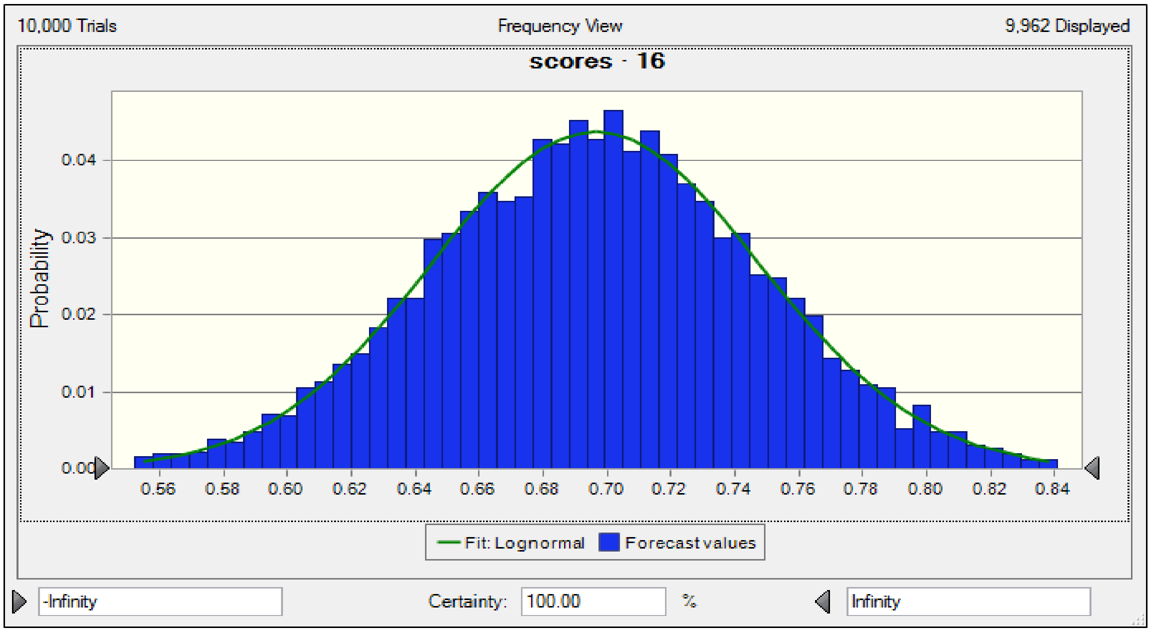
Assumption: Socio-Economic · 1

Normal distribution with parameters:

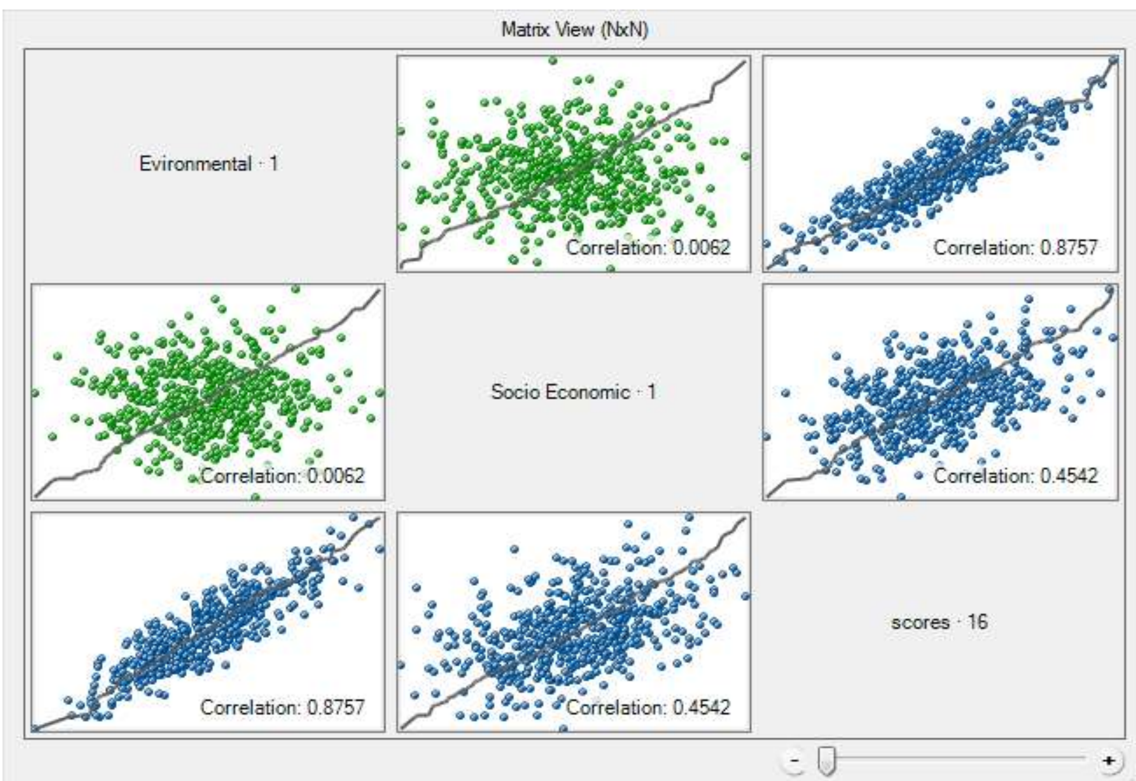
Mean	0.30
Std. Dev.	0.03



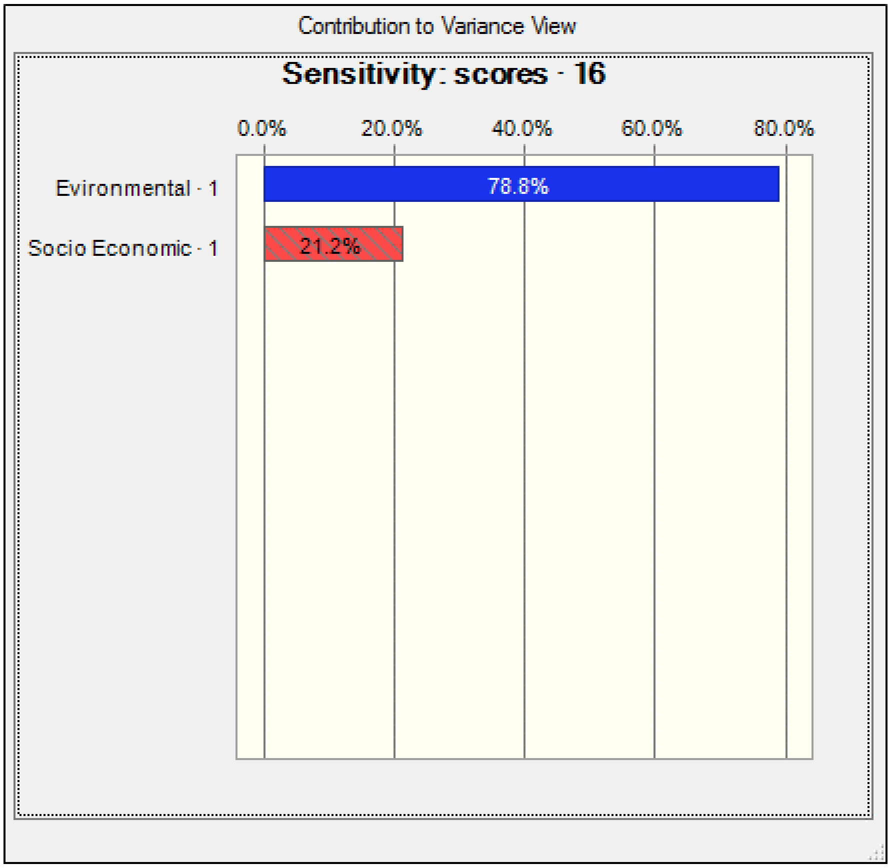
Forecasted scores



Scatter Chart



Sensitivity Chart



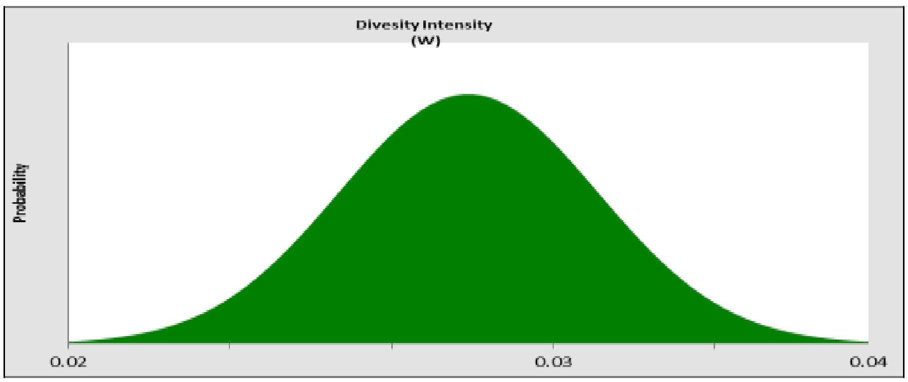
Ras Gas: Sub Criteria Weights

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

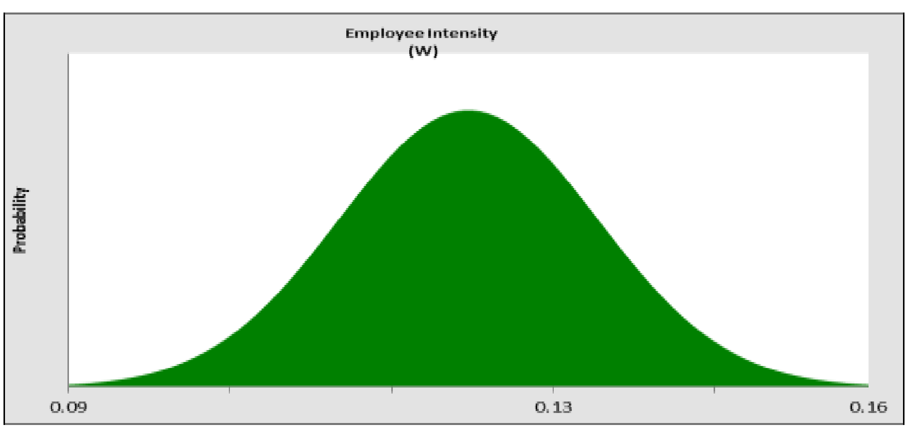
Mean	0.03
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	0.12
Std. Dev.	0.01

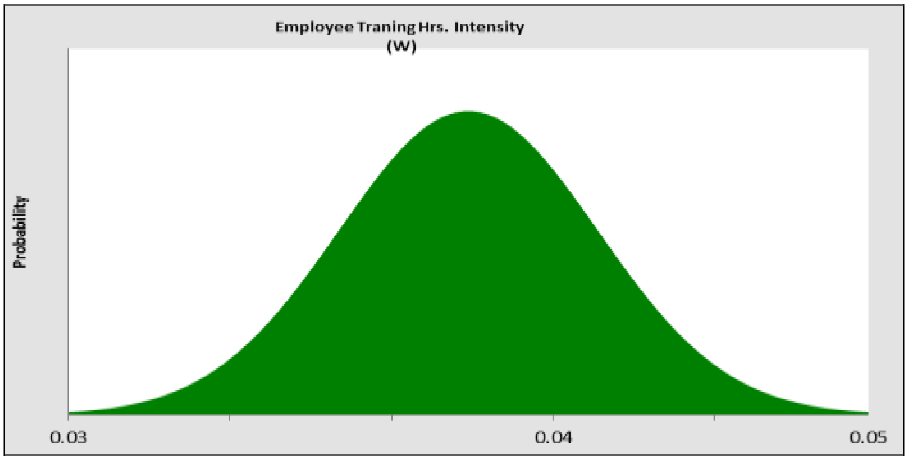


Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

Mean 0.04

Std. Dev. 0.00

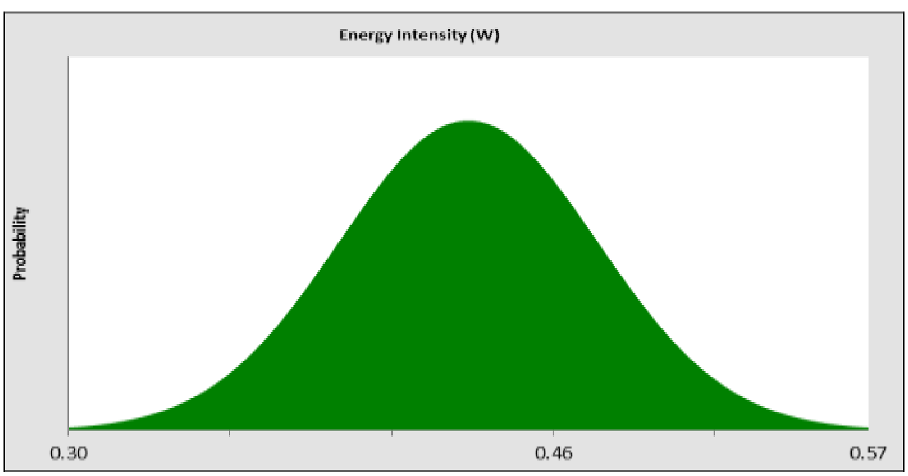


Assumption: Energy Intensity

Normal distribution with parameters:

Mean 0.43

Std. Dev. 0.04

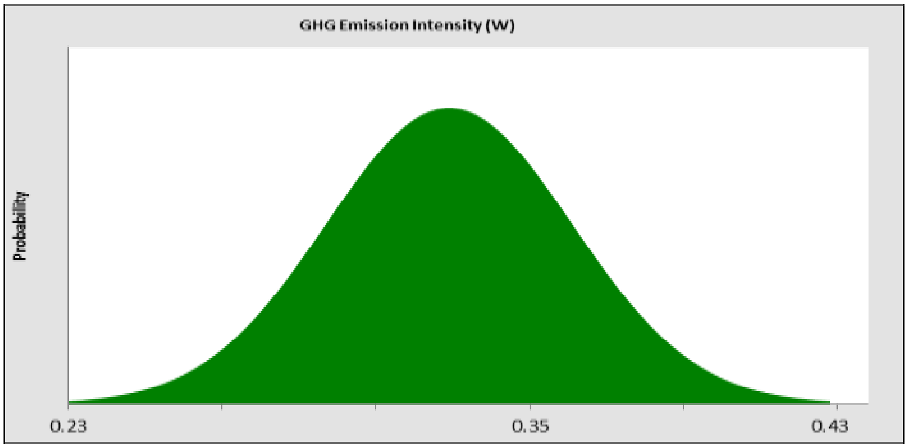


Assumption: GHG Emission Intensity

Normal distribution with parameters:

Mean 0.33

Std. Dev. 0.03

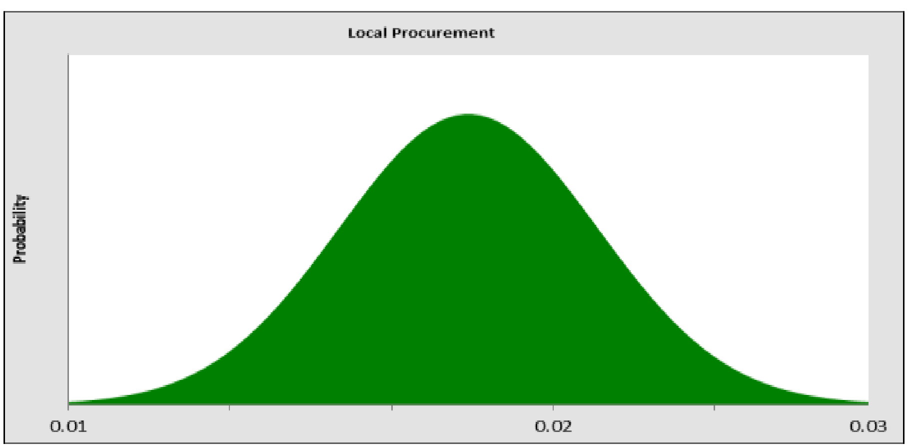


Assumption: Local Procurement

Normal distribution with parameters:

Mean 0.02

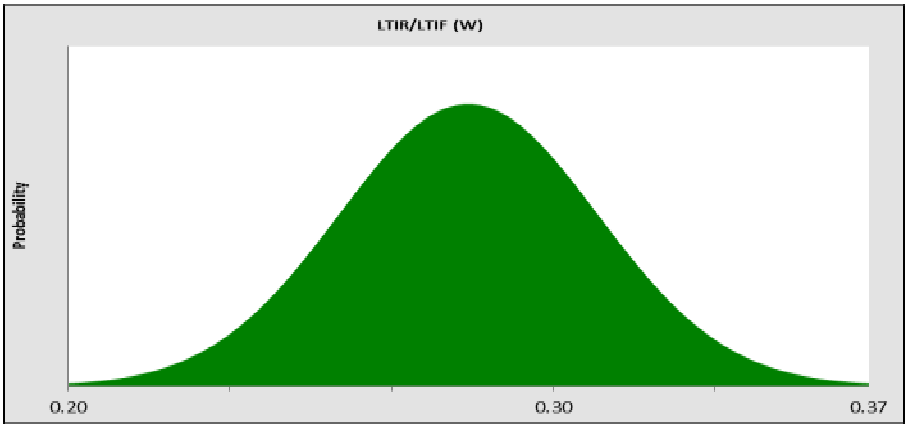
Std. Dev. 0.00



Assumption: LTIR

Normal distribution with parameters:

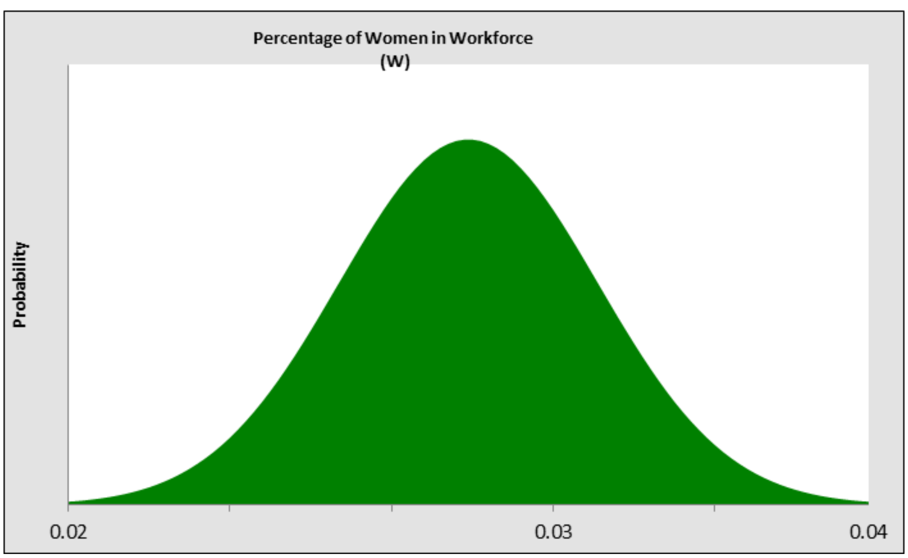
Mean	0.28
Std. Dev.	0.03



Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean	0.03
Std. Dev.	0.00

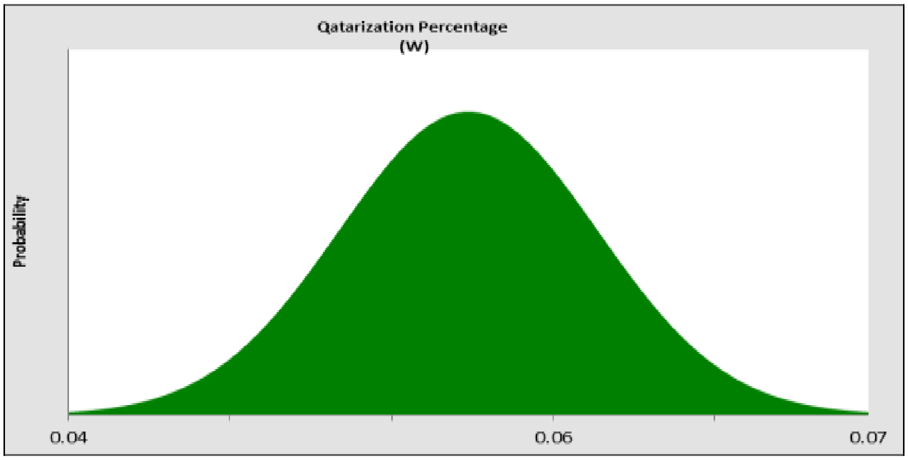


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.05

Std. Dev. 0.01

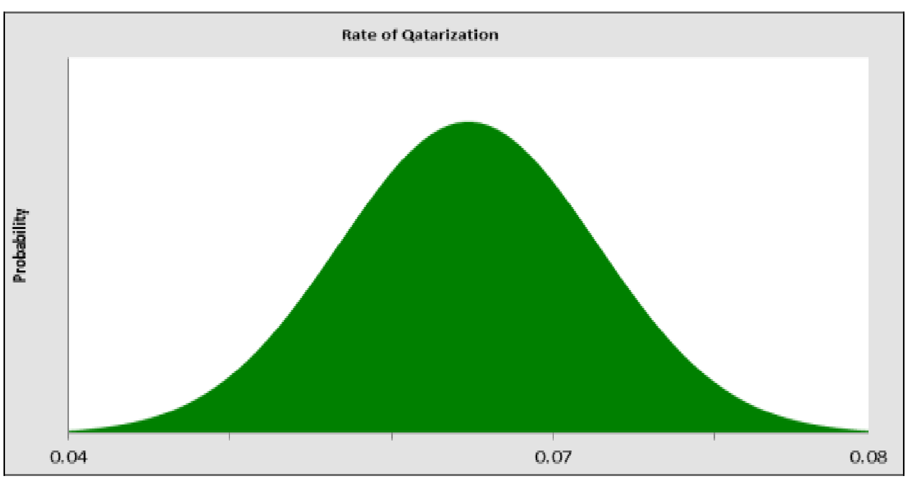


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

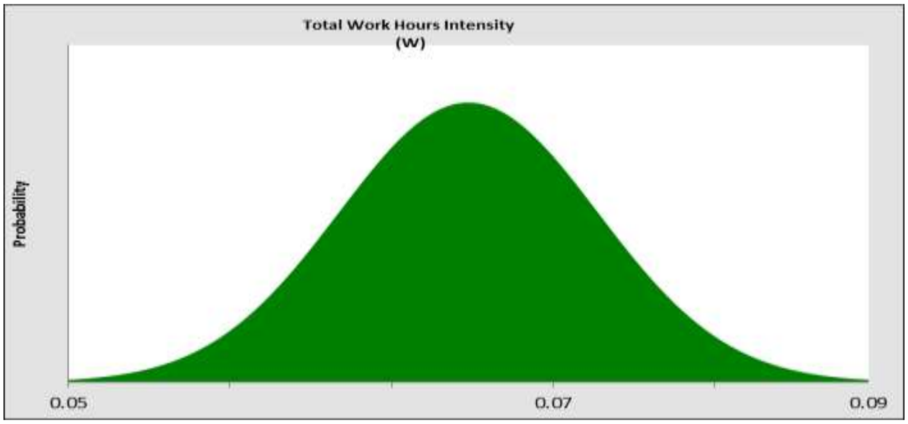


Assumption: Total Work Hours Intensity

Normal distribution with parameters:

Mean 0.07

Std. Dev. 0.01

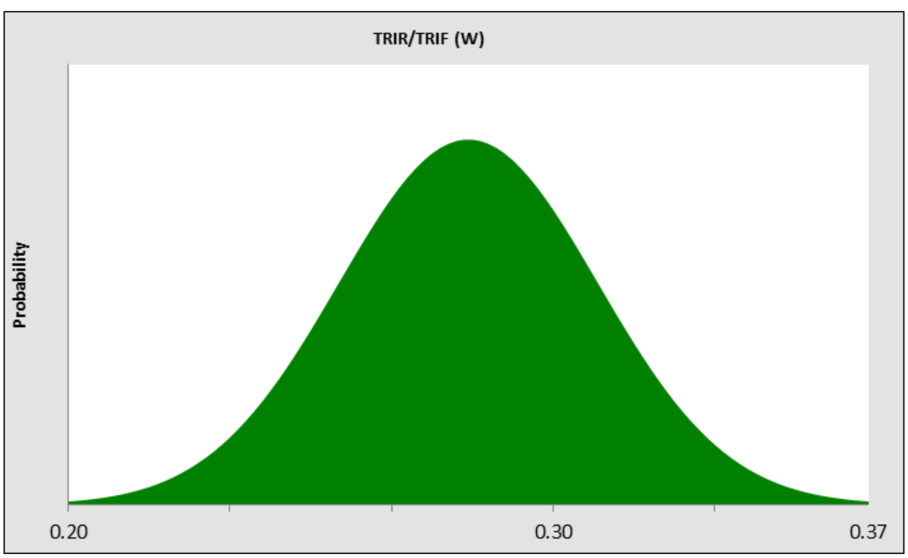


Assumption: TRIR

Normal distribution with parameters:

Mean 0.28

Std. Dev. 0.03

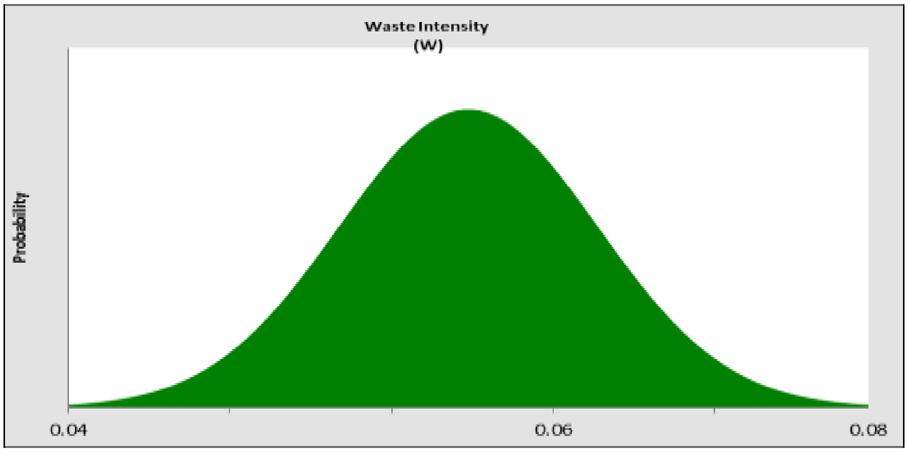


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

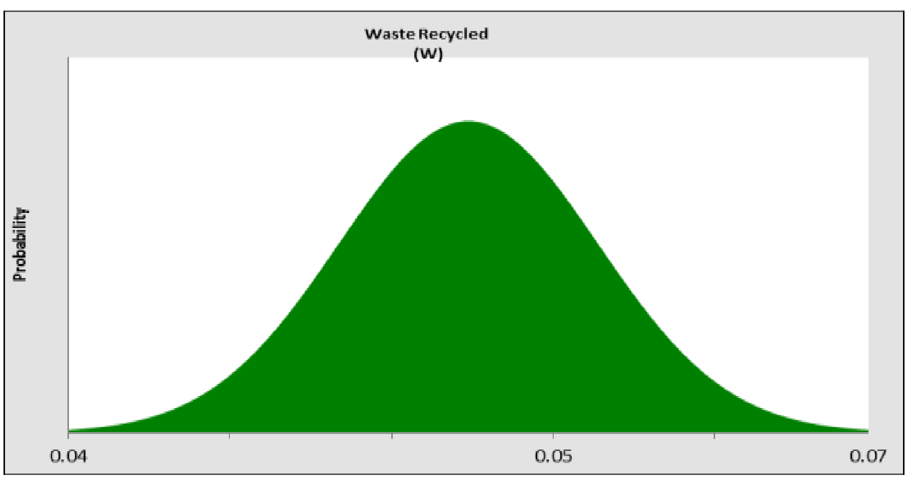


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.05

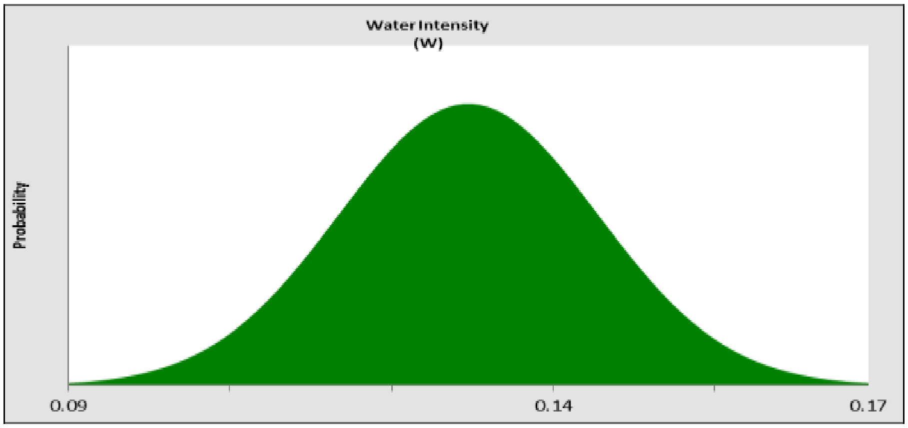
Std. Dev. 0.01



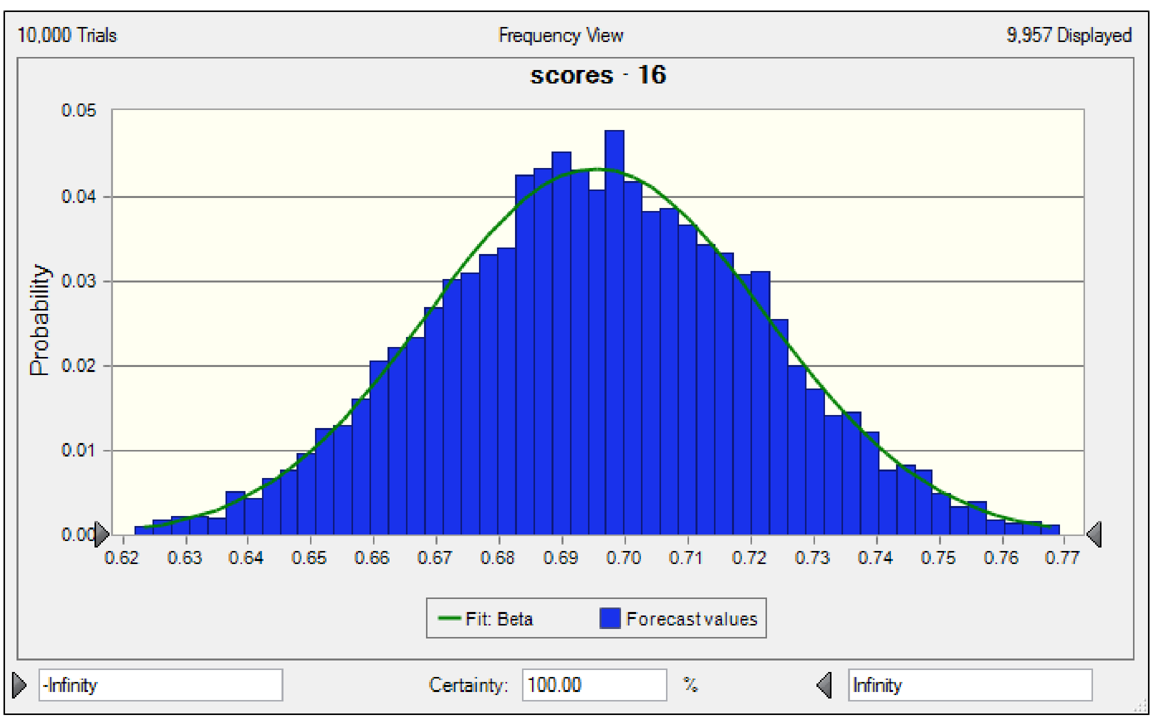
Assumption: Water Intensity

Normal distribution with parameters:

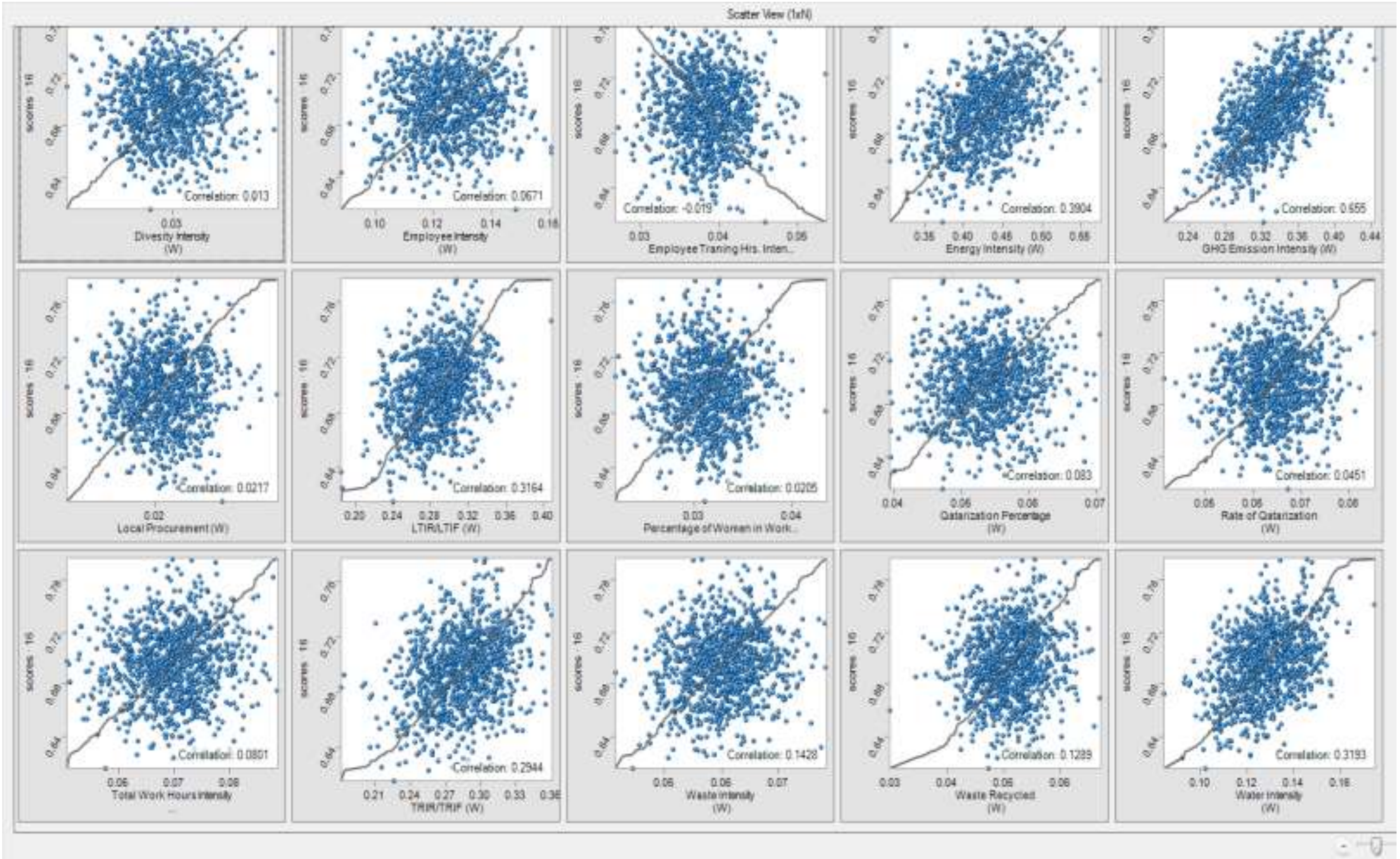
Mean	0.13
Std. Dev.	0.01



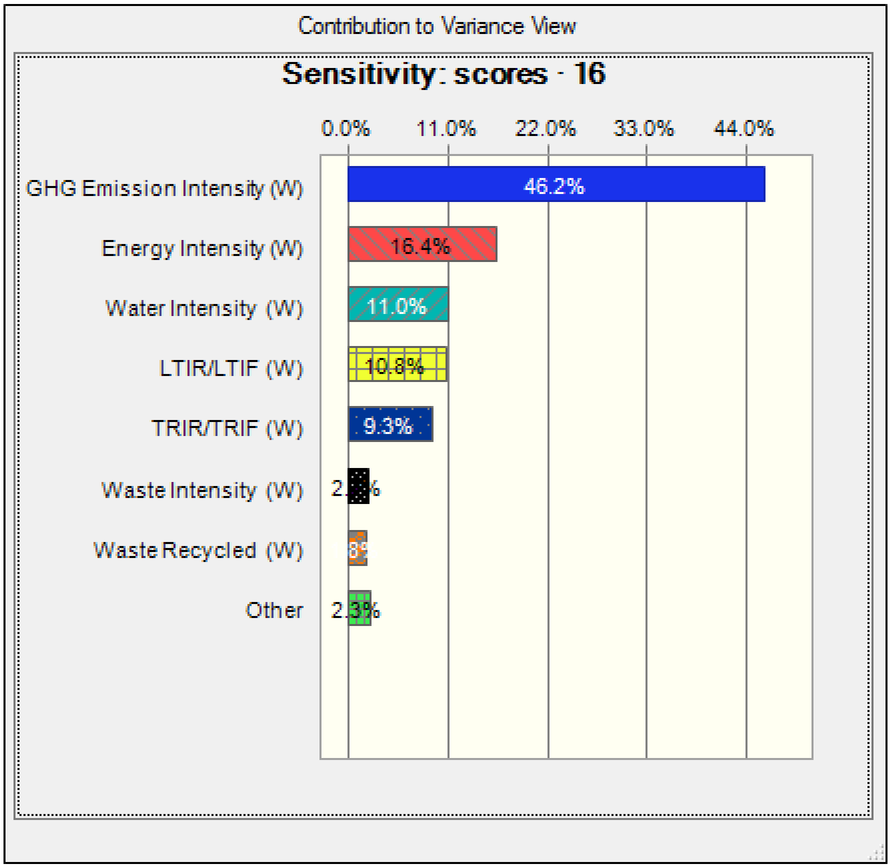
Forecasted Scores



Scatter Charts



Sensitivity Chart



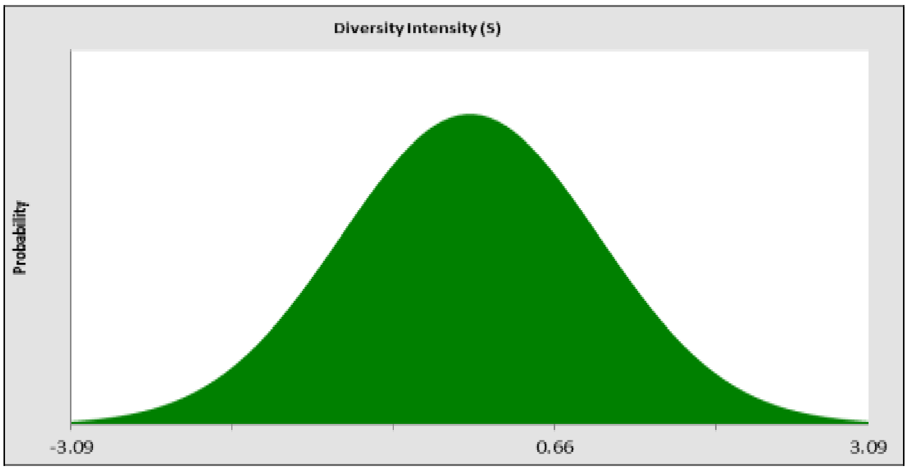
Ras Gas: Sub Criteria Scores

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

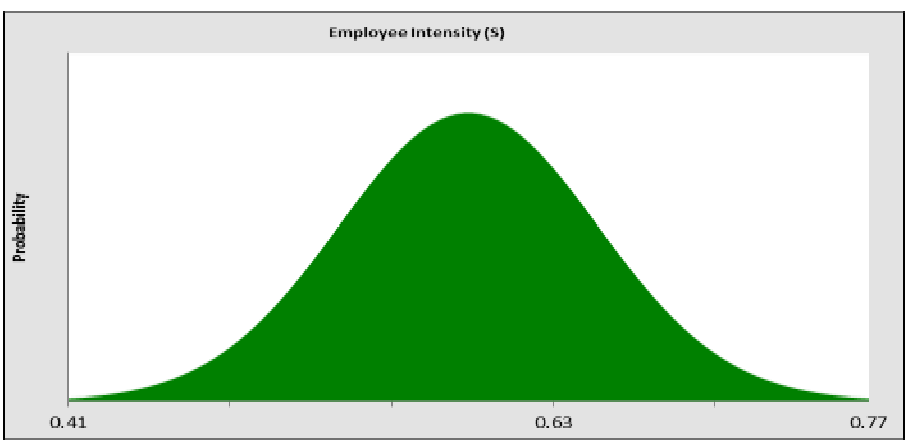
Mean	0.00
Std. Dev.	1.00



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	0.59
Std. Dev.	0.06

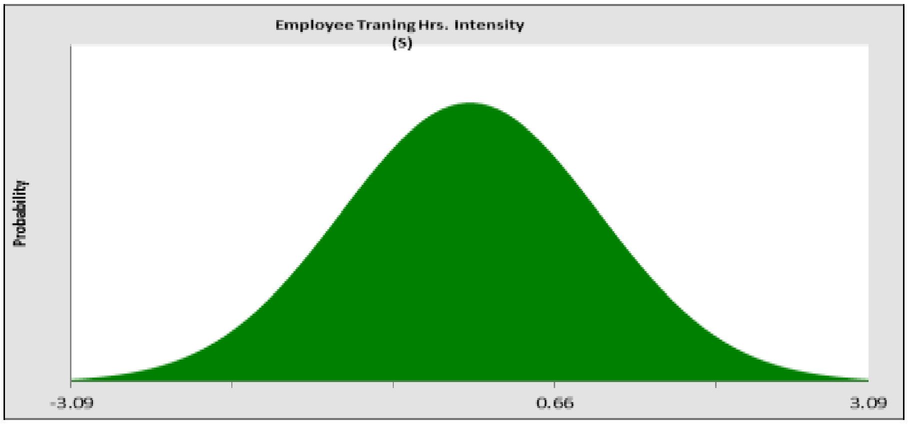


Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

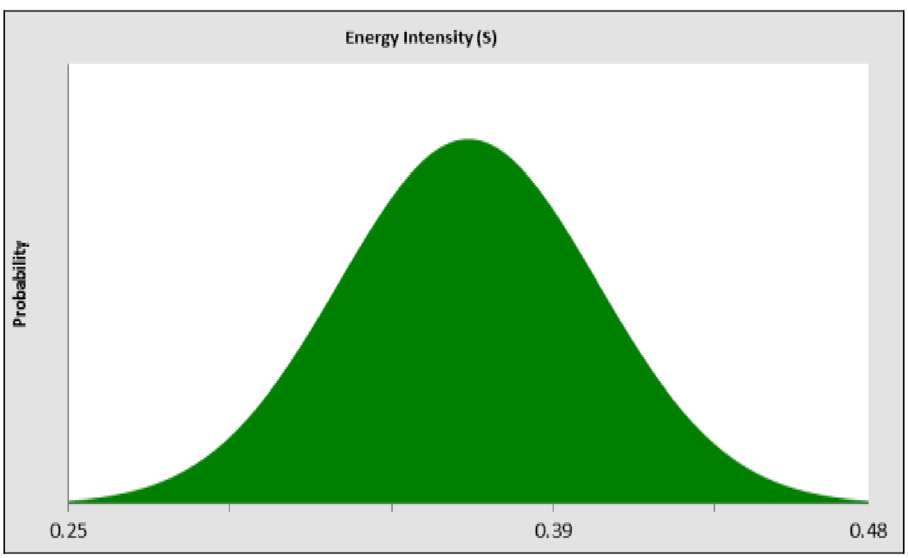


Assumption: Energy Intensity

Normal distribution with parameters:

Mean 0.37

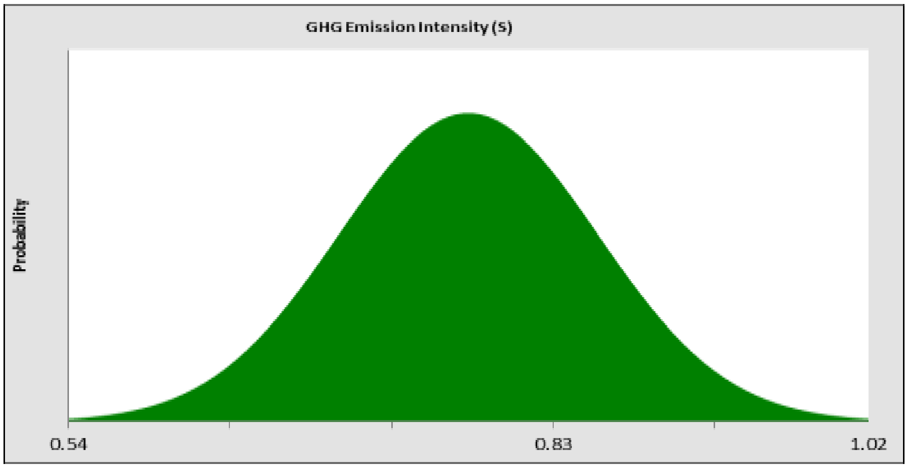
Std. Dev. 0.04



Assumption: GHG Emission Intensity

Normal distribution with parameters:

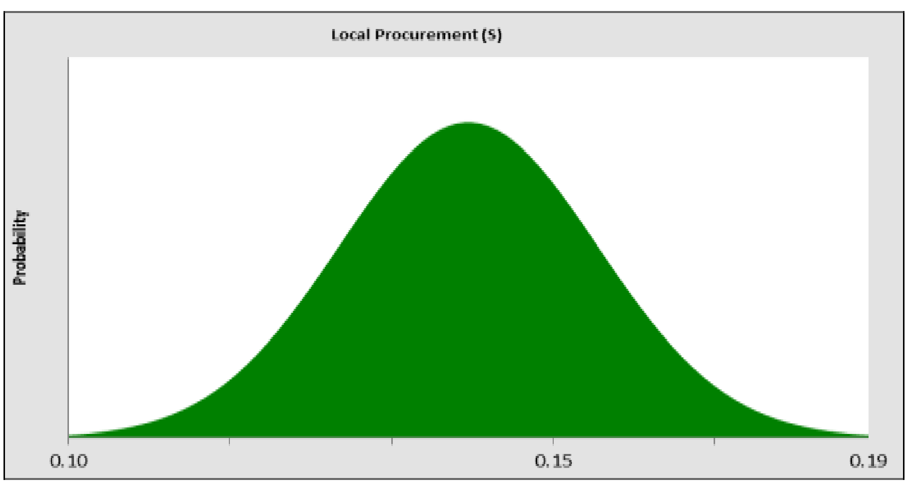
Mean	0.78
Std. Dev.	0.08



Assumption: Local Procurement

Normal distribution with parameters:

Mean	0.14
Std. Dev.	0.01

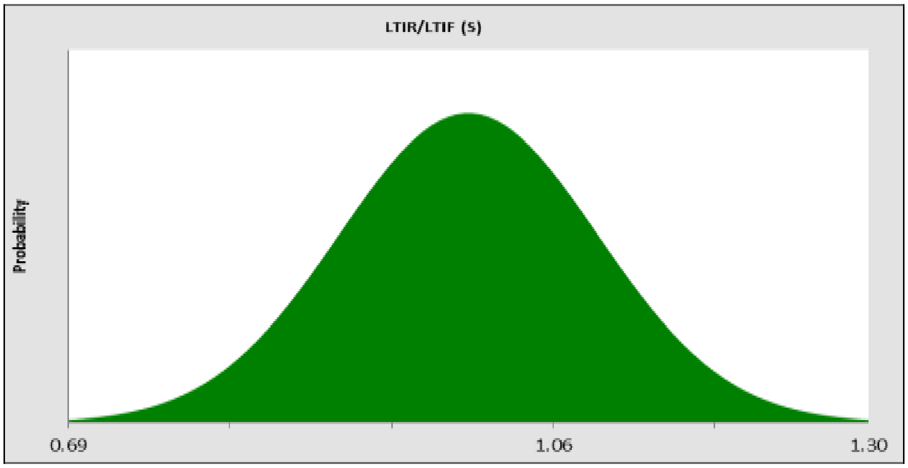


Assumption: LTIR

Normal distribution with parameters:

Mean 0.99

Std. Dev. 0.10

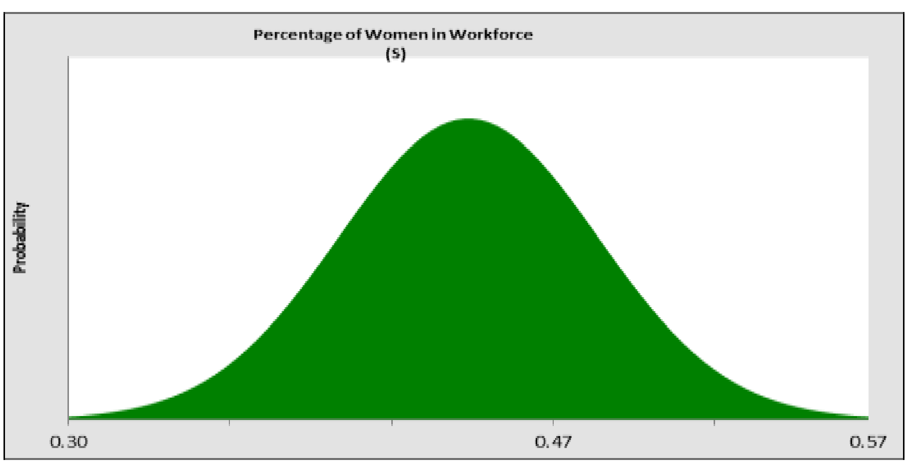


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 0.44

Std. Dev. 0.04

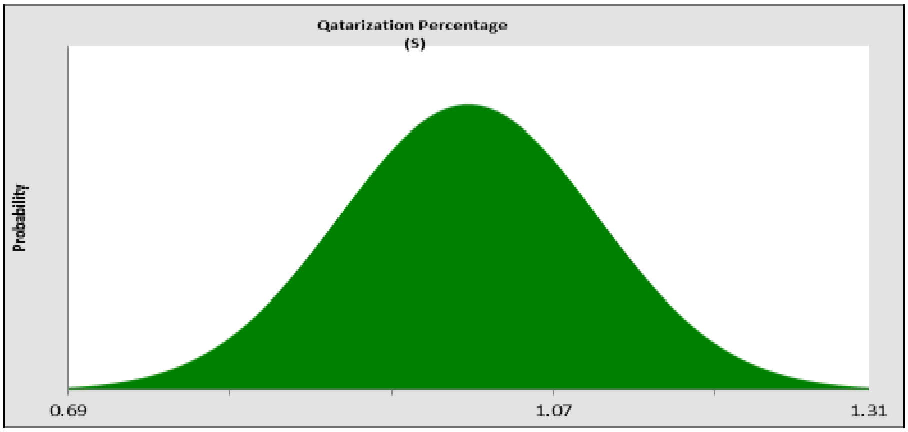


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 1.00

Std. Dev. 0.10

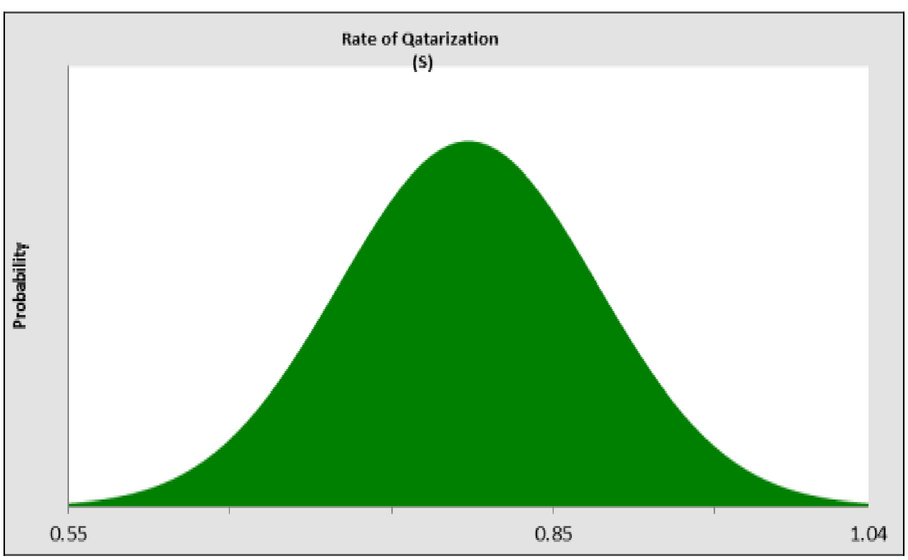


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.79

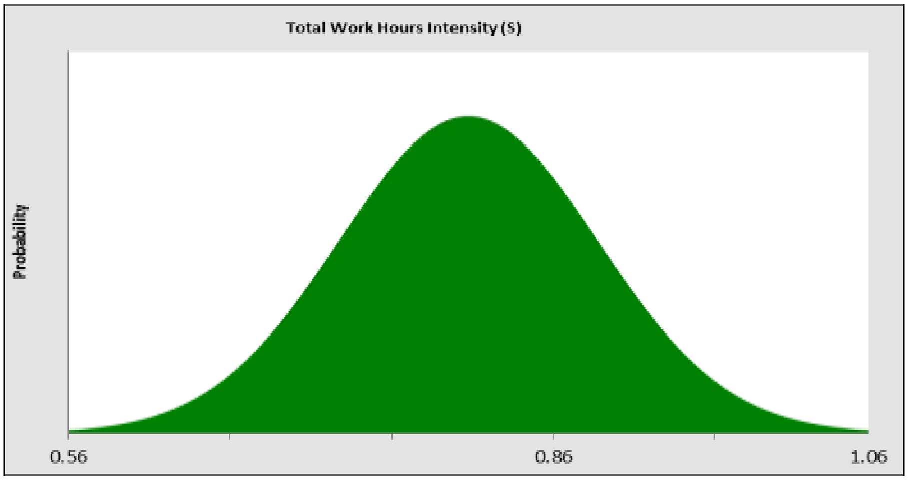
Std. Dev. 0.08



Assumption: Total Work Hours Intensity

Normal distribution with parameters:

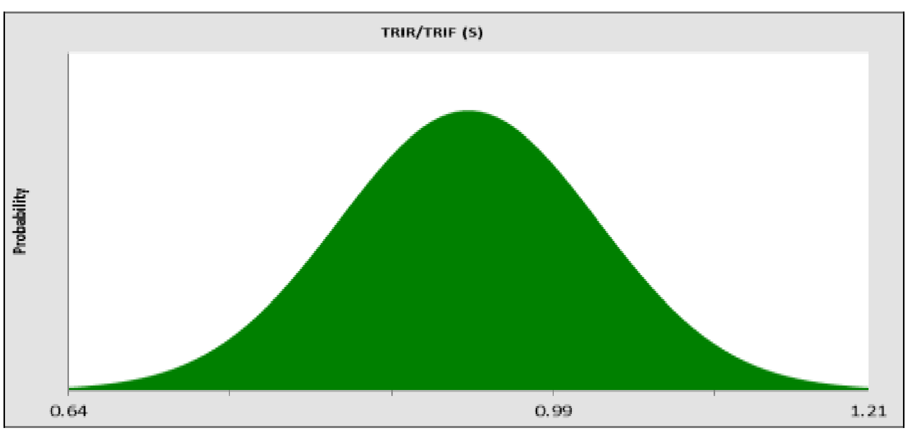
Mean	0.81
Std. Dev.	0.08



Assumption: TRIR

Normal distribution with parameters:

Mean	0.93
Std. Dev.	0.09

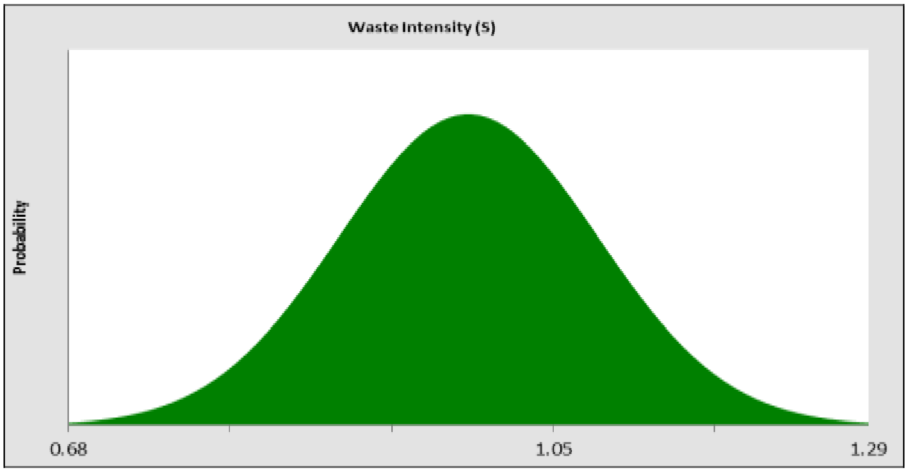


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.99

Std. Dev. 0.10

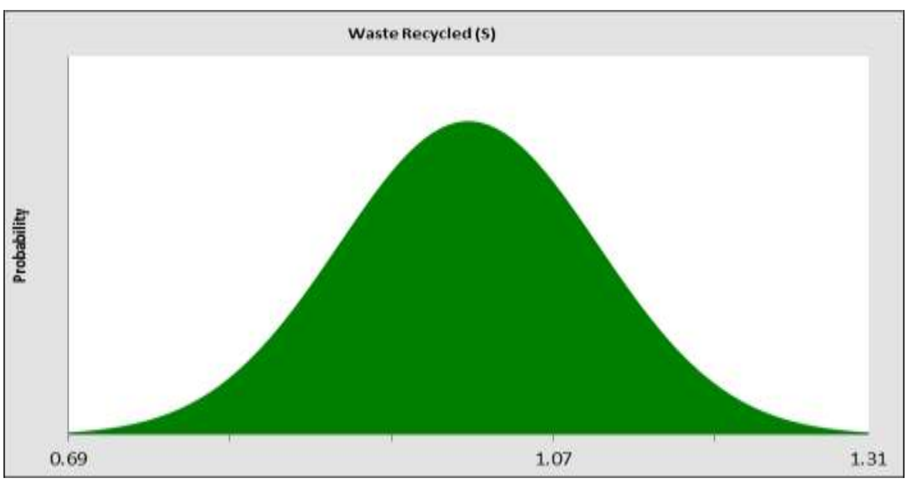


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 1.00

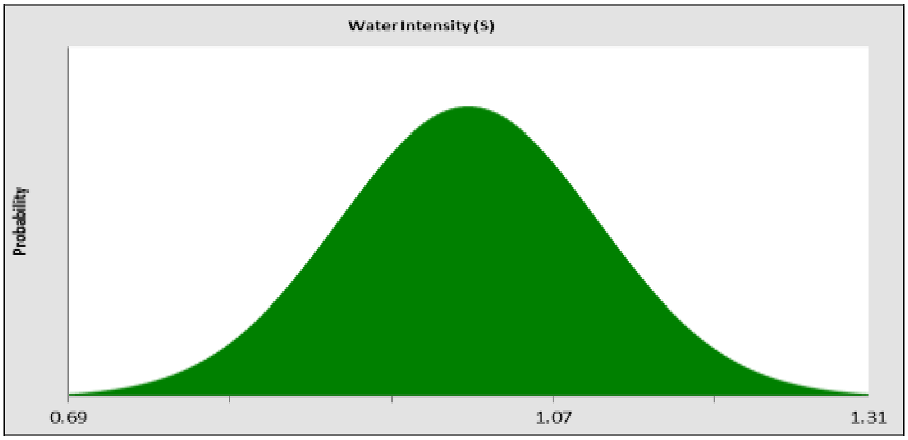
Std. Dev. 0.10



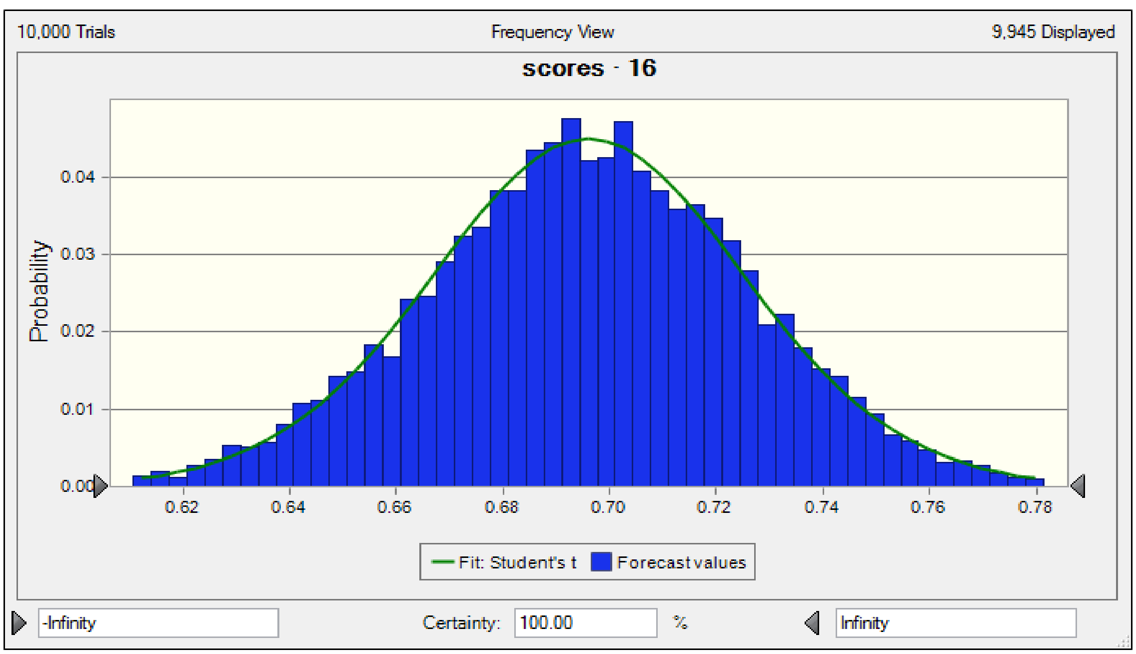
Assumption: Water Intensity

Normal distribution with parameters:

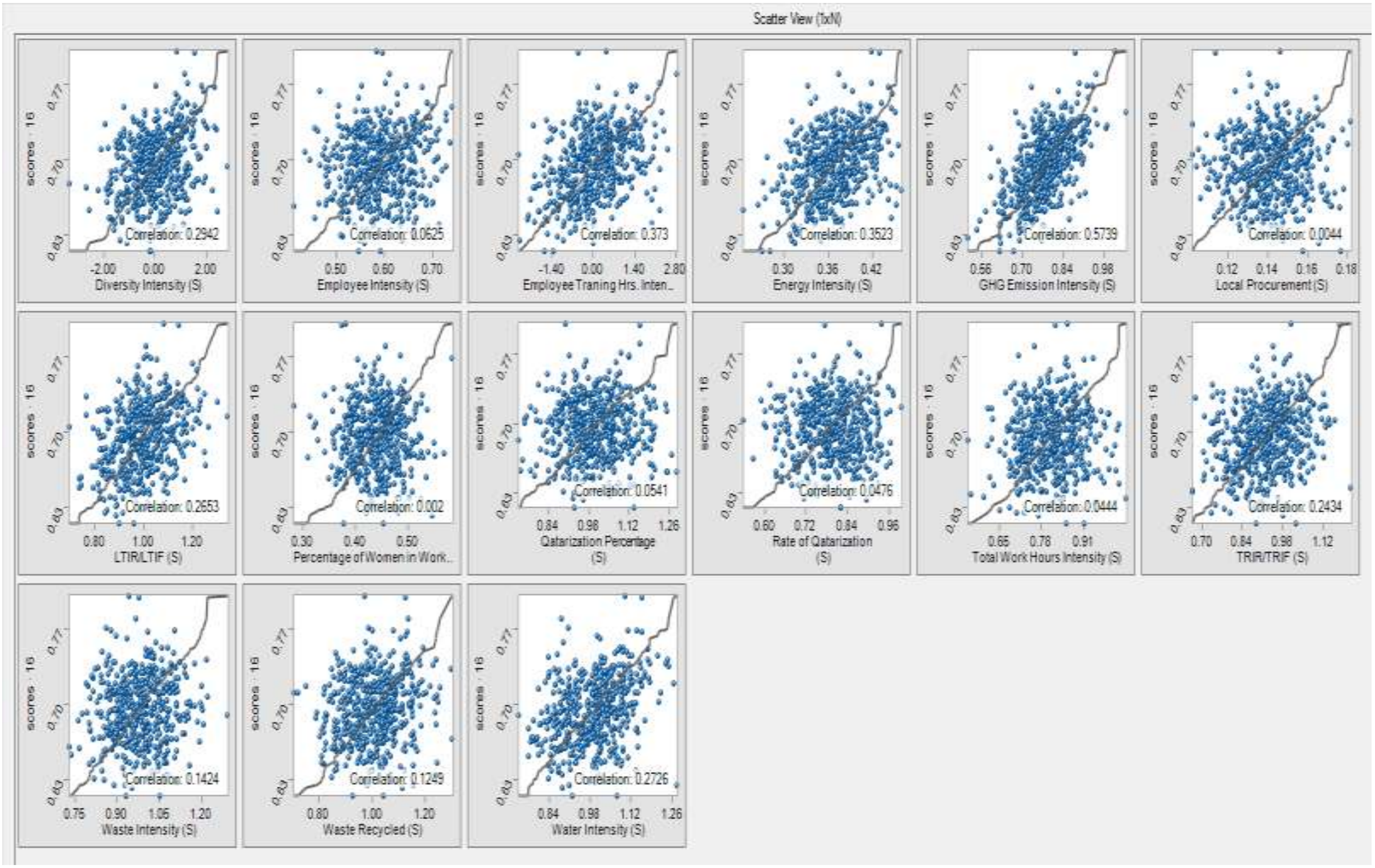
Mean	1.00
Std. Dev.	0.10



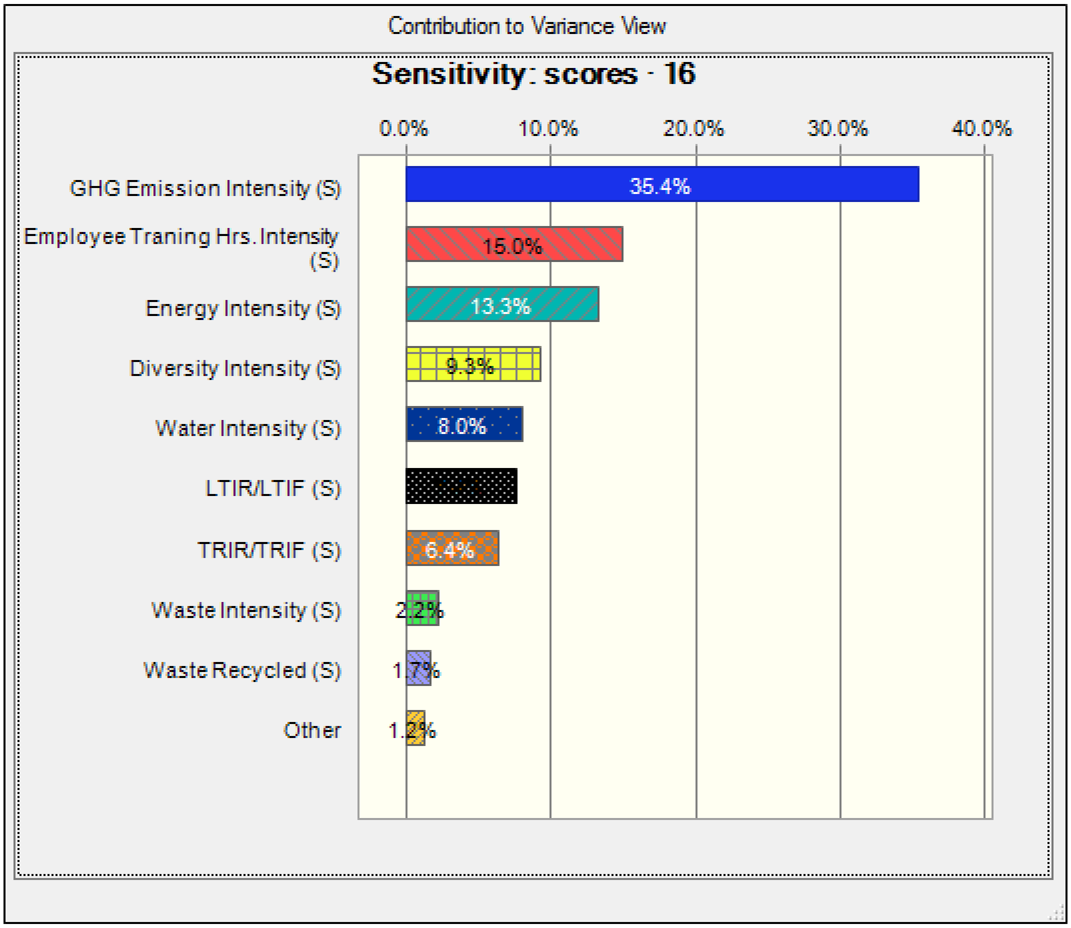
Forecasted Scores



Scatter Charts

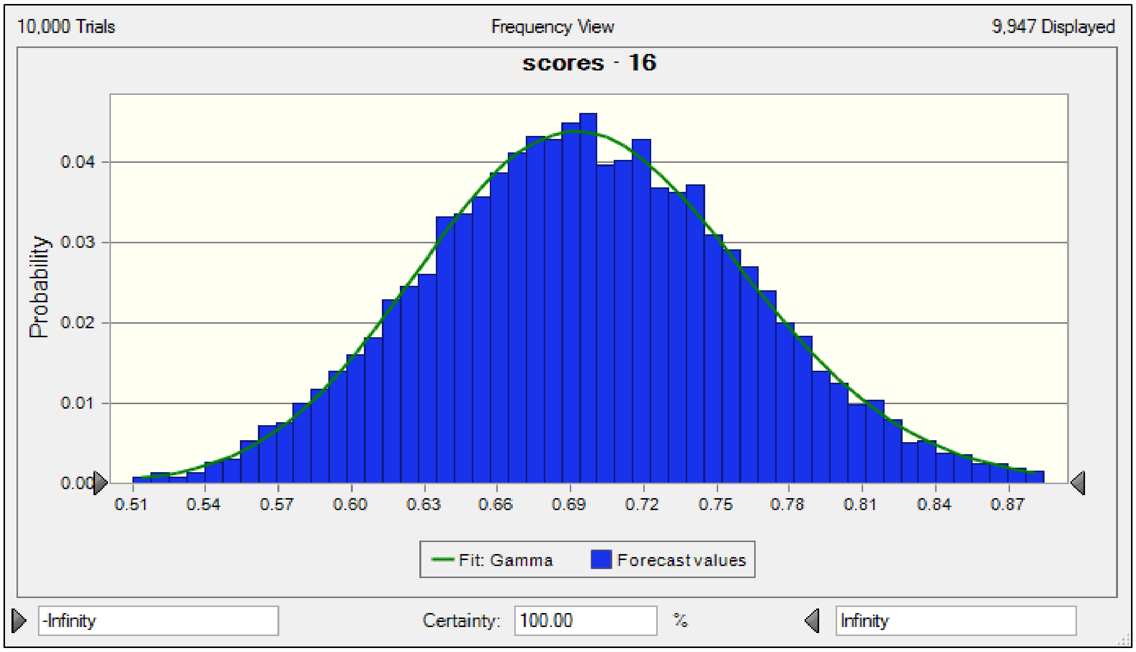


Sensitivity Chart

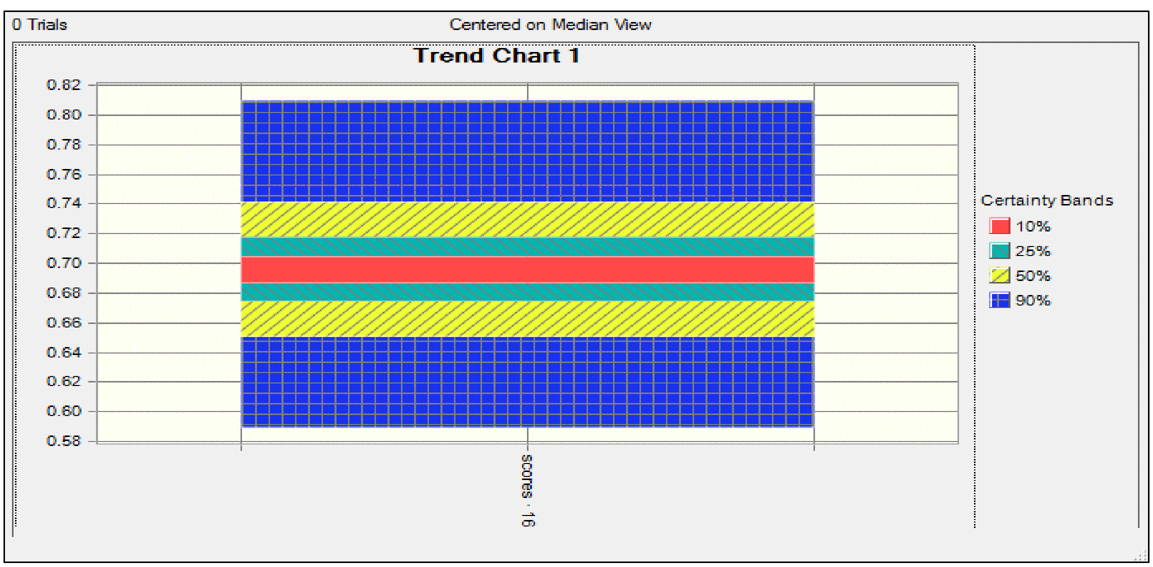


Ras Gas: All Uncertainties

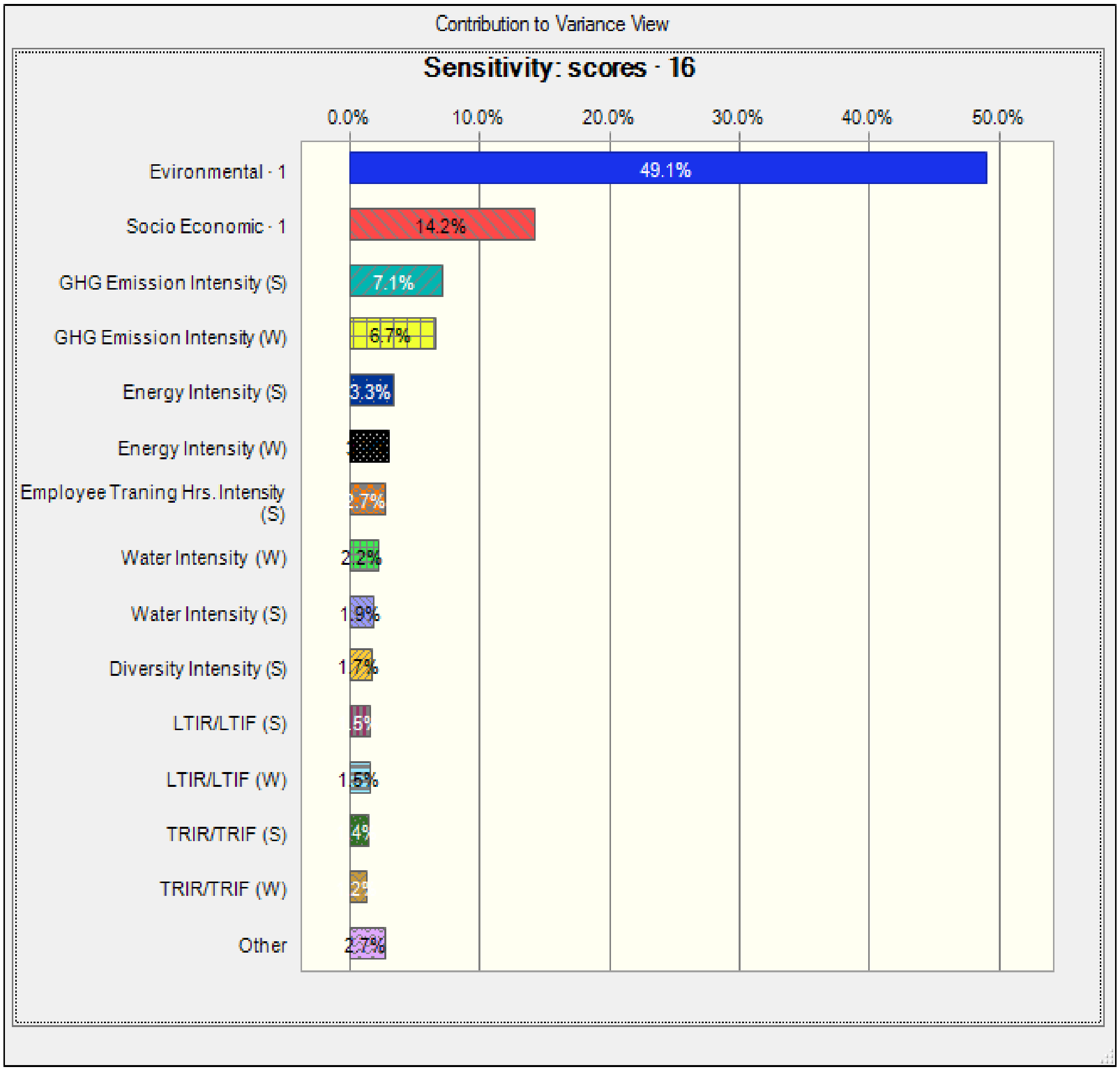
Forecasted Scores



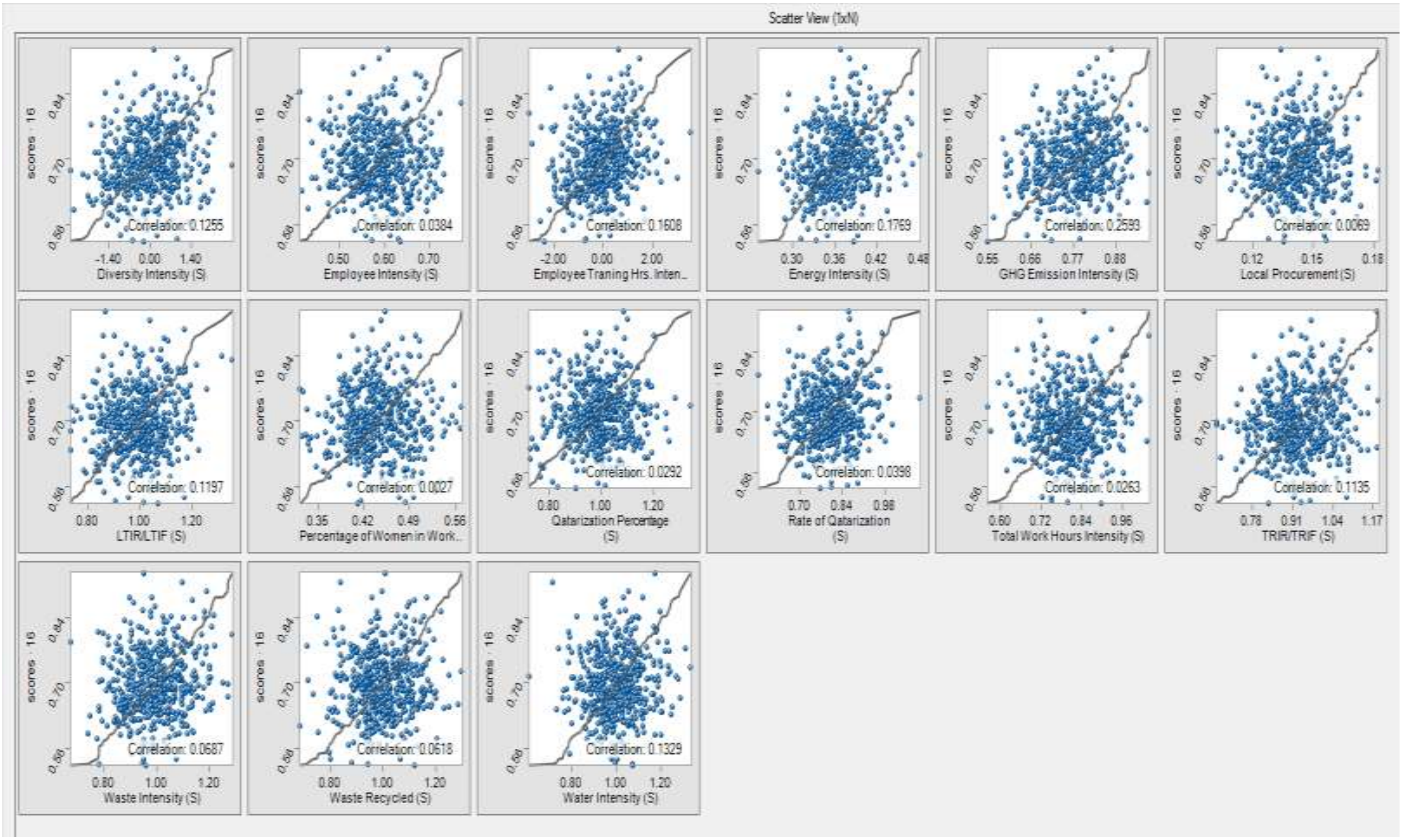
Trend Chart

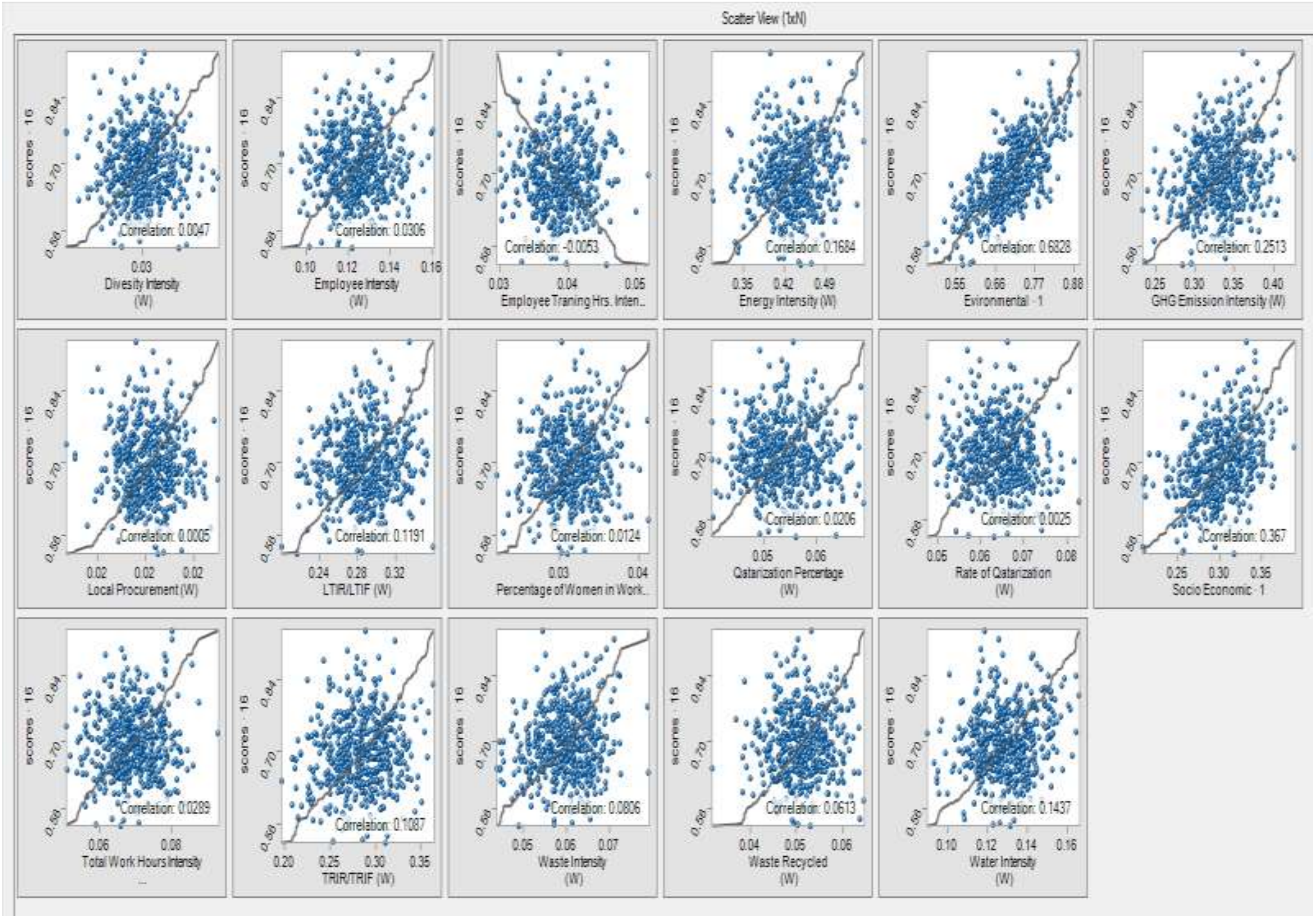


Sensitivity Chart



Scatter Chart




Scatter View (1xN)
Correlation: 0.0047
Divesity Intensity (W)
Correlation: 0.0306
Employee Intensity (W)
Correlation: -0.0053
Employee Traning Hrs. Inten...
Correlation: 0.1684
Energy Intensity (W)
Correlation: 0.6828
Evironmental - 1
Correlation: 0.2513
GHG Emission Intensity (W)
Correlation: 0.0005
Local Procurement (W)
Correlation: 0.1191
LTIR/LTIF (W)
Correlation: 0.0124
Percentage of Women in Work...
Correlation: 0.0206
Qatarization Percentage (W)
Correlation: 0.0025
Rate of Qatarization (W)
Correlation: 0.367
Socio Economic - 1
Correlation: 0.0289
Total Work Hours Intensity ...
Correlation: 0.1087
TRIR/TRIF (W)
Correlation: 0.0806
Waste Intensity (W)
Correlation: 0.0613
Waste Recycled (W)
Correlation: 0.1437
Water Intensity (W)
scores - 16

Number of trial runs (Monte Carlo Simulation) 10,000

Confidence Level: 95%

GDI: Main criteria Weights

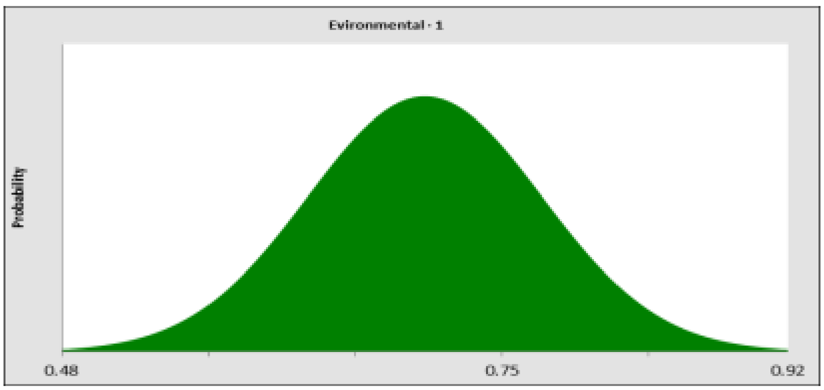
Assumptions

Assumption: Environmental · 1

Normal distribution with parameters:

Mean 0.70

Std. Dev. 0.07

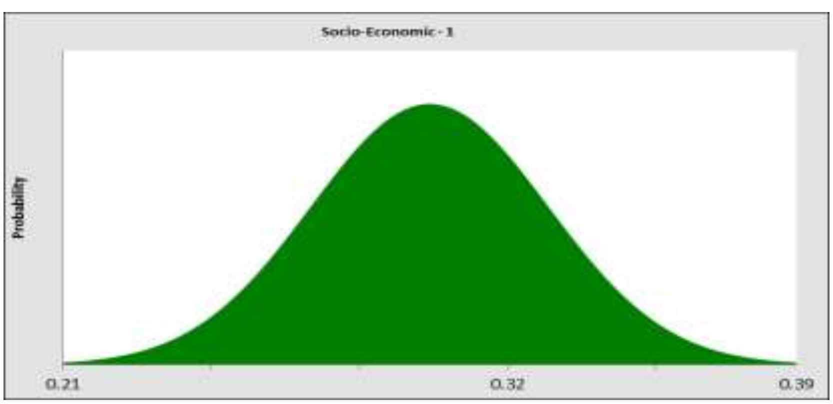


Assumption: Socio-Economic · 1

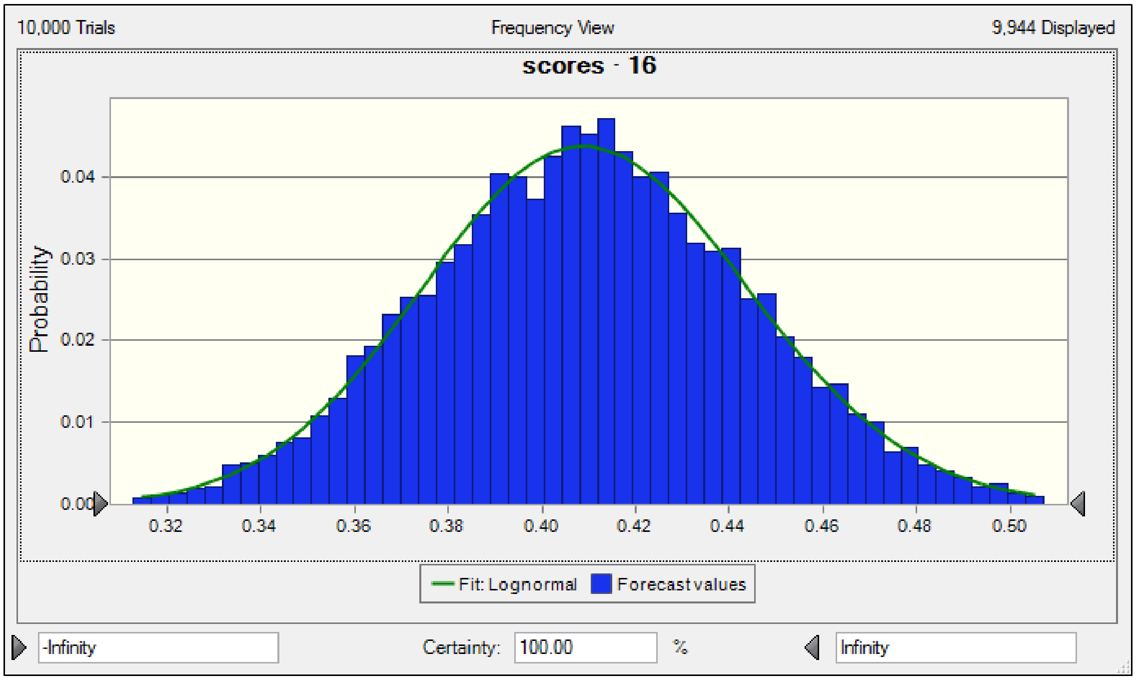
Normal distribution with parameters:

Mean 0.30

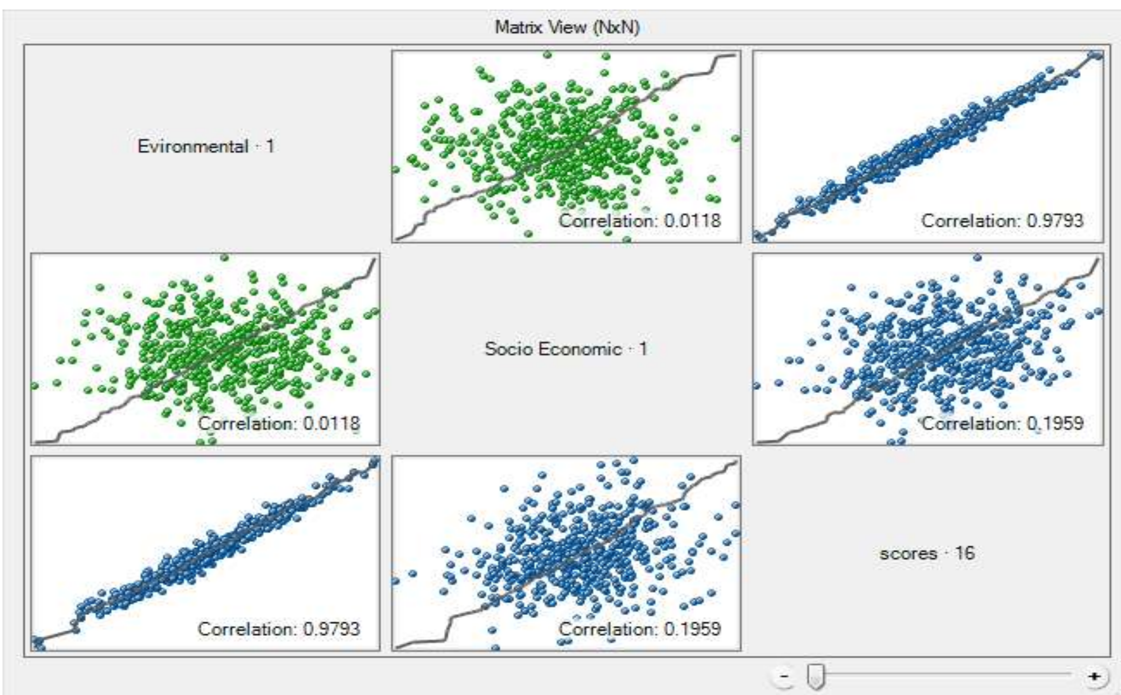
Std. Dev. 0.03



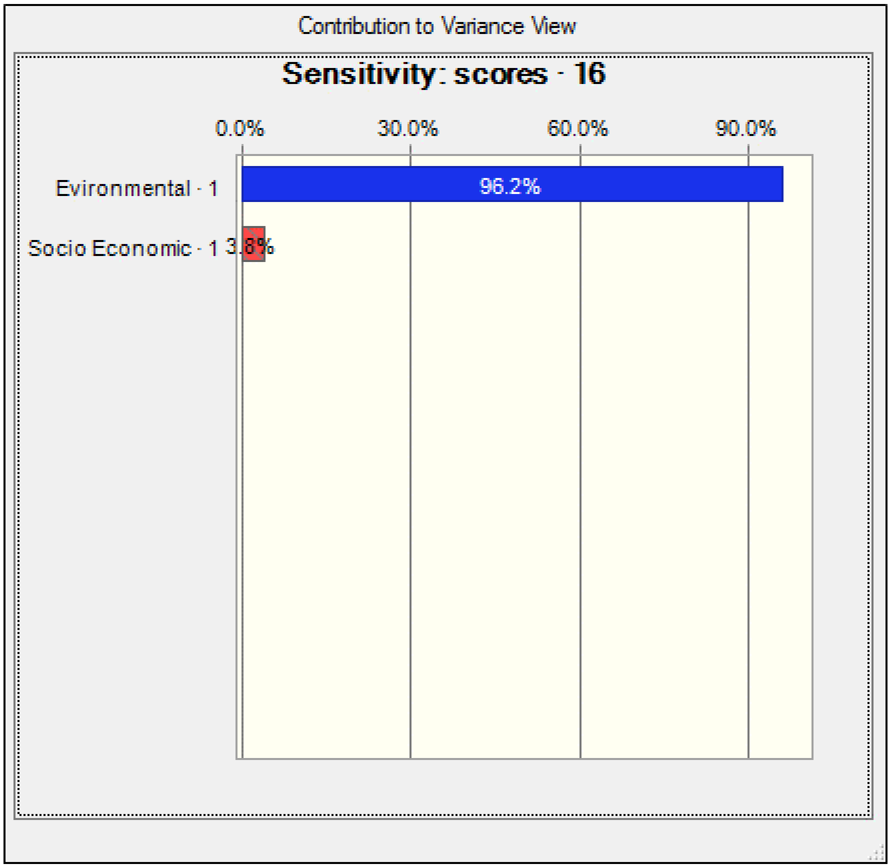
Forecasted scores



Scatter Chart



Sensitivity Chart



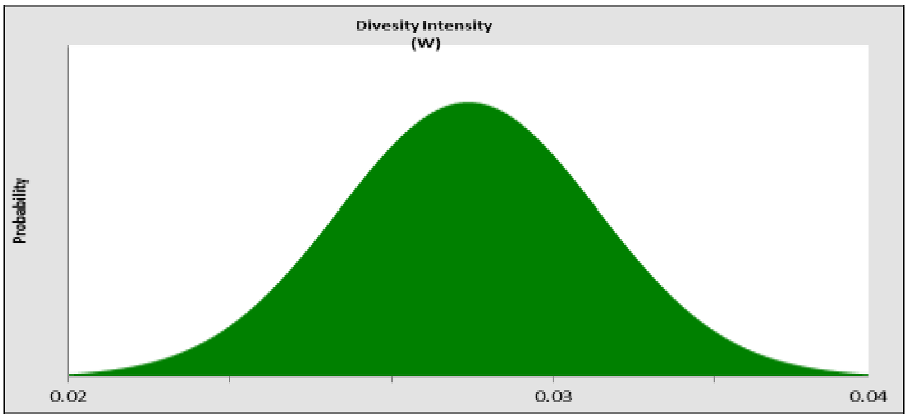
Ras Gas: Sub Criteria Weights

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

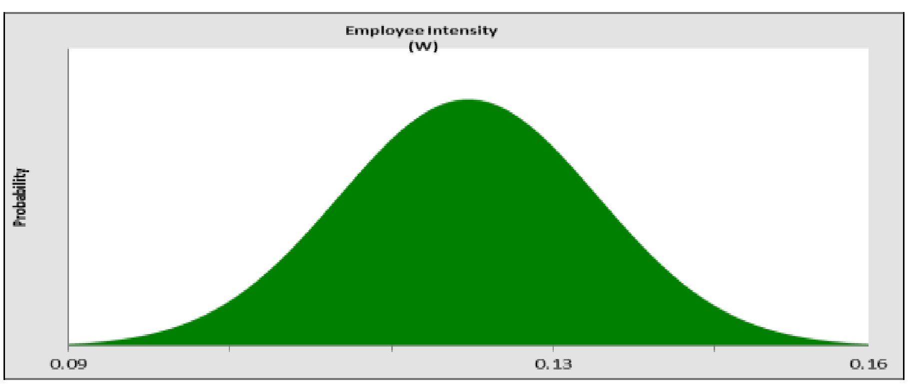
Mean	0.03
Std. Dev.	0.00



Assumption: Employee Intensity

Normal distribution with parameters:

Mean	0.12
Std. Dev.	0.01

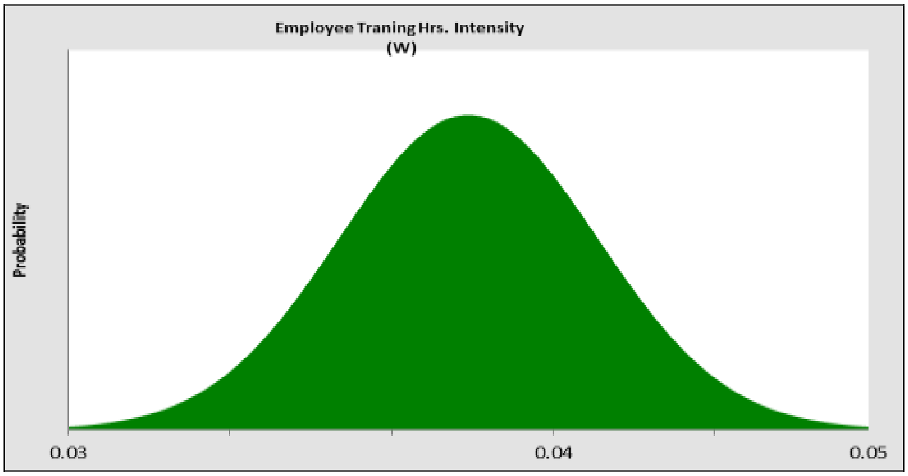


Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

Mean 0.04

Std. Dev. 0.00

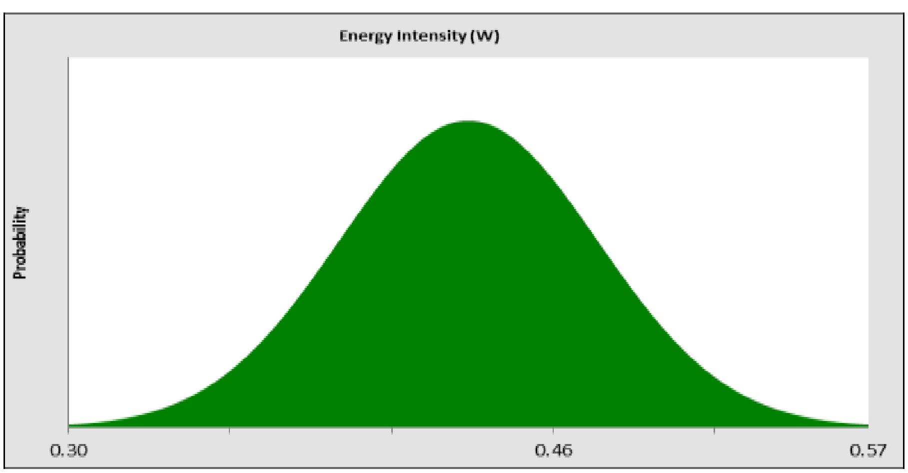


Assumption: Energy Intensity

Normal distribution with parameters:

Mean 0.43

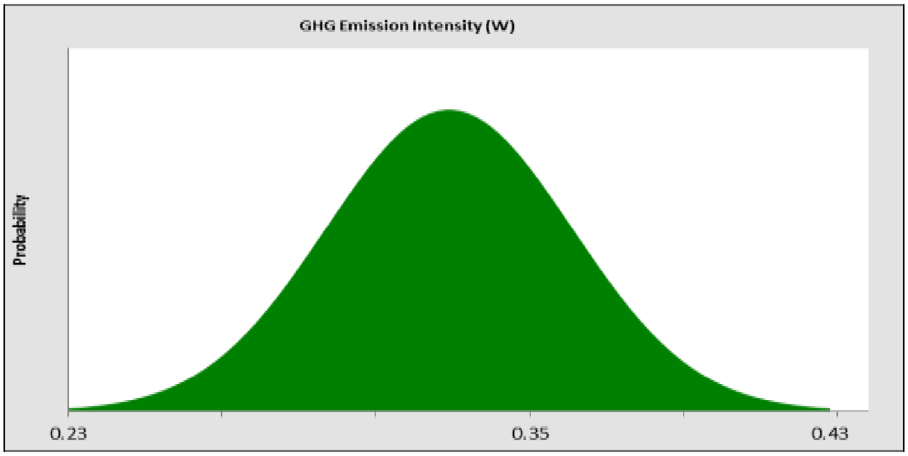
Std. Dev. 0.04



Assumption: GHG Emission Intensity

Normal distribution with parameters:

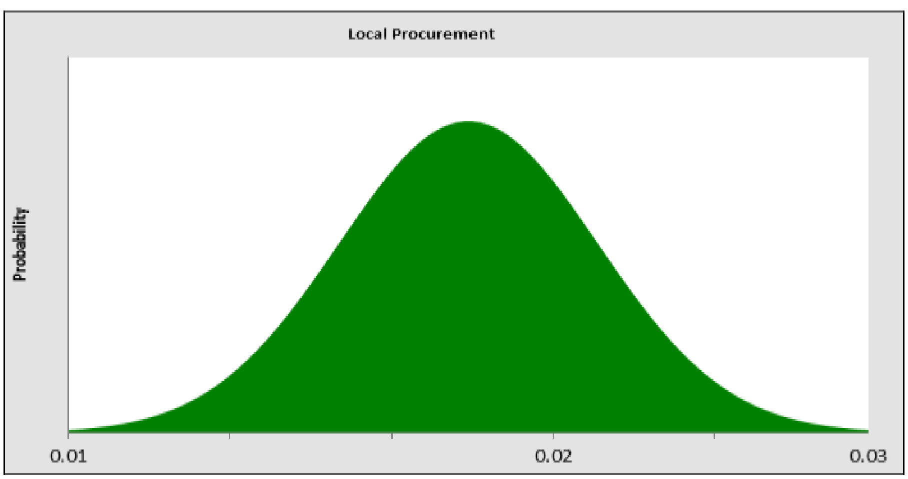
Mean	0.33
Std. Dev.	0.03



Assumption: Local Procurement

Normal distribution with parameters:

Mean	0.02
Std. Dev.	0.00

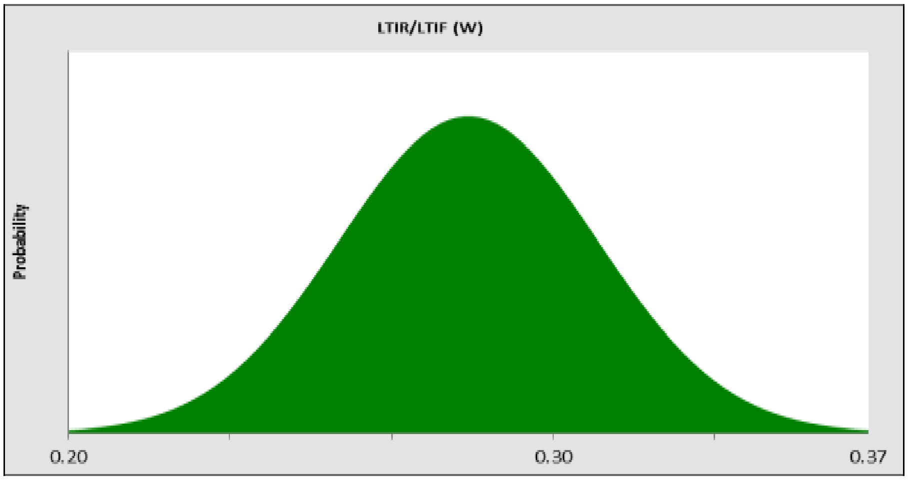


Assumption: LTIR

Normal distribution with parameters:

Mean 0.28

Std. Dev. 0.03

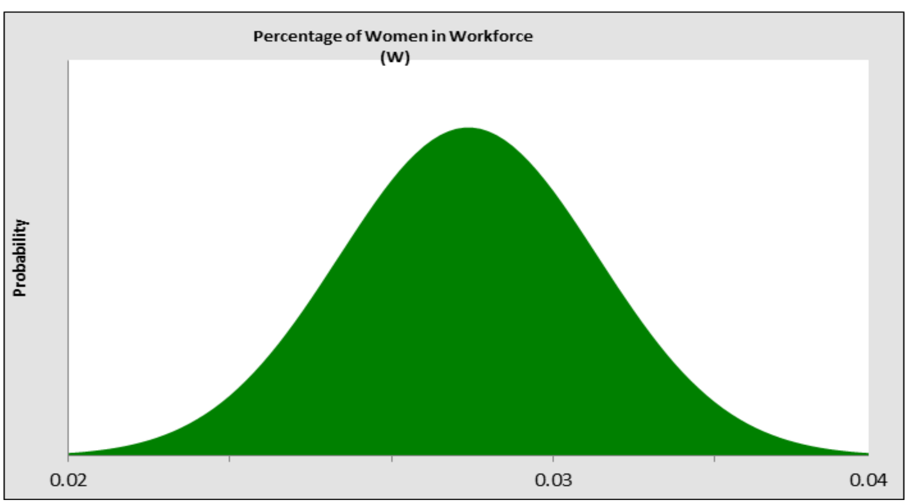


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 0.03

Std. Dev. 0.00

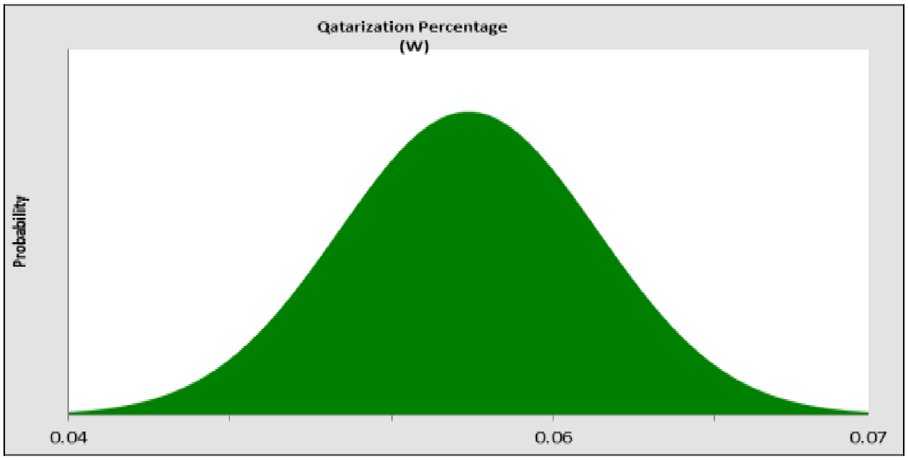


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.05

Std. Dev. 0.01

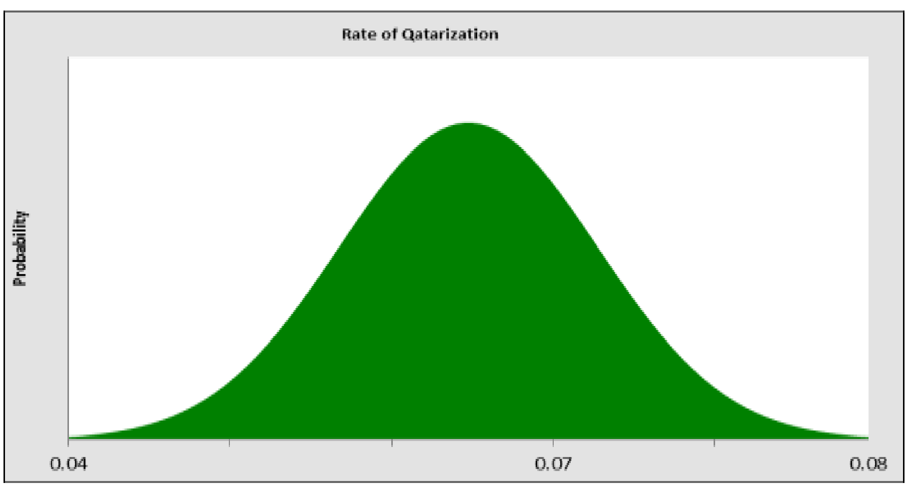


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.06

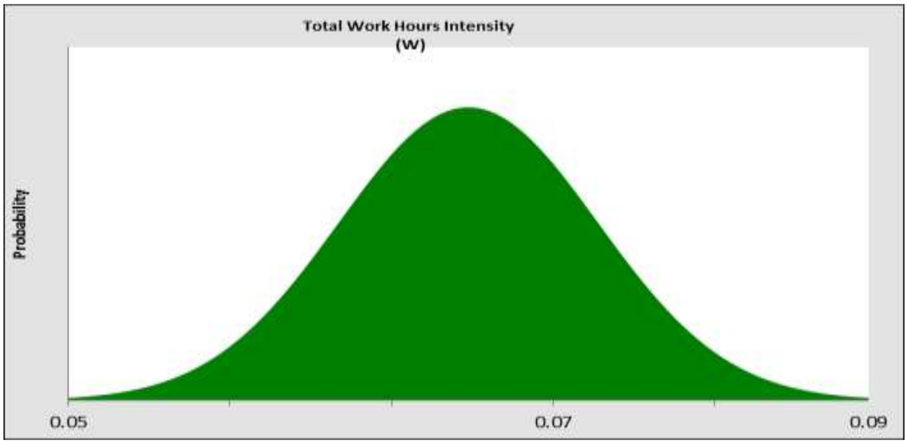
Std. Dev. 0.01



Assumption: Total Work Hours Intensity

Normal distribution with parameters:

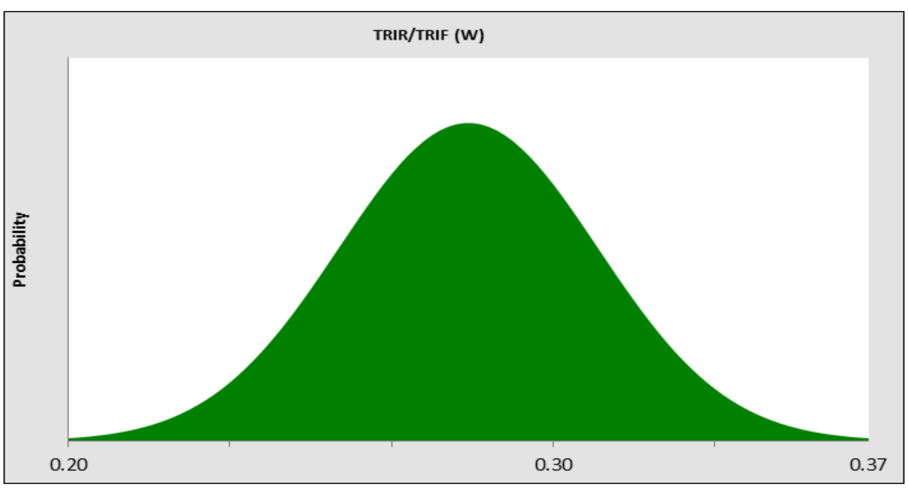
Mean	0.07
Std. Dev.	0.01



Assumption: TRIR

Normal distribution with parameters:

Mean	0.28
Std. Dev.	0.03

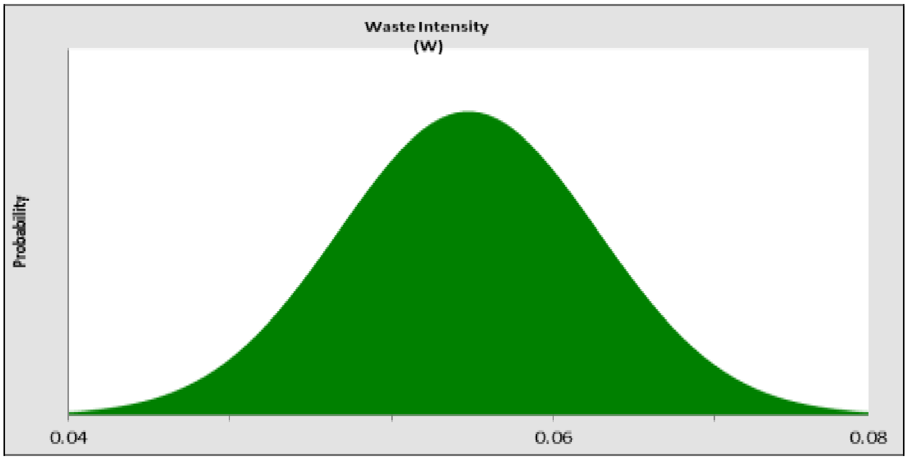


Assumption: Waste Intensity

Normal distribution with parameters:

Mean 0.06

Std. Dev. 0.01

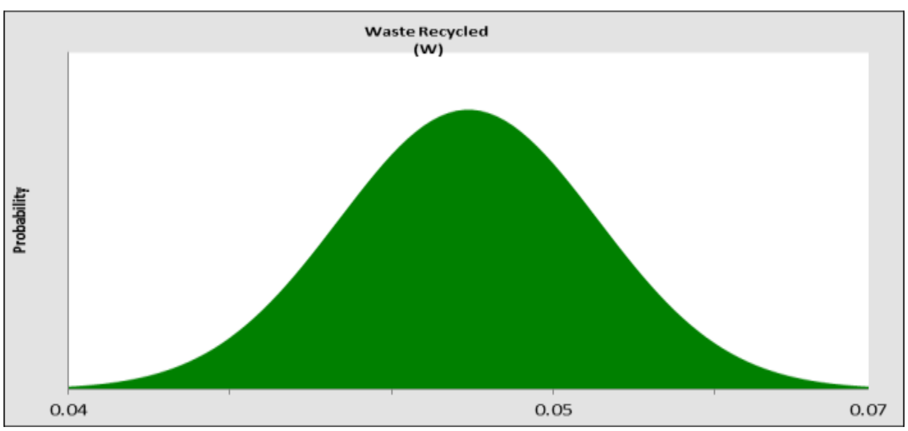


Assumption: Waste Recycled

Normal distribution with parameters:

Mean 0.05

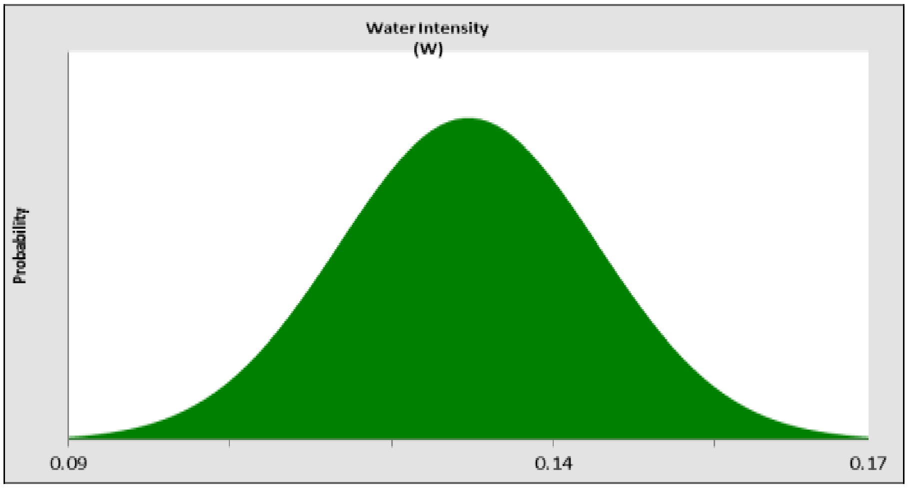
Std. Dev. 0.01



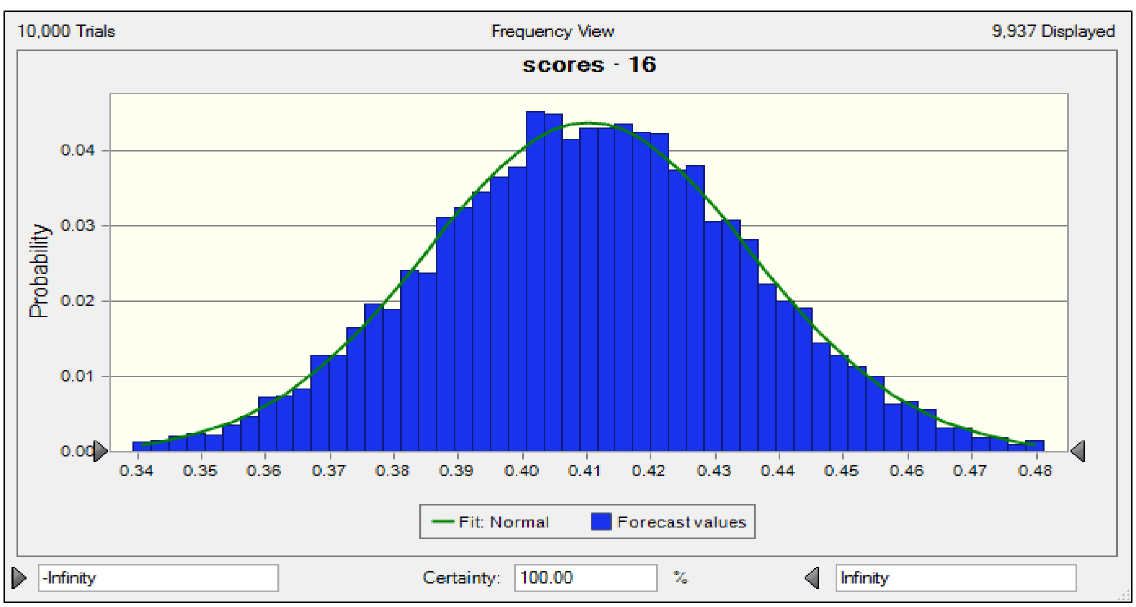
Assumption: Water Intensity

Normal distribution with parameters:

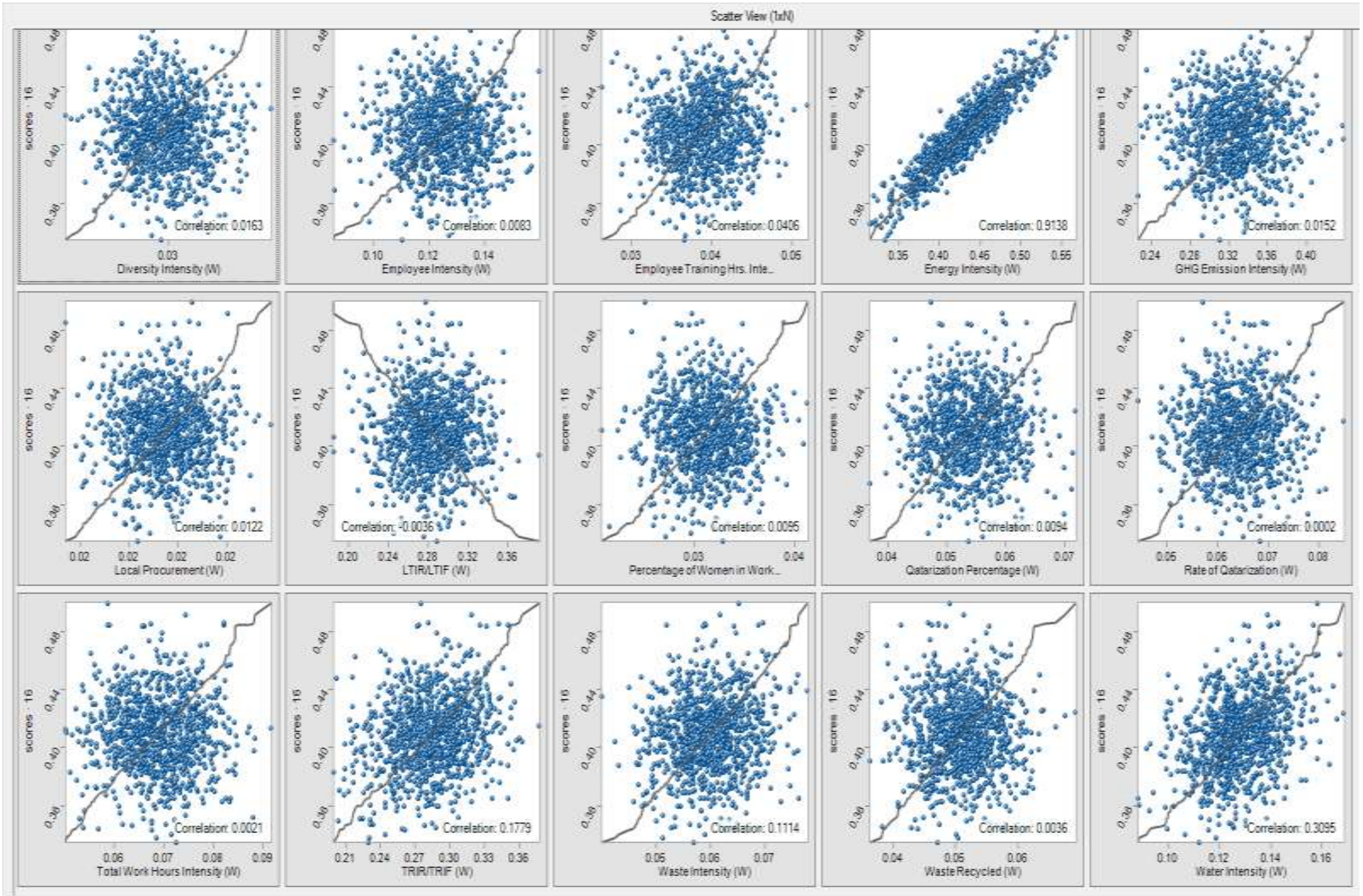
Mean	0.13
Std. Dev.	0.01



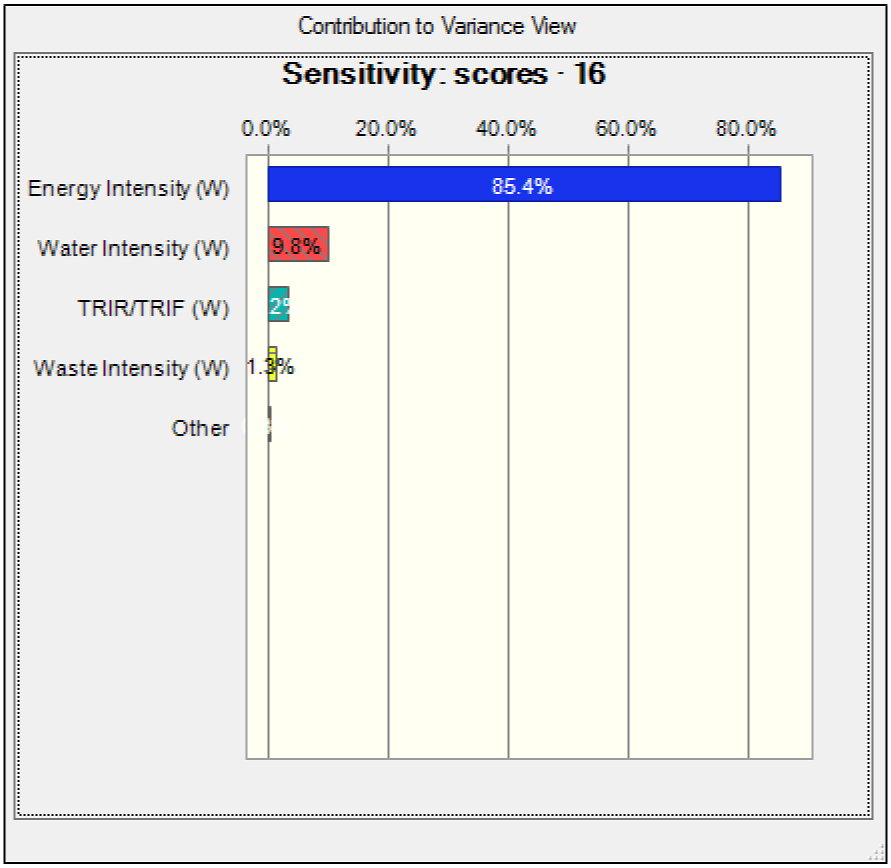
Forecasted Scores



Scatter Charts



Sensitivity Chart



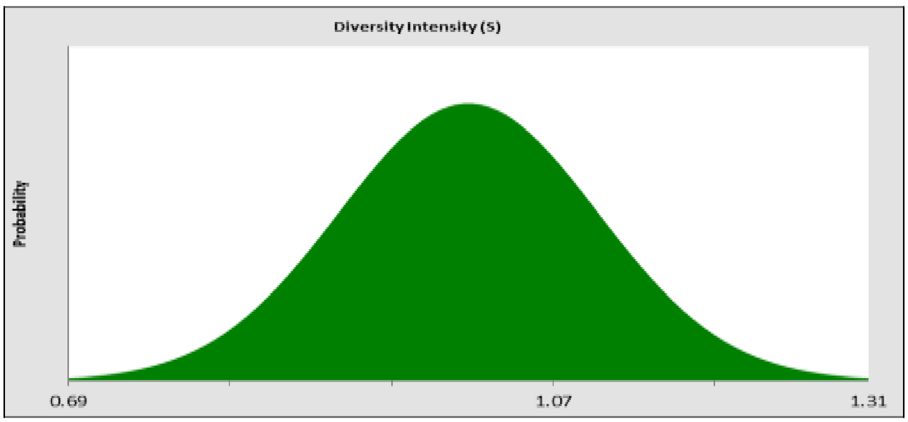
GDI: Sub Criteria Scores

Assumptions

Assumption: Diversity Intensity

Normal distribution with parameters:

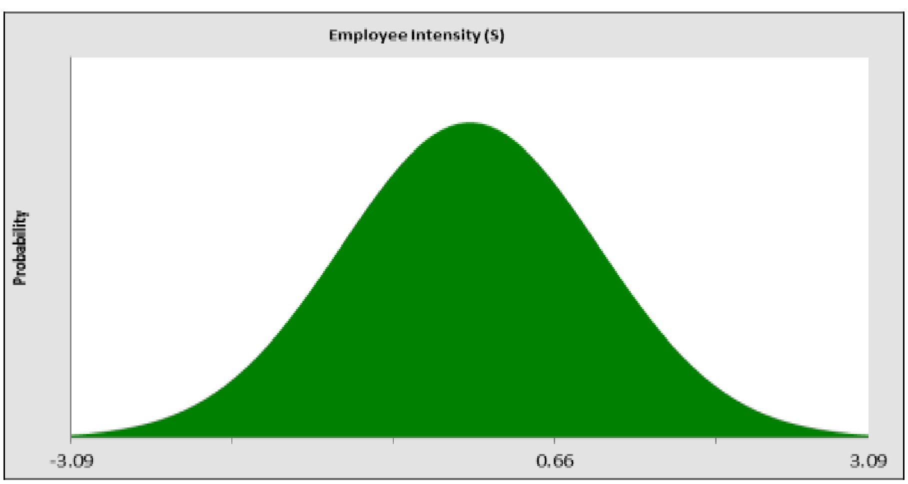
Mean	1.00
Std. Dev.	0.10



Assumption: Employee Intensity

Normal distribution with parameters:

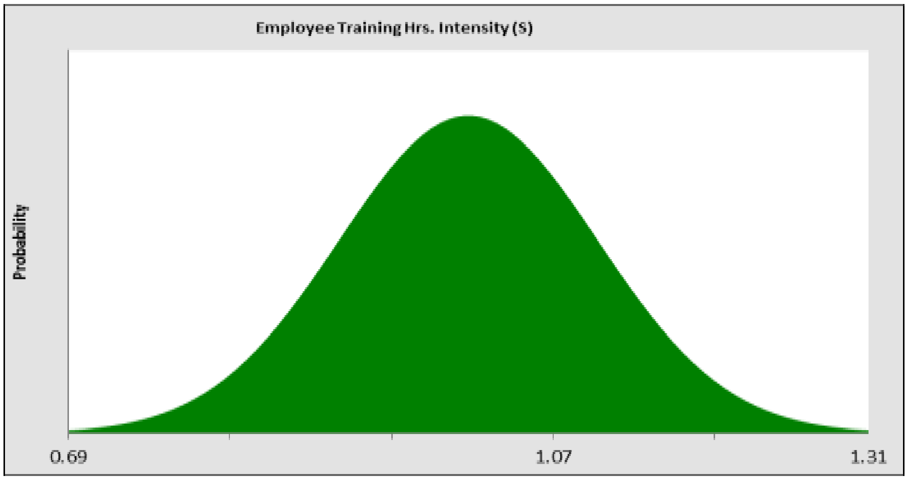
Mean	0.00
Std. Dev.	1.00



Assumption: Employee Training Hrs. Intensity

Normal distribution with parameters:

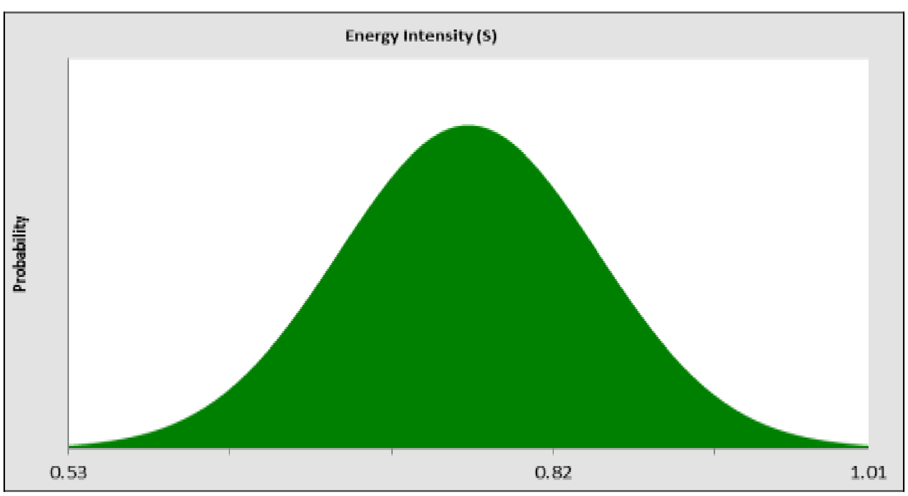
Mean	1.00
Std. Dev.	0.10



Assumption: Energy Intensity

Normal distribution with parameters:

Mean	0.77
Std. Dev.	0.08

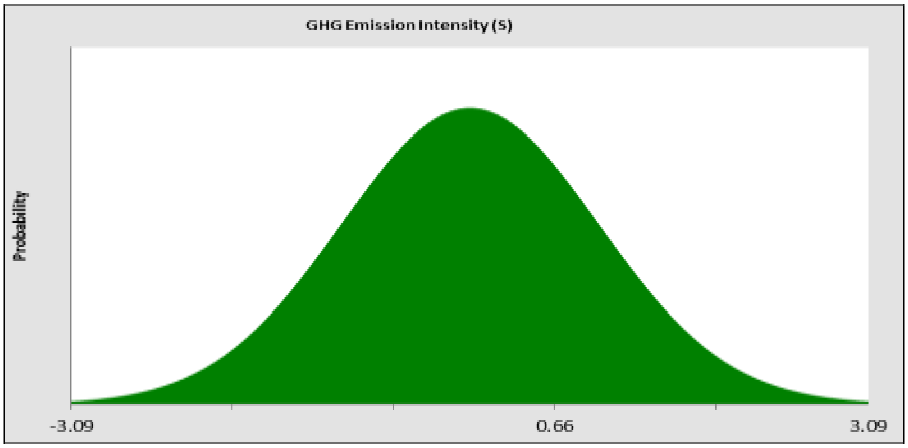


Assumption: GHG Emission Intensity

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

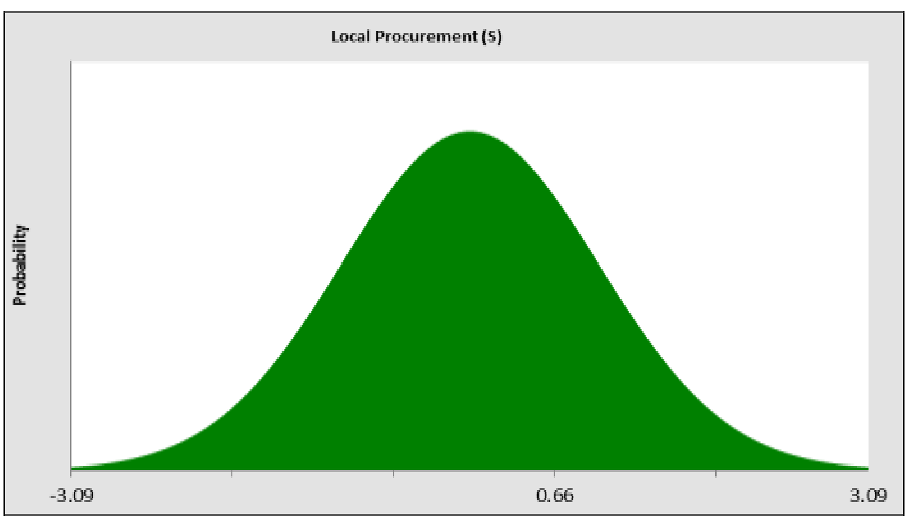


Assumption: Local Procurement

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

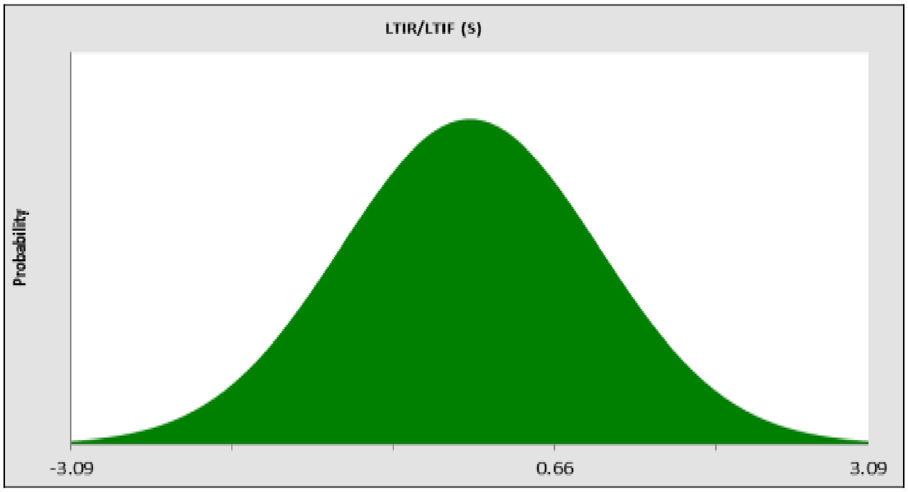


Assumption: LTIR

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

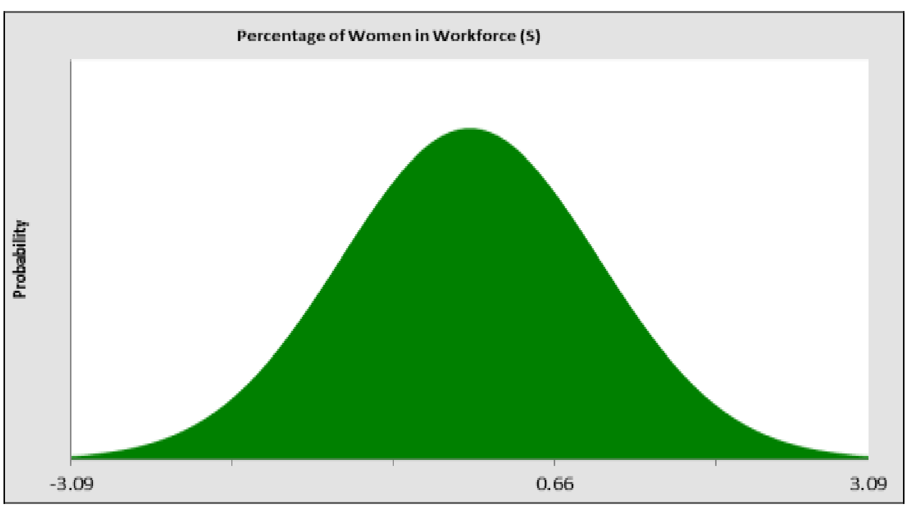


Assumption: Percentage of Women in Workforce

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

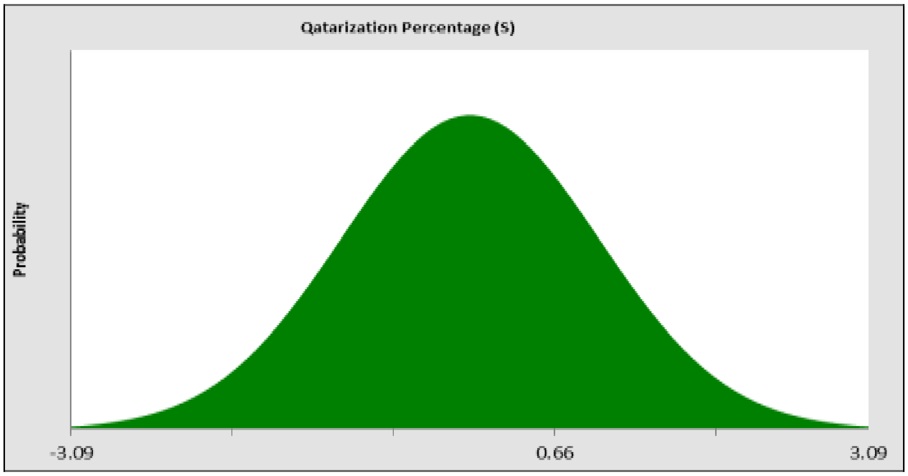


Assumption: Qatarization Percentage

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

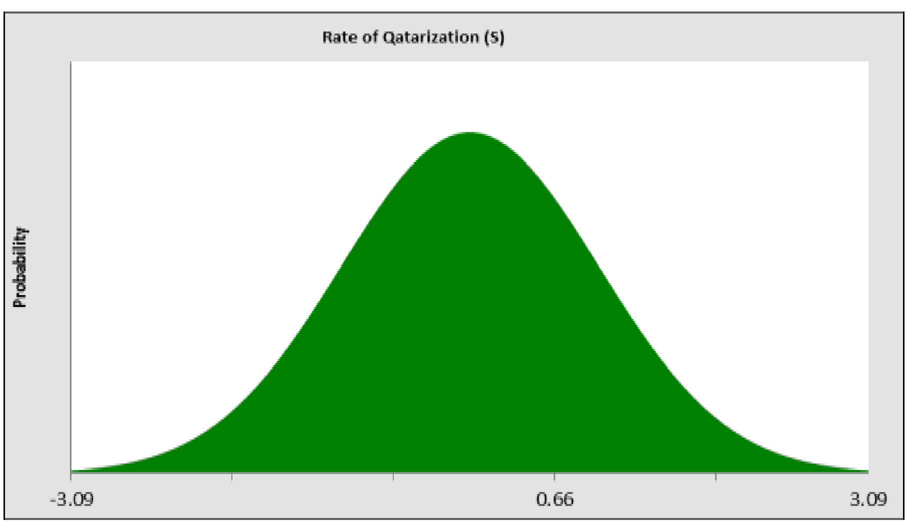


Assumption: Rate of Qatarization

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

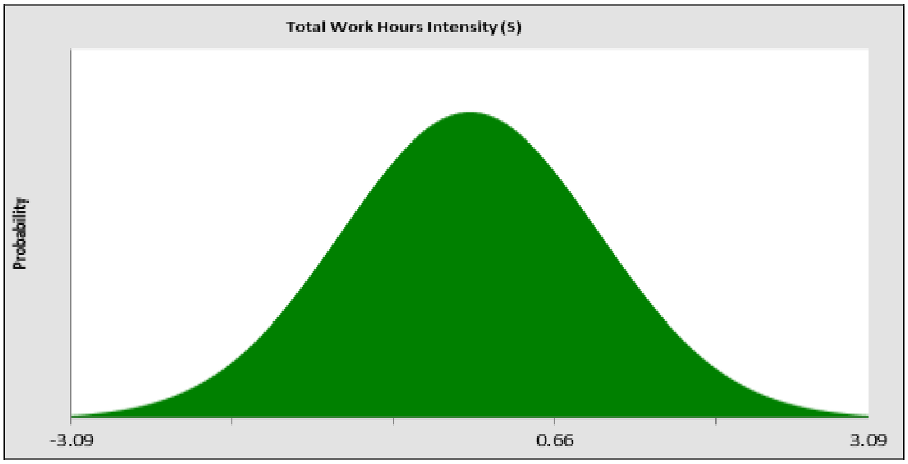


Assumption: Total Work Hours Intensity

Normal distribution with parameters:

Mean 0.00

Std. Dev. 1.00

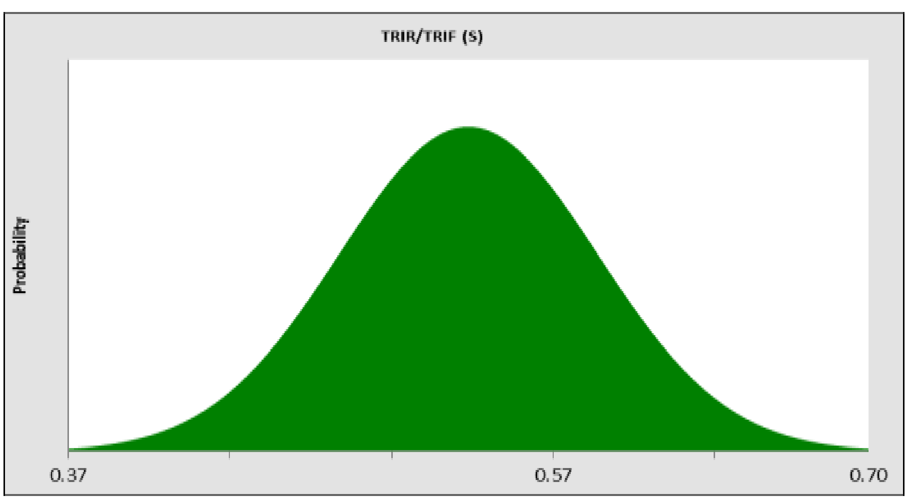


Assumption: TRIR

Normal distribution with parameters:

Mean 0.54

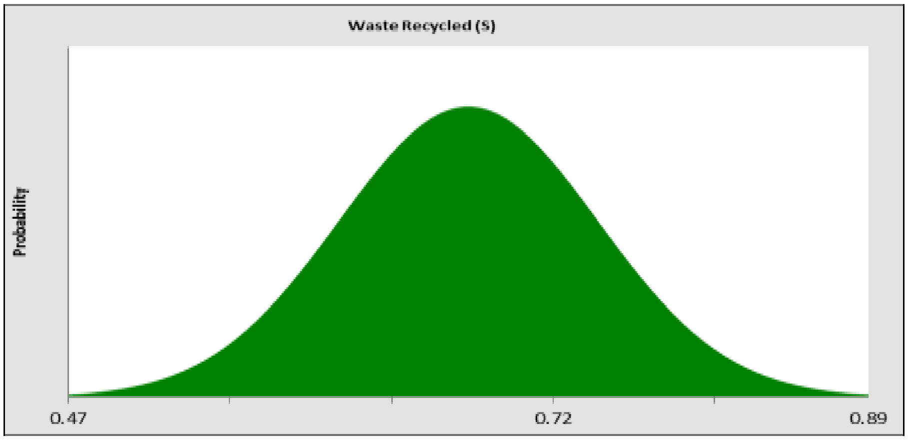
Std. Dev. 0.05



Assumption: Waste Recycled

Normal distribution with parameters:

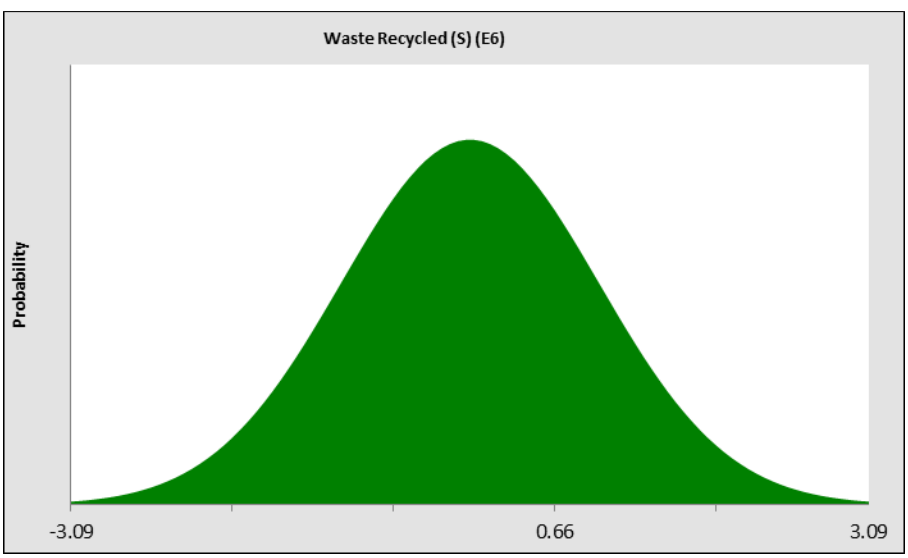
Mean	0.68
Std. Dev.	0.07



Assumption: Waste Recycled

Normal distribution with parameters:

Mean	0.00
Std. Dev.	1.00

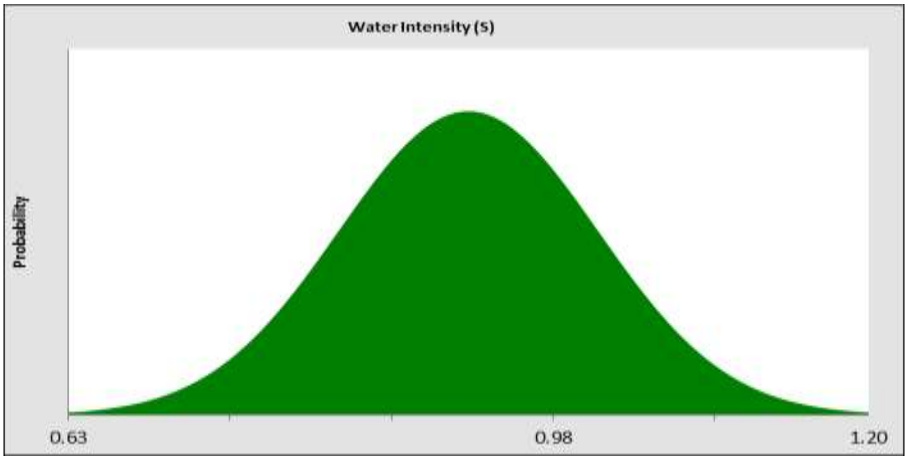


Assumption: Water Intensity

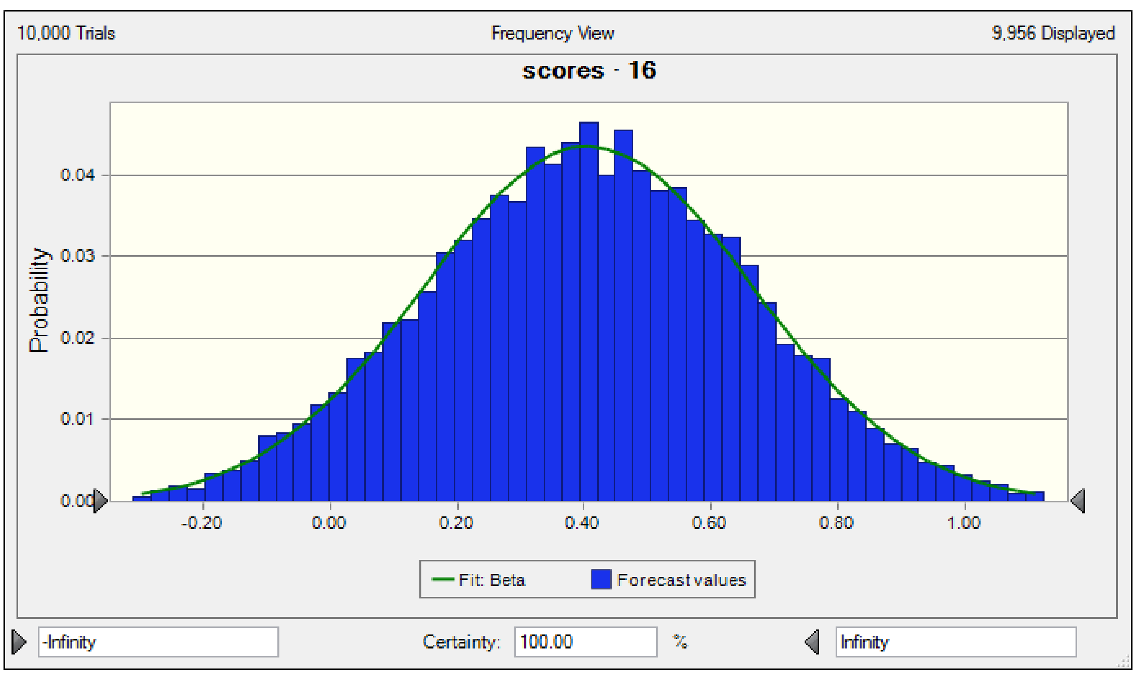
Normal distribution with parameters:

Mean 0.92

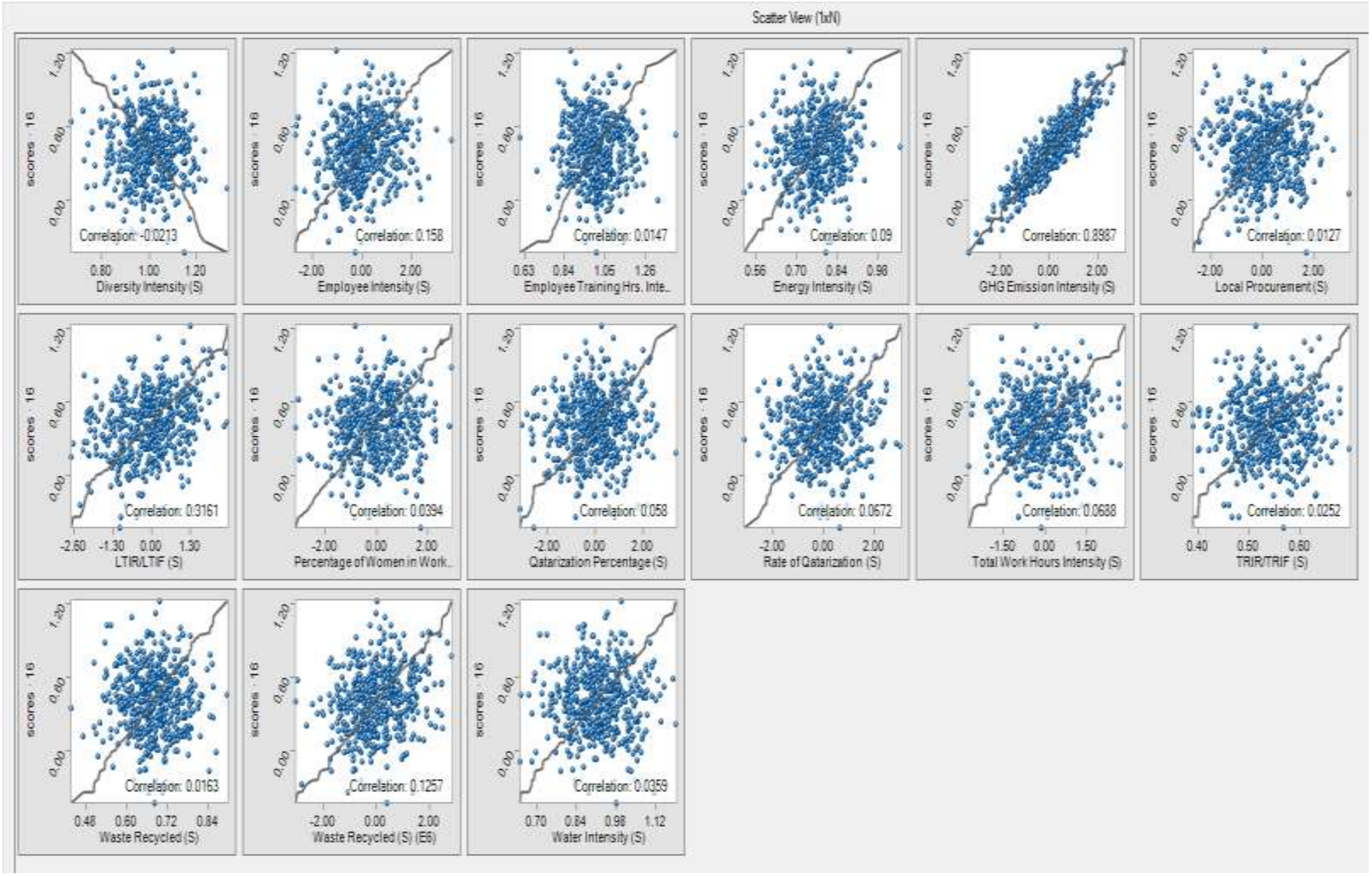
Std. Dev. 0.09



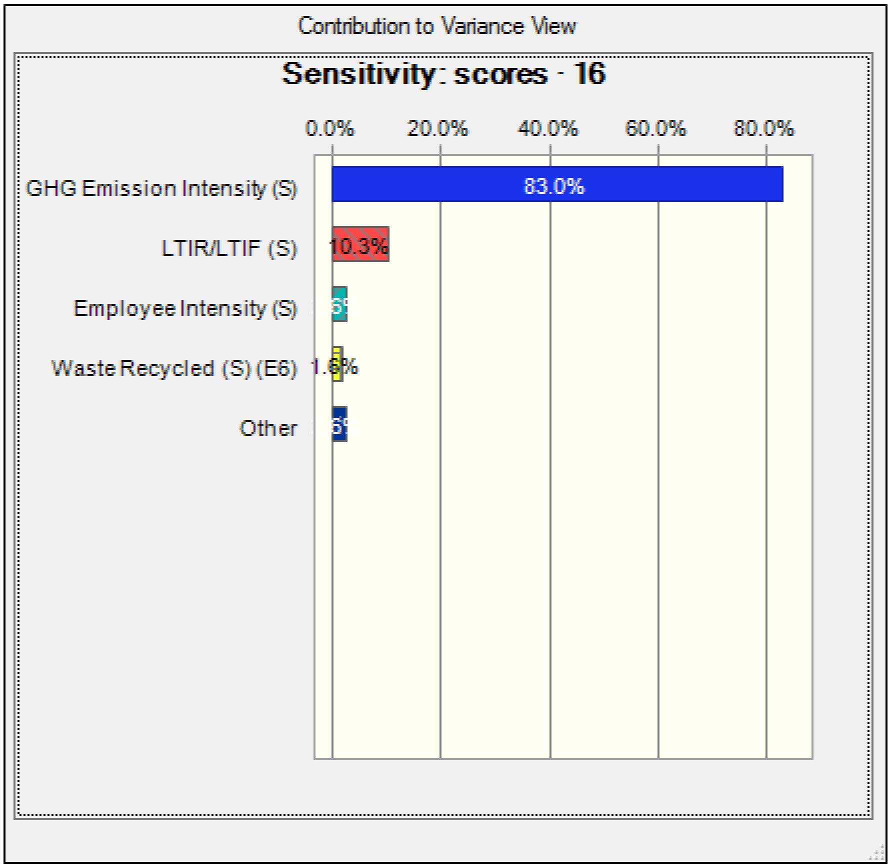
Forecasted Scores



Scatter Charts

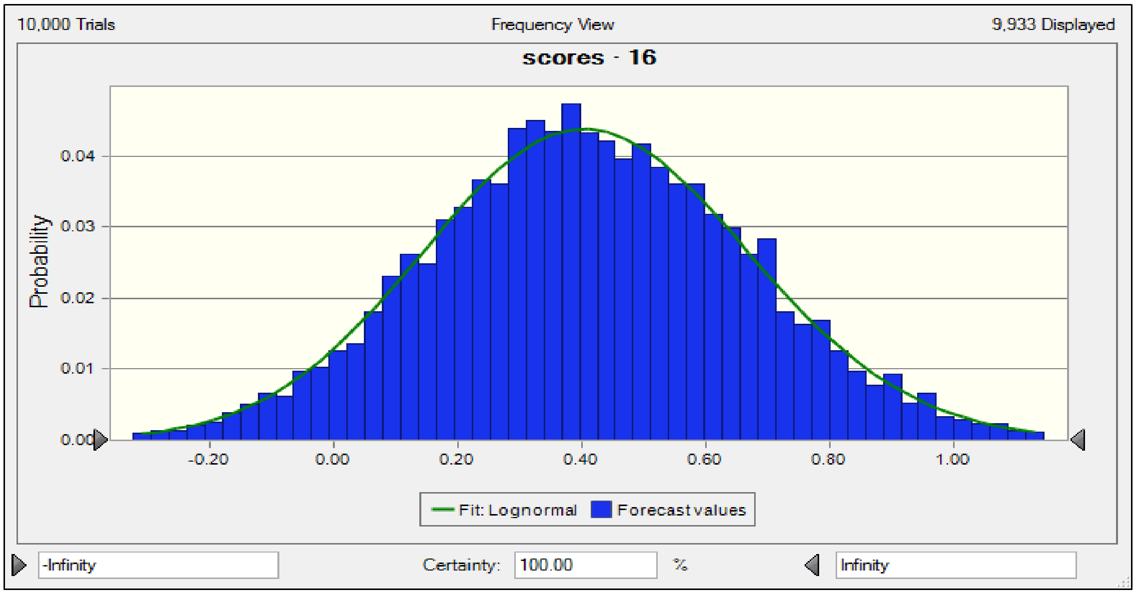


Sensitivity Chart

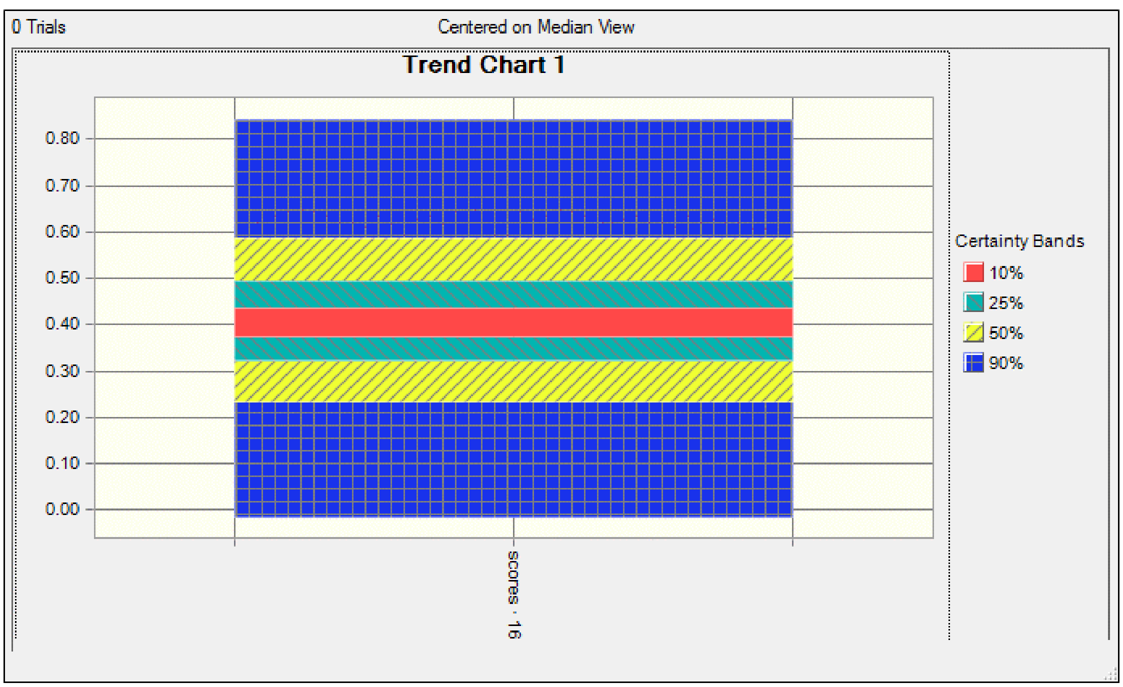


GDI: All Uncertainties

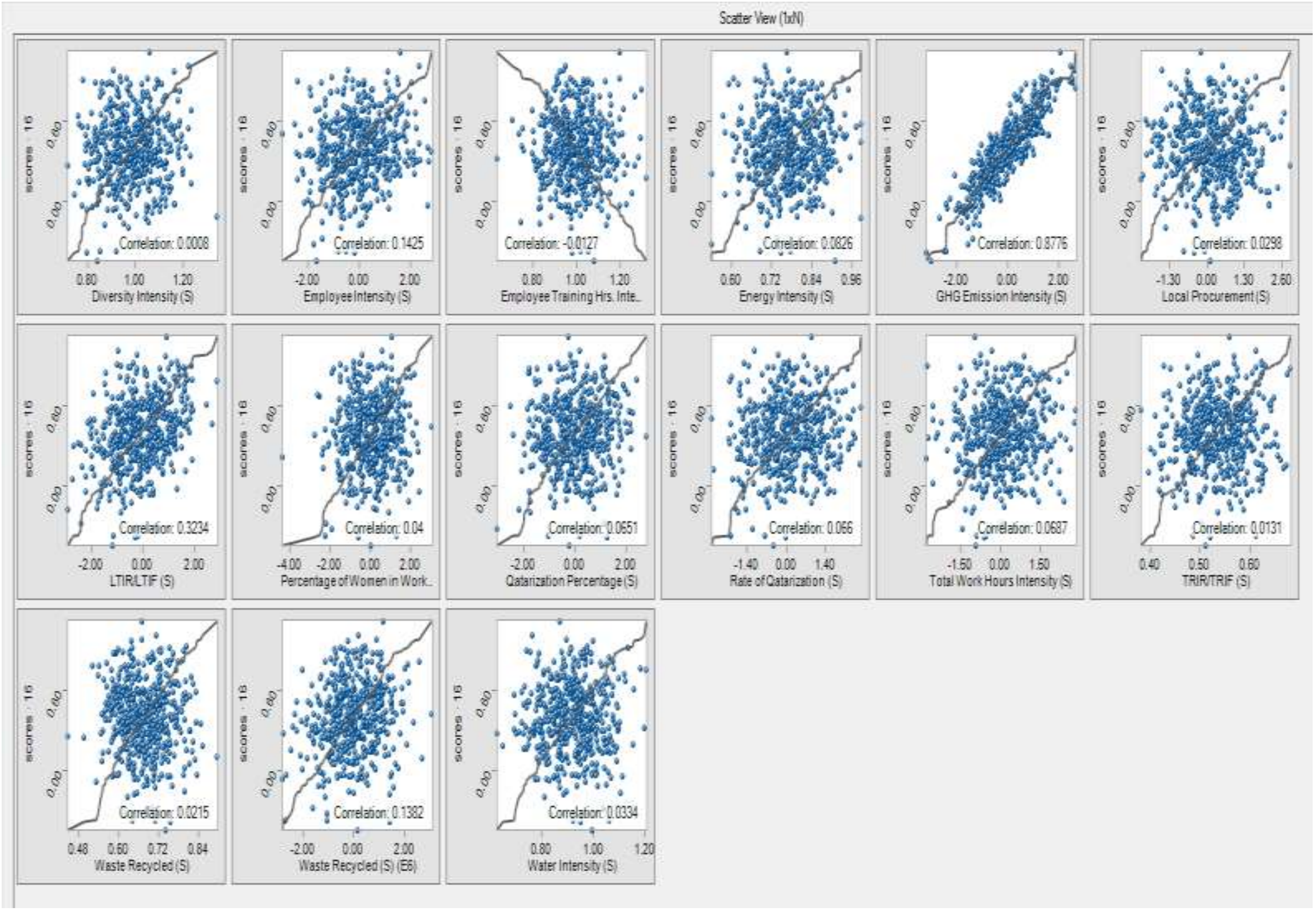
Forecasted Scores

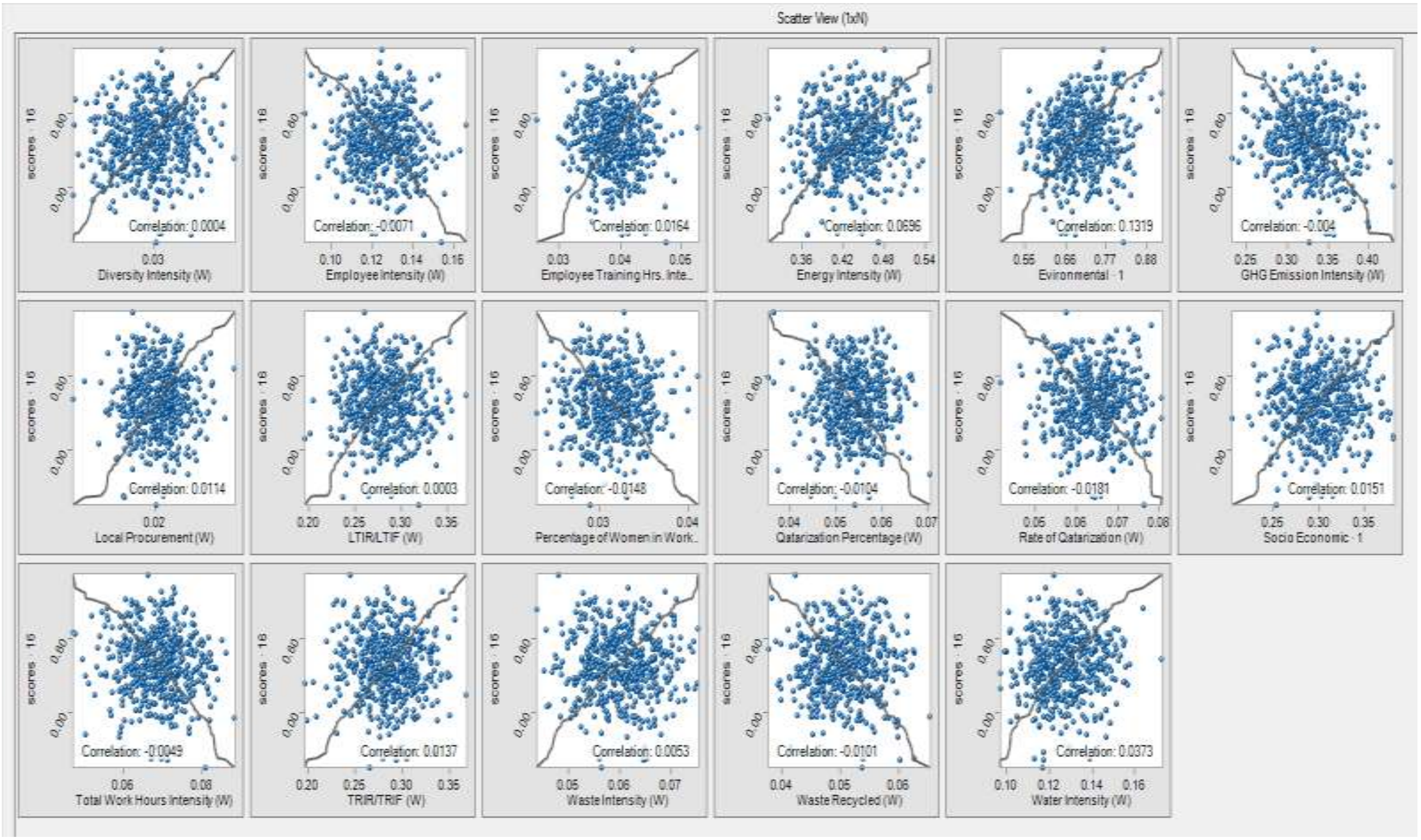


Trend Chart



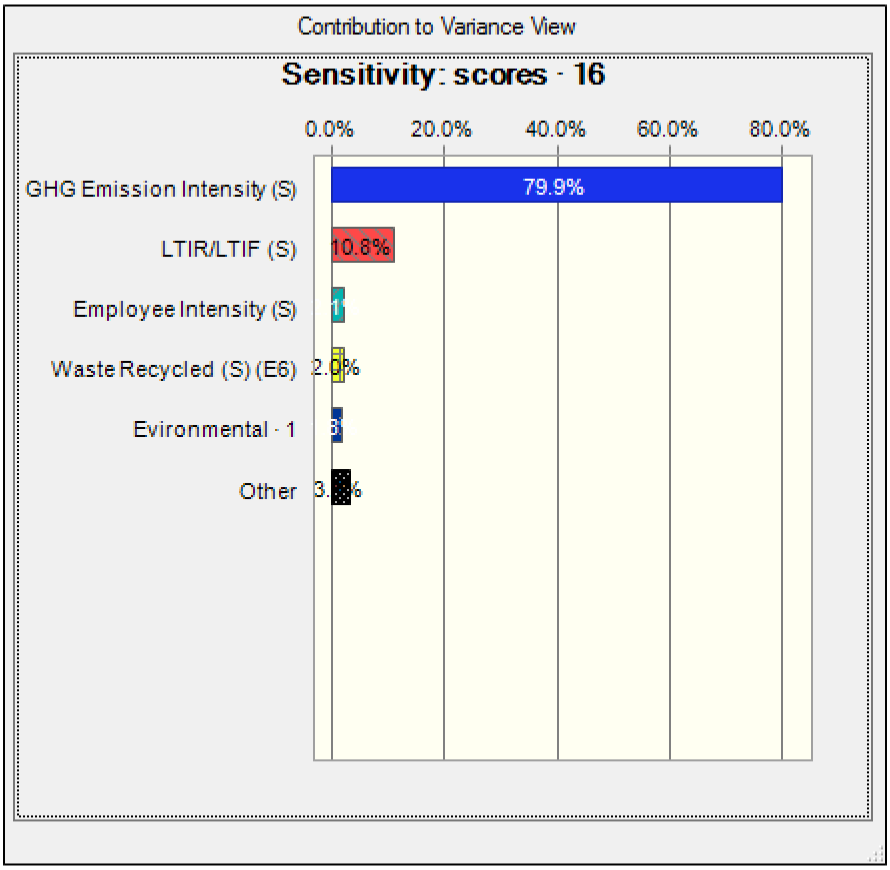
Scatter Charts





Scatter View (1xN)
Correlation: 0.0004
Diversity Intensity (W)
Correlation: -0.0071
Employee Intensity (W)
Correlation: 0.0164
Employee Training Hrs. Inte..
Correlation: 0.0696
Energy Intensity (W)
Correlation: 0.1319
Evironmental - 1
Correlation: -0.004
GHG Emission Intensity (W)
Correlation: 0.0114
Local Procurement (W)
Correlation: 0.0003
LTIR/LTIF (W)
Correlation: -0.0148
Percentage of Women in Work..
Correlation: -0.0104
Qatarization Percentage (W)
Correlation: -0.0181
Rate of Qatarization (W)
Correlation: 0.0151
Socio Economic - 1
Correlation: -0.0049
Total Work Hours Intensity (W)
Correlation: 0.0137
TRIR/TRIF (W)
Correlation: 0.0053
Waste Intensity (W)
Correlation: -0.0101
Waste Recycled (W)
Correlation: 0.0373
Water Intensity (W)

Sensitivity Chart



APPENDIX H: TABLE OF ABBREVIATIONS

Abbreviations	Explanation
GRI	Global Reporting Initiative
G3, G3.1, G4	Different versions of GRI reporting guidelines
ESG	Environmental, Social and Governance
UN	United Nations
SSE	Sustainable Stock Exchange
UNSSEI	United Nations of Sustainable Stock Exchange Initiative
MCDA	Multi-Criteria Decisions Analysis
AHP	Analytic Hierarchy Process
TRIR	The total recordable injury rate
LTIR	The Lost Time Injury Frequency Rate
GHG	Green House Gases