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ACRONYMS

ASEAN	Association of Southeast Asian Nations
CCA	Climate Change Adaptation
CCAP	Cold Chain Association of the Philippines
COVID-19	Coronavirus Disease-19
CPDD	City Planning and Development Department
CSR	Corporate Social Responsibility
DENR	Department of Environment and Natural Resources
DOE	Department of Energy
DPB	Discounted Payback Period
DR	Discount Rate
DRF	Disaster Risk Financing
DRR	Disaster Risk Reduction
DTI	Department of Trade and Industry
HFA	Hyogo Framework for Action
HMDF	Home Development Mutual Fund
IT	Information Technology
KFC	Kentucky Fried Chicken
kW	Kilowatt
kWh	Kilowatt hour
Max	Maximum
Meralco	Manila Electric Company
NPV	Net Present Value
OCA	Office of the City Administrator

OCM	Office of the City Mayor
PPA	Power Purchase Agreement
PSBA	Philippine School of Business Administration
PV	Photovoltaic
PVGCS	Photovoltaic Grid Connected System
QC	Quezon City
RA	Republic Act
ROI	Return of Investment
SDGs	Sustainable Development Goals
SPV	Solar Photovoltaic
SQ	Survey Questionnaires
SSS	Social Security System
UN	United Nation
UPB	Undiscounted Payback
VSM	Viable System Model
WM	Weighted Mean

ARTICLE 1

The Editor's Perspective

Title: **Concept Note of International Seminar 2022 with the theme: "Disaster Risk Financing Awareness towards Disaster and Climate Change Resiliency"**

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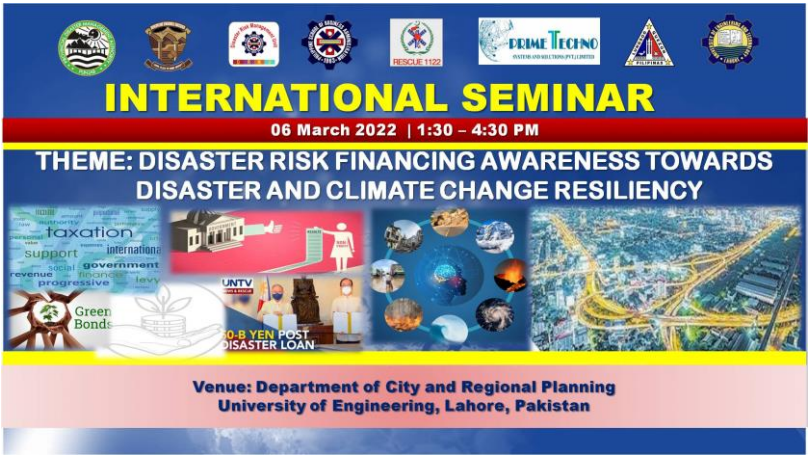

Taking off the 3rd International Research Colloquium of our Partner School with the theme: "Business Management Resiliency towards Risk Reduction in Changing Climate: Promoting Financial, Industrial, and Environmental Safety". The frequency and intensity of disasters, both natural and man-made, are on the rise. Their impact on our own well-being, livelihood, and economy, including industries, is ever-increasing. Essentially, the increasing impact of disasters on the numbers of communities affected and on economic and material loss is logically explained

by the increasing levels of vulnerability of people, caused by poverty, having to settle in marginal risk-prone areas due to population pressure, environmental degradation, and ill-planned development interventions (Hallegatte, 2020).

Moreover, Climate Change (CC) is emerging as a threat to the stability of the financial system. The finance industry could be forced into making rapid adjustments if they do not gradually expose where their CC risks might lie, which could trigger steep losses. Thus, there is a serious need to strengthen our chances of surviving disasters (CAP, 2019).

To deal with Disaster Risk Reduction (DRR), the United Nations (UN) and member countries showed their concern by formulating the Hyogo Framework for Action (HFA) in 2005 which set goals to reduce disaster losses by 2015. The HFA states that, "At times of disasters, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management". In addition, 2015 was an important year for DRR and Climate Change Adaptation (CCA) in the international level. Following the end of the HFA, the Sendai Framework was developed with seven targets through four priorities for action by the year 2030 focusing on DRR (UNISDR, UNDP, 2012). Further, in December 2015, a conference between 195 countries was held in Paris, France which set goals for Climate Change came to be known as "The Paris Agreement". In addition, in September 2015 at the UN Sustainable Development Summit, a final document for the Sustainable Development Goals (SDGs) was developed, which lists 169 targets over 17 goals, each with its own indicators to measure compliance. The 13th SDG in particular focuses on Climate Action (IAEG-SDGs, 2016).

At the regional level, the Association of Southeast Asian Nations (ASEAN) has also issued joint declarations and statements on working effectively against Climate Change and for DRR. This includes adopting a protocol or legal instrument to understand more about Climate Change and DRR issues and to engage in joint efforts to address these issues.

It is to be noted that natural disasters are increasing in their frequency and magnitude due to climate change and unprecedented urban and technological growth; generating significant fiscal risk and creating major budget volatility especially for developing countries like Pakistan. Pakistan has been victim to the economic and fiscal shocks caused by major disasters such as Earthquake, Floods, etc. Indeed, risk financing in terms of investment was considered to be one of the many forms of risk actions that most of the countries, large companies and business entities must take in consideration as it does not just only protect damages, but also gives them an opportunity to initiate involvement among local-based and small-scale entrepreneurs in the local community to be part of their value chain by allowing them to be their suppliers, producers, shareholders, employees, and even as consumers that can be both sustainable and equitable (WB, 2015).

Indeed, Disaster Risk Financing (DRF) is a critical component in strengthening the resilience of developing countries and in protecting poor and vulnerable communities from the financial and economic impacts of disasters. The Sovereign disaster risk financing could strengthen government's capacity to deliver more timely and effective disaster response. NDMA is also considering mechanisms to enhance financial preparedness of other stakeholders, looking towards creating policy frameworks and guidelines based on which, the private sector and other stakeholders could start developing alternative disaster risk financing solutions.

Pakistan's financial preparedness is improving but could be further strengthened. Prior to the severe earthquake in 2005, which took roughly 85,000 lives, there was little recognition within government of a need for an institutionalized disaster risk management system in Pakistan, including financial arrangements for potential disaster response. While the country was still struggling with the establishment of appropriate institutions, major floods in 2010 stretched public resources yet further. Private philanthropy plays a major role in Pakistan in times of disasters and has often complemented government's response.

Institutions are learning from those experiences and working to improve their capacities.

Thus, the main objective of this International Seminar is to contribute to make our society resilient by providing a stage in disaster risk financing. It also aims to foster closer ties among diversified participants and provide an avenue to share thoughts and exchange of ideas on how business organizations and its members can contribute more meaningfully to resolve disaster-related challenges faced and opportunities gained by Public Private Partnership. Further, it is the intention of this seminar to encourage governments and private sector including academia and business community to adopt sustainable Inclusive Financial Mechanism by integrating the poor at the core of risk management.

Specifically the above said seminar aims to:

Seek fundamental awareness regarding Disaster Risk Financing as an important part of Disaster Risk Management Plan and make it a policy priority.

Have knowledge about on-ground realities and challenges faced by the institutional agencies and organizations regarding disaster risk financing.

Provide knowledge on how to drive capital towards sustainable climate change

Raise awareness and thereby understanding of the impact of disaster on economic stability of a nation.

In this regard, we have invited distinguished speakers and top-notch resource persons to help us get a better sense of the financial strategies and when to apply which strategy at what stage.

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ARTICLE 2

Dissertation

Title: **Operational and Financial Viability of Solar Photovoltaic (PV) System of Cold Storage Industry in Greater Manila Area: An Alternative Sustainable Energy Solution**

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Degree: Doctor in Business Administration

School Year: AY 2019-2020

Adviser: Prof. Dr. Tabassam Raza

1.1. Introduction

Organizations engaged in business desire efficiency in the cost of operations to maximize profitability. One source of expense that needed to be controlled is energy cost which the cold storage business of the Greater Manila Area is disadvantaged. This is due to power providers continuously increasing energy costs, especially the cold storage facility which uses much electricity (Yoshimoto, 2019). There is a need, therefore, to remedy the constraint by using an alternative energy source, the solar PV system as a key to sustainable energy solution. It is important; to assess the operational and financial viability of the contraption as it will save cost.

Ensuring affordable, dependable, and sustainable energy for all that meets environmental goals has become vital to the development and energy policy making of most nations in the world (ESCAP, 2019).

Over the last two centuries, energy needs have increased significantly, particularly because of the growing industry and transportation sectors. Furthermore, energy demands are and will be amplified by the economic boom of growing areas and by the

demographic, the world's population should reach nearly 10 billion people in 2050, and 11 billion in 2100 (DESA, 2017).

The world's current energy source relies almost entirely on the use of non-renewable energy sources such as oil, gas, coal, and uranium. However, fossil fuels which are limited are polluting the environment. According to Solar Impulse Foundation, there would be 40 to 60 years of proven reserves of conventional oil. Natural gas could be exploited for another 70 years. For coal, there would be around two centuries of reserves (Solar Impulse Foundation, 2020).

There would be an energy crisis from the foreseeable end of the cycle of oil, gas and coal, which, in addition, have been producing a considerable increase in greenhouse gases resulting in global warming that drives climate change and harming the environment and biodiversity. In recent years, many scientists have raised their voices to warn about climate change, caused notably by the burning of oil and coal in order to produce energy (Union of Concerned Scientists, 2018).

Transitions toward a more sustainable future are possible with clear, effective, and targeted goals that move investments and political will towards science, knowledge, social capacity, and technological capabilities for sustainable development. As such renewable energy technologies, play key roles in these transitions (Whiteacre, P. (2017).

Renewable energy is a form of energy that meets our today's demand of energy without compromising the ability of future generations to meet their own needs (Rinkesh, 2020).

Across the world, commonly applied renewable energy solutions are solar, wind, hydrothermal, and the traditional biofuel or biomass that are not in danger of being expired or depleted and can be used over and over again. Besides, they will not cause any harm to the environment and are available widely free of cost (Ritchie, H. and Roser, M. (2018).

The Philippines following the course of transforming progress toward sustainable development had passed several laws;

among them are: Republic Act (RA) Number 11285 known as an Act Institutionalizing Energy Efficiency and Conservation, Enhancing the Efficient Use of Energy, and Granting Incentives to Energy Efficiency and Conservation Projects, and Republic Act (RA) Number 9513 An Act Promoting the Development, Utilization, and Commercialization of Renewable Energy Resources and for Other Purposes.

1.2. Background of the Study

Cold Storage Industry consumption from Manila Electric Company (Meralco) grid increased significantly for the past three (3) years that consequently increased substantial cost in the overall operation of the cold storage system with an annual spend of 50 million pesos as noted by KFC, eventually reducing its bottom line. Thus, the researcher proposes to investigate the Operational and Financial Viability of solar PV System of Cold Storage Industry in Greater Manila Area towards an alternative sustainable energy solution that will eventually increase the profitability of the companies in the cold storage industry and strengthen their competitive advantage.

To achieve the above objectives, this research needs to find out:

1. The perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate.

2. The significant difference that exists in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on the abovementioned variables.

3. The perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to financial savings using Net Present Value (NPV), annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements.

4. The significant difference that exists in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the abovementioned variables.

5. The financial savings using Net Present Value (NPV) and the attractiveness of investment using PB Period and ROI of the cold storage industry respondents on the implementation of the solar PV system.

6. The significant relationship that exists between the financial savings using NPV of the cold storage industry respondents and the perceived operational viability of the solar PV.

7. The significant relationship that exists between the financial savings using NPV of the cold storage industry respondents and the perceived financial viability of the Solar PV.

8. The alternative sustainable energy solution that may be advanced.

In this study, the researcher limits the financial savings to the use of NPV and the attractiveness of investment using PB Period, and ROI, determining for the cold storage industry in Greater Manila Area the recent and projected electricity consumption, inflation rate (IR), and the corresponding energy cost both for the Meralco grid and the grid tied solar PV system, the commercial contract options in the market for solar PV system, product and performance warranties, production estimate, and degradation rate of the solar PV system, the schedule and cost of replacement for the inverter, the annual maintenance cost of solar PV system, the Discount Rate (DR) in the cash inflow and outflow, the selected Vendor and User respondents of solar PV system in the Philippine Market, and the key reference indicators that will be used to assess the operational viability of solar PV system.

The evaluation of the feasibility of this research was significantly derived from the output of financial and operational viability study. A summary of research in financial savings was

tabulated using the NPV and the attractiveness of investment using PB Period and ROI while the operational viability of the system was assessed by determining the perception of the select Vendor and User respondents using reference key indicators of a successful project related to support the solar PV system requirements. The key reference indicators used to assess the operational viabilities were the industry experience of the Vendor and User respondents in the solar PV, the production output of the solar PV, the efficiency and degradation rate of the solar PV, and the product and performance warranty of the solar PV.

Operational viability is the measure of how well a proposed system solves the problems and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development (Wikipedia, 2020).

On the business environment, the researcher noted the upcoming threat from the depletion of Malampaya Natural Gas Reserves by 2020 to 2024 (Chang, 2019), and the implementation of Train Law that might significantly affect electricity cost to run a cold storage facility. As of 2019, the Philippines surprisingly has the third highest average electricity rate in Asia reaching about 10 pesos per kilowatt (kWh) next to Japan and Singapore (Oplas, 2019). Also, the researcher recognizes the opportunity to adopt technological advances in solar PV systems that served as the key component of this research and source for further reducing electricity cost.

The output of foregoing viability study on the financial and operational aspect of solar PV system of cold storage industry in the Greater Manila Area is an integral basis of the research conclusion and recommendation that will be used as standard for all cold storages serving fast food businesses in the Philippines.

1.3. Statement of the Problem

Cold storage industry consumption from Meralco grid increased significantly for the past three (3) years that consequently increased substantial cost in the overall operations

of the cold storage system with an annual spend of 50 million pesos as noted by KFC, eventually reducing its profitability.

The research aims to determine the operational and financial viability of solar PV system towards alternative sustainable energy solutions including the performance of solar PV. More particularly, it seeks to answer the following questions:

1. What is the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate?

2. What significant difference that exists in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on the abovementioned variables?
3. What is the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to financial savings using NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements?

4. What significant difference that exists in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the abovementioned variables?

5. What are the financial savings using NPV and the attractiveness of investment using PB Period and ROI of the cold storage industry respondents on the implementation of the solar PV system?

6. What significant relationship that exists between the financial savings using the NPV of the cold storage industry respondents and the perceived operational viability of the solar PV?

7. What significant relationship that exists between the financial savings using the NPV of the cold storage

industry respondents and the perceived financial viability of the solar PV?

8. Based on the results of the study, what alternative sustainable energy solution may be advanced?

1.4. Theoretical Framework

The theoretical framework in this research uses the Viable System Theory which was cited in an article in the *Journal of Management Studies* (November 1988) entitled "An Appreciation of Stafford Beer's Viable System" viewpoint on managerial practice (Jackson, 1988).

The Viable Systems Theory concerns cybernetic processes in relation to the development (evolution) of dynamical systems. Viable Systems are considered to be living systems in the sense that systems are complex and adaptive, can learn, and are capable of maintaining an autonomous existence, at least within the confines of their constraints. These attributes involve the maintenance of internal stability through adaptation to changing environments. One can distinguish between two strands of such theory: formal systems and principally non-formal systems. Formal viable system theory is normally referred to as viability theory and provides a mathematical approach to explore the dynamics of complex systems set within the context of control theory. In contrast, principally non-formal viable system theory is concerned with descriptive approaches to the study of viability through the processes of control and communication, through these theories may have mathematical descriptions associated with them (Wordisk, 1994). The Viable System Model (VSM) is illustrated in Figure 1.

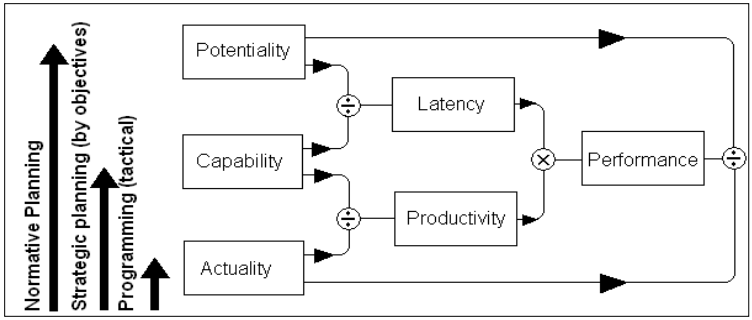

Figure 1. The Viable System Model (VSM)

Note: Adapted from "Viable System Model", (Wikipedia, 2020).

In Brain of the Firm (p. 163), Beer describes a triple vector to characterize activity in a System 1. The components are: **Actuality**: "What we are managing to do now, with existing resources, under existing constraints;", **Capability**: "This is what we could be doing (still right now) with existing resources, under existing constraints, if we really worked at it;" and **Potentiality**: "This is what we ought to be doing by developing our resources and removing constraints, although still operating within the bounds of what is already known to be feasible." Beer adds, "It would help a lot to fix these definitions clearly in the mind. " System 4's job is essentially to realize potential. He then defines **Productivity** as the ratio of actuality and capability; **Latency** as the ratio of capability and potentiality; **Performance** as the ratio of actuality and potentiality, and also the product of latency and productivity (Wikipedia, 2020).

The Viable System Model (VSM) guides the direction of the research and its findings, which in turn guides the researcher to search for alternative sustainable energy sources by scanning, skimming, detailing the environment exploring for threats that affect electricity cost and opportunities in alternative renewable energy of power supply to run the cold storage to achieve the objective of reducing dependency on the existing power supply and thus decrease electricity cost. The VSM model points out the identification of the program (tactical) required to achieve the strategic objective into a viable performance or output. The VSM

emphasizes a well-organized program as a basis to study, record, and analyze aspects of the transformation (change) process while facilitating the identification of what actions to take to achieve the desired output of concluding the viability in the financial and operational aspect of the study on solar PV (Klosterman, 1978).

1.5. Conceptual Framework

The conceptual framework of the study illustrates the interrelationships among the variables in this research. It includes the basis of the research problem which is a mix of the strategic plan and objective of the cold storage industry to minimize electricity consumption from the existing power supply towards a sustainable natural energy solution and also considering the business environment affecting electricity consumption and cost.

As cold storage industries are commercial businesses, companies seek to reduce electricity consumption that will reduce costs to be able to gain better margins for profits. However, business plans border on economic environment which is aligning with the legal-governmental thrust that mandates companies and individuals as well to reduce not only the consumption of electricity but also, shift from traditional fossil fuels to renewable energy due to a combination of beneficial economic and financial considerations. These include the need to protect the Philippines (and planet earth) from the more severe natural disasters as climate changes with the overuse of fossil fuels, the critical depletion of the gas reserves in Malampaya, the impact of the TRAIN law, and the technological advances in the solar PV system.

The business objective has to be realistic by being attuned with the changing business environment. In this manner, there is a dynamic relationship between the two. As the business objective and the business environment comprise the starting factors to consider progressing the research to adopt solar PV for the cold storage industry and their cold storage system. The business environment also includes not only the factor on threat but also opportunity such as technology advances in solar energy. This

presents the attractiveness to buy and use solar PV technology. First, it is free. Second, it is clean energy without the unwanted pollution effects of coal and oil. Third, as the increasing trend of studies on solar PV illustrate the evidence that it can reduce electricity cost and adds to the firm's savings. The Conceptual Model is illustrated in Figure 2.

In this manner, investigating the feasibility of the solar PV system will need a conclusive research on the financial and operational viability of the system. The financial viability mainly focuses on the cash flow analysis using NPV, and the attractiveness of investment using PB and ROI as financial tools. Also, considering the commercial contracts, electricity consumption, power rate, and spend to calculate the cash flow of the contract options. The operational viability basis is the industry experience of selected Vendor and User respondents, the production output of solar PV system, the efficiency and degradation rate of solar PV, the product and performance warranties of solar PV.

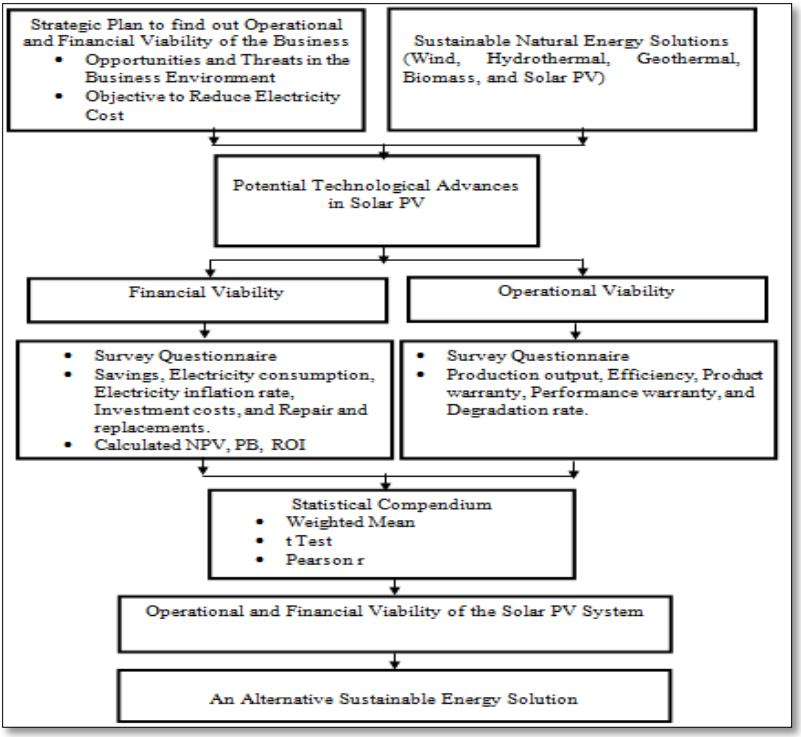

Figure 2. Conceptual Model

From the study's findings – through the financial and operational data presented – the researcher would be able to present critical information to enhance the logical decision-making of the cold storage industry User respondents. Also, the researcher envisages that both financial and the operational viability components will provide the expected findings that solar PV system will generate the necessary energy to run the cold storage system effectively and efficiently and become a standard model to be adopted by the cold storage industry for the food service companies.

1.6. Hypothesis of the Study

In conducting this study, the following null hypotheses were stated:

1. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on production output.
2. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on efficiency.
3. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on product warranty.
4. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on performance warranty.
5. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on degradation rate.
6. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on financial savings using NPV.
7. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on annual electricity consumption.
8. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the electricity inflation rate.
9. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on investment cost.

10. There is no statistical significant difference that exists between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on repairs and replacements.
11. There is no statistically significant relationship that exists between the financial savings using NPV on Power Purchase Agreement (PPA) of the cold storage industry respondents and their perceived operational viability on solar PV.
12. There is no statistically significant relationship that exists between the financial savings using NPV on Outright Purchase (OP) of the cold storage industry respondents and the perceived operational viability on solar PV.
13. There is no statistically significant relationship that exists between the financial savings using NPV on Power Purchase Agreement (PPA) of the cold storage industry respondents and the perceived financial viability on solar PV.
14. There is no statistically significant relationship that exists between the financial savings using NPV on Outright Purchase (OP) of the cold storage industry respondents and the perceived financial viability on solar PV.

1.7. Objective of the Study

In conducting the study on the Operational and Financial Viability of solar PV System of Cold Storage Industry in Greater Manila Area: An Alternative Sustainable Energy Solution, the researcher aims to achieve the following objectives:

1. To find out the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate.
2. To find out what significant difference that exists in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on the abovementioned variables.
3. To find out the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to financial savings using

NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements.

4. To find out what significant difference that exists in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the abovementioned variables?
5. To find out the financial savings using NPV and the attractiveness of investment using PB Period and ROI of the cold storage industry respondents on the implementation of the solar PV system.
6. To find out what significant relationship that exists between the financial savings using NPV of the cold storage industry respondents and the perceived operational viability of the solar PV.
7. To find out what significant relationship that exists between the financial savings using NPV of the cold storage industry respondents and the perceived financial viability of the solar PV.
8. To find out based on the results of the study, what alternative sustainable energy solution may be advanced.

1.8. Significance of the Study

This research can prove beneficial to a range of sectors. These are the following:

1.8.1. To the Society

This research on solar PV system will contribute to the benefit of society by reducing air pollution, water pollution, and other greenhouse gases pollutants. Greenhouse gases in balance trap the excessive heat from the sun enough to keep the earth's climate habitable to society. The use of PV system can have a positive, indirect effect on the environment when solar energy replaces or reduces the use of other energy sources that have larger and disastrous effects on the environment, thus saving the planet earth towards its own destruction.

Fossil fuels such as coal and oil are the sources of chemical substances such as carbon dioxide that lead to the

warming of the earth's surface. On the other hand, the use of natural energy or renewable do not do so. Hence, the world has chosen to lower the use of fossil fuels and to increase the renewable.

1.8.2. To the Government

This research will contribute to the progress and realization of the government thrust on the promotion and encouragement of the development and utilization of efficient renewable energy technologies and system to ensure optimal use and sustainability of the country's energy sources pursuant to RA Act Number 11285 known as An Act Institutionalizing Energy Efficiency and Conservation, Enhancing the Efficient Use of Energy, and Granting Incentives to Energy Efficiency and Conservation Projects and RA Act No. 9513, An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes

1.8.3. To the Community

This research will provide the community where cold storage operates a clean air by eliminating greenhouse gas emissions and/ or avoid the use of its diesel generator to supplement energy coming from the grid. The increasing urban sprawl in Bulacan, Cavite, and Rizal, and the transfer of factories and plants away from Metro Manila to adjacent areas will also lead to increased environmental pollution if fossil fuels will remain as the main source of energy and electricity. The use of renewable energy, with its clean air attraction, will minimize such occurrences in the near future.

1.8.4. To the Industry

This research will provide the model for cold storage industry serving fast food businesses and enable them to adopt solar PV system and come to a decision to choose solar PV solution as an alternative to supply electricity demand to run cold storage and become a standard of sustainable energy solution. Thus, it is important that the assessment of the viability of solar PV systems be studied and examined so that businesses will have

the confidence to use such energy sources for their profitability motives.

1.8.5. To the Company

This research will enable the company to reduce electricity consumption from Meralco grid and lessen the use of a more expensive electricity rate thus reducing electricity cost, enhance the company's image on corporate social responsibility (CSR) by negating the effect of disproportionate carbon footprint from fossil oil use by the Independent Power Producers (IPP), and support government thrust on the promotion and encouragement of the development and utilization of efficient renewable energy technologies.

1.8.6. To the Academe and future Researchers

This dissertation will benefit and help future researchers conduct further studies about or related to the subject matter with more valuable information, findings, and analysis. The findings of the study will be used by the academicians in discussing the subject matter particularly the application of financial and operational output of the study. In addition, this paper will serve as a foundation for future research studies considering the rapid advancement of solar PV technology. Particularly, this paper will be used by other researchers as secondary data. Also, the findings of the study will be used as a reference to conduct parallel studies.

1.9. Scope and Delimitations of the Study

The study is limited to the aspect of operational and financial viability of the solar PV system of the Cold Storage Industry in Greater Manila Area by calculating the financial savings in terms of the NPV and the desirability of an investment by computing the PB Period and ROI.

The research is limited further to the commercial contract options applied and available in the market for solar PV, investment cost, production and solar PV output estimates, degradation rate of solar PV, and schedule and cost of replacement of the inverter.

The research focuses on the Cold Storage Industry in Greater Manila Area with select Vendor and User respondents which experiences were provided with analysis for greater clarity on the issue of Operational and Financial Viability of the solar PV system.

The limitation includes historical experiences of the solar Vendor and User respondents on the solar PV system in the industry as reference to production output, degradation rate, product and performance warranty of the system, and consistency of operational viability.

The respondents of the study are limited to the select Vendors and Users of the solar PV system in the industry in Greater Manila Area. These are the top Vendor and User respondents listed by Cold Chain Association of the Philippines (CCAP, 2020).

In this research, the Pearson **r** and Test statistics **t** applies the calculation using the Vendor respondents' perception on operational viability, the calculated NPV on Power Purchase Agreement (PPA) and Outright Purchase (OP) Agreement.

1.10. Research Methodology

This chapter presents the scientific approach of the research study and the method of systematically solving the research problem. It involves the process adopted to study the problem and the essential logic behind the variables investigated. The method includes Research Design, Research Locale, Respondents of the Study, Population and Sampling, Research Instrument, Validity and Reliability of Research Instrument, Data Gathering Procedure, and Statistical Treatment of Data. The research essentially focuses on gathering and processing of data so findings can be deduced as a basis of conclusion and further recommendation.

On financial viability, data were gathered on the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to the financial

savings using NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements and then assess the significant difference in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the referenced variables. The data for the calculation of financial analysis of the cold storage industry were obtained from the User respondents and consists of the financial numbers before and after the implementation of the solar PV system. The financial numbers consist of the historical records and estimates of electricity consumption, electricity spends, and power rates of the User respondents in the cold storage industry.

The electricity consumption, spends and power rates consider the existing power supply fully connected to Meralco grid in comparison with the solar PV system. The commercial contract option used by the User respondents was noted in gathering the financial data. Contract prices for the option used in the project were obtained from the User respondents providing details on sizes of the system per kilowatt (kW) peak, annual production estimates of the system, the contract option prices, the schedule of payment and end of term payment for the investment, the power rate and the maintenance costs and schedules for each of the options.

On the operational viability, survey questionnaires were used to gather data to find out the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate. Then, these data were processed to find out the significant difference in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on the abovementioned variables. Subsequently, the aforementioned data and information were used to find out the significant relationship between the financial analysis of the cold storage industry respondents and the perceived operational viability of the solar PV and to find out the significant relationship between the financial analysis of the cold storage industry respondents and the perceived financial viability of the solar PV.

From the result of the research, an alternative sustainable energy solution may be advanced.

1.11. Research Design

The preceding statement of the problem on the operational and financial viability of the solar PV System for the cold storage industry in Greater Manila Area, an alternative energy solution and the specific research questions identified and specifically listed in this study substantiate the use of the Descriptive Research particularly answering questions about the "how, what, when, and where" of the research problem (Formplus, 2020). The questions are fundamental in facilitating and gathering of data needed for the analysis of the study. Furthermore, the research was conducted under existing conditions with Survey Questionnaires (SR) under the prevailing market situation with selected Vendor and User respondents representing an industry.

1.12. Research Locale

The research locale of this study is Greater Manila Area where the Vendor and User respondents of the cold storage system reside. Greater Manila Area is the contiguous urbanization surrounding Metro Manila. This built-up zone includes Metro Manila and the neighboring provinces of Bulacan to the north, Cavite and Laguna to the south, and Rizal to the east (Wikipedia, 2020). Metro Manila, officially the National Capital Region (NCR), is the seat of government and one of three defined metropolitan areas in the Philippines. It is composed of sixteen (16) cities: the city of Manila, Quezon City, Caloocan, Las Piñas, Makati, Malabon, Mandaluyong, Marikina, Muntinlupa, Navotas, Parañaque, Pasay, Pasig, San Juan, Taguig, and Valenzuela, as well as the municipality of Pateros (Wikipedia, 2020).

1.13. Respondents of the Study

The respondents of the study were four (4) solar PV Vendors and two (2) Users of solar PV system of the cold storage system in Greater Manila Area. The selected Vendor respondents were Solar NRG, Upgrade Energy, Sasonbi Solar, and Sunfish Solar, and the selected cold storage User respondents using solar

PV system were Koldstor Centre Philippines and Arctic Cold Refrigeration.

The selected Vendors and Users determine the number of respondents interviewed and surveyed separately from each other. The Vendor and User respondents were represented by the top executives of the company including the Chief Executive Officer, the President or the Vice President, and or the top manager of the company who were tasked and authorized to enter into negotiations with the customer or clients. In the interview sessions, only one interviewee per Vendor and or User engaged the researcher in a question and answer exchange. The Vendor and the User respondents are in the top list of CCAP. Figures 5 to Figure 6 show the cold storage facilities of the User respondents and Figures 7 to Figure 10 present the location of the offices of the Vendor respondents.

Figure 3. Koldstor Centre Philippines, Imus Cavite

Note: Adapted from "Cold Storage Facility", (Koldstor Centre Philippines, 2019).

Figure 4 Arctic Cold Refrigeration, Mercedes Avenue Pasig City

Note: Adapted from "Cold Storage Facility", (Arctic Cold Refrigeration, 2016).

Figure 5. Solar NRG, Emerald Avenue, San Antonio, Pasig City

Note: Adapted from "Head Office", (Solar NRG, 2021).

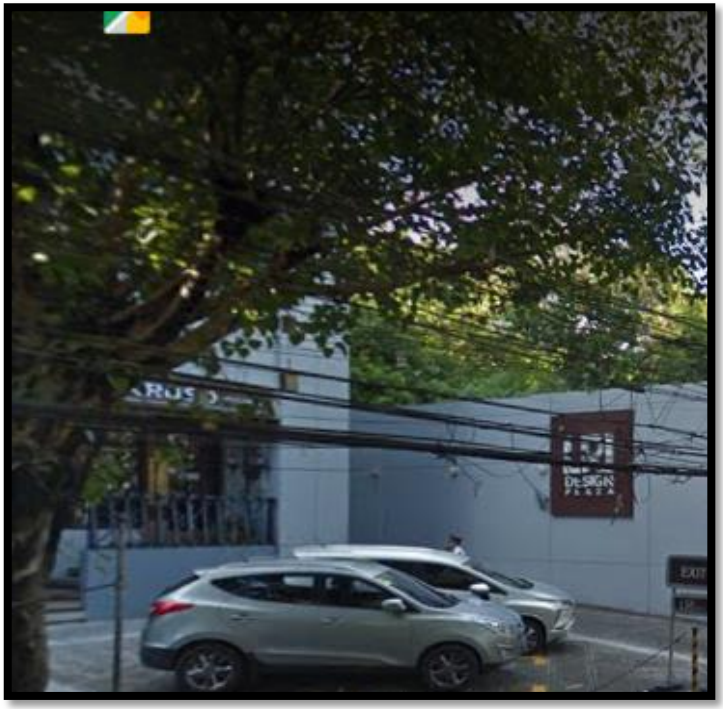

Figure 6. Upgrade Energy, LRI Business Plaza, Bel-Air, Makati

Note: Adapted from "Head Office", (Upgrade Energy, 2019).

Figure 7. Sasonbi Solar, Stock Exchange Center, Ortigas Center, Pasig

Note: Adapted from "Head Office", (Sasonbi Solar, 2019).

Figure 8. Sunfish Solar, Burgundy Tower, Ortigas Center, Pasig

Note: Adapted from "Head Office", (Sunfish Solar, 2019).

Purposive sampling or judgmental sampling (Lavrakas, 2008) was used to select Vendor and User respondents from the population of solar PV Vendors and Users of solar PV of cold storage industry in Greater Manila Area. The selected Vendor and User respondents were recognized full-size companies with expertise in their own field of operation and are on the top list of Cold Chain Association of the Philippines (CCAP, 2020). CCAP represents mainly cold storage operators and allied partners whose main clients are large fast food businesses of the country. The Vendor and User respondents selected are indicative of the reliable cross section of the population of solar PV Vendors and cold storage Users in Greater Manila Area.

1.14. Research Instrument

The research instruments that were used to collect data and information in the conduct of this study were surveys. Self-constructed survey questionnaires were used for determining the

respondent's perception of the operational and financial viability of solar PV.

In conducting surveys, self-constructed survey questionnaires (SQ) were developed and distributed earlier to the selected Vendor and User respondents. During an individual interview with the Vendor and User respondents, follow up questions and or probes were raised to clarify their responses.

The researcher employed the five-point Likert Scale allowing the respondents to express the extent of their agreement or disagreement about a particular statement or item in a survey questionnaire. Table 4 shows the Five-Point Likert Scale.

Table 1. Five-Point Likert Scale

Weight/Scale	Mean/Range	Verbal Interpretation
5	4.51 - 5.00	Strongly Agree
4	3.51 - 4.50	Agree
3	2.51 - 3.50	Moderately Agree
2	1.51 - 2.50	Slightly Agree
1	1.00 - 1.50	Disagree

Source: Adapted from "Cronbach Alpha", (Research Gate, 2012).

1.15. Data Gathering Procedure

The important information contained in Survey Questionnaires (SQ) were distributed to the selected Vendor and User respondents for reference and guidance. The SQ that were completed by each of the selected Vendor and User respondents were collected by the researcher during meetings and interviews, then clarified, collated, and tabulated. The results were presented, interpreted, explained, and analyzed using tables, text, and graphs as the bases of findings, conclusion, and recommendation.

Tables 9, Table 13, Table 14 and Table 18 show the survey questionnaires on part 1 Operational Viability of Solar PV system and the survey questionnaires on part 2 Financial Viability of Solar PV system, respectively.

Table 2. Survey Questionnaire on Production Output

1.1 Production Output	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. Solar PV system generates electricity at its rated capacity.					
2. Solar PV system output will not be significantly reduced.					
3. A company has better confidence in its regular electricity supply when solar PV system is in place.					

Source: Appendix C Survey Questionnaire

Table 3. Survey Questionnaire on Production Efficiency

1.2 Efficiency	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. Consistent good performance of solar PV system with no increase in cost when power fluctuates.					
2. Electricity cost from solar PV is less based on the overall assessment by the					

1.2 Efficiency	Strongly Agree (5)	Agree (4)	Moderately Agree (3)	Disagree (2)	Strongly Disagree (1)
sellers and users.					
3. Less manpower effort is needed to make storage and distribution efficient.					

Source: Appendix C Survey Questionnaire

Table 4. Survey Questionnaire on Product Warranty

1.3 Product Warranty	Strongly Agree (5)	Agree (4)	Moderately Agree (3)	Disagree (2)	Strongly Disagree (1)
1. No malfunction in the solar PV system is experienced as guaranteed by the vendors.					
2. Effective production of electricity from the solar PV is seen as a commitment by the vendors.					
3. No instance of work stoppage due Solar PV System.					

Source: Appendix C Survey Questionnaire

Table 5. Survey Questionnaire on Performance Warranty

1.4 Performance Warranty	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. The guarantee yield of electric power should be sufficient.					
2. It renders good overall performance as a warranty commitment.					
3. Extended performance in production output of electricity is expected and achieved as a quality of Solar PV.					

Source: Appendix C Survey Questionnaire

Table 6. Survey Questionnaire on Degradation Rate

1.5 Degradation Rate	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. The solar PV will not perform less than what is expected.					
2. Downcast state should not be experienced.					
3. It will perform to a greater respectable state of function.					

Source: Appendix C Survey Questionnaire

Table 7. Survey Questionnaire on Financial Savings using NPV

2.1 Financial Savings using Net Present Value (NPV)	Strongly Agree (5)	Agree (4)	Moderately Agree (3)	Disagree (2)	Strongly Disagree (1)
1. There will be an improvement in cash inflows.					
2. Better investment planning will be achieved.					
3.Better profitability will be achieved using solar PV.					

Source: Appendix C Survey Questionnaire

Table 8. Survey Questionnaire on Annual Electricity Consumption

2.2 Annual Electricity Consumption	Strongly Agree (5)	Agree (4)	Moderately Agree (3)	Disagree (2)	Strongly Disagree (1)
1. Electricity consumption has been assessed to be lower in overall cost.					
2. Millions are generated as savings using solar PV.					
3. Savings have been utilized for other worthy investment in the organization.					

Source: Appendix C Survey Questionnaire

Table 9. Survey Questionnaire on Electricity Inflation Rate

2.3 Electricity Inflation Rate	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. Inflation rate on electricity cost does not have much effect because of savings in the solar PV system.					
2. Increase in traditional cost of electricity is offset by the solar PV system.					
3. Company has lesser worries over the fluctuation of electricity cost.					

Source: Appendix C Survey Questionnaire

Table 10. Survey Questionnaire on Investment Cost

2.4 Investment Cost	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. Investment cost is well within the development phase of the company.					
2. It has been used to provide greater modifications.					
3. Solar PV has been used for development of new capabilities.					

Source: Appendix C Survey Questionnaire

Table 11. Survey Questionnaire on Repair and Replacements

2.5 Repairs and Replacements	**Strongly Agree (5)**	**Agree (4)**	**Moderately Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. While replacement parts are always available, they are seldom used.					
2. Very minor repairs occurred; almost none throughout the years.					
3. Almost no repair and the need for replacement parts has been normal.					

1.16. Validity and Reliability of Research Instrument

To ensure that the questions in the survey were valid and reliable as they relate to the operational and financial viability of solar PV system, that is, each question measures consistently what it intends to measure, the researcher used reliability statistics, the Cronbach Alpha (Laerd Statistics , 2018). Cronbach's alpha results should give a number from 0 to 1. If alpha is equals to 0, all of the scale items are entirely independent from one another that is not correlated. If alpha = 1, all the items have high covariance as the number of items in the scale approaches infinity. The general rule is that a Cronbach's alpha of .70 and above is good, .80 and above is better, and .90 and above is best (Statistics Solution, 2020).

Cronbach's alpha is computed by correlating the score for each scale item with the total score for each observation and then comparing that to the variance for all individual item scores:

$$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum_{i=1}^{k} \sigma_{y_i}^2}{\sigma_x^2}\right)$$

..where: k refers to the number of scale items

$\sigma_{y_i}^2$ refers to the variance associated with item i

σ_x^2 refers to the variance associated with the observed total scores

Alternatively, Cronbach alpha can also be defined as,

$$\alpha = \frac{k \times \bar{c}}{\bar{v} + (k-1)\bar{c}}$$

..where: k refers to the number of scale items

$\bar{c}$ refers to the average of all covariances between items

$\bar{v}$ refers to the average variance of each item

On Cronbach Alpha Calculation Part 1 Vendor Perception on Operational Viability of Solar PV System, the number of scale items is five (5) consisting of 1.1 Production Output, 1.2 Efficiency, 1.3 Product Warranty, 1.4 Performance Warranty, and 1.5 Degradation Rate.

The sum of variance of item scores is 0.16, and the sum of variance of total responses scores is 0.52.

Cronbach Alpha is calculated at 0.87 with a verbal interpretation as "Good".

The formula in computing the Cronbach Alpha is:

Number of scale items/(number of scale items - 1) x (1-sum of variance of item scores)/(sum of variance of total responses scores).

Table 5 shows Cronbach Alpha Calculation Part 1 Vendor Perception of Operational Viability of Solar PV System.

Table 12. Cronbach Alpha Calculation Part 1 Vendor Perception of Operational Viability of Solar Photovoltaic (PV) System

Parameters	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**	**Total**	**Variance**
1.1 Production Output	4.67	4.67	4.67	4.67	18.67	-
1.2 Efficiency	4.67	5.00	4.67	5.00	19.33	0.03
1.3 Product Warranty	4.67	4.67	4.67	5.00	19.00	0.02
1.4 Performance Warranty	4.33	4.67	4.67	5.00	18.67	0.06
1.5 Degradation Rate	4.33	4.67	4.67	5.00	18.67	0.06
Total	22.67	23.67	23.33	24.67	94.33	0.16
Weighted Mean	4.53	4.73	4.67	4.93	4.72	
Verbal Interpretation	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	

Source**:** Adapted from Appendix A1.

On Cronbach Alpha Calculation Part 1 User Perception of Operational Viability of Solar PV System, the number of scale items is five (5) consisting of 1.1 Production Output, 1.2 Efficiency, 1.3 Product Warranty, 1.4 Performance Warranty, and 1.5 Degradation Rate.

The sum of variance of item scores is 0.75, and the sum of variance of total responses scores is 3.36.

Cronbach Alpha is calculated at 0.97 with a verbal interpretation as "Excellent".

The formula in computing the Cronbach Alpha is:

Number of scale items/(number of scale items - 1) x (1-sum of variance of item scores)/(sum of variance of total responses scores)

Table 13. Cronbach Alpha Part 1 User Perception of Operational Viability of Solar PV System

Parameters	Koldstor	Arctic	Total	Variance
1.1 Production Output	4.67	4.00	8.67	0.11
1.2 Efficiency	4.67	4.33	9.00	0.03
1.3 Product Warranty	5.00	4.00	9.00	0.25
1.4 Performance Warranty	4.67	4.00	8.67	0.11
1.5 Degradation Rate	5.00	4.00	9.00	0.25
Total	24.00	20.33	44.33	0.75
Weighted Mean	4.80	4.07	4.43	
Verbal Interpretation	Strongly Agree	Agree	Agree	

Source: Adapted from Appendix A2

On Cronbach Alpha Calculation Part 2 Vendor Perception of Financial Viability of Solar PV System, the number of scale items is five (5) consisting of 2.1 Financial Savings using NPV, 2.2 Annual Electricity Consumption, 2.3 Electricity Inflation Rate, 2.4 Investment Cost, and 2.5 Repairs and Replacements.

The sum of variance of item scores is 0.23, and the sum of variance of total responses scores is 0.72.

Cronbach Alpha is calculated at 0.85 with a verbal interpretation as "Good".

The formula in computing the Cronbach Alpha is:

Number of scale items/(number of scale items - 1) x (1-sum of variance of item scores)/(sum of variance of total responses scores)

Table 14. Cronbach Alpha Part 2 Vendor Perception of Financial Viability of Solar PV System

Parameters	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Total	Variance
2.1 Financial Savings using Net	4.33	4.50	4.67	5.00	18.50	0.06

Parameters	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Total	Variance
Present Value						
2.2 Annual Electricity Consumption	4.33	4.50	4.40	5.00	18.23	0.07
2.3 Electricity Inflation Rate	4.33	4.67	4.67	4.67	18.33	0.02
2.4 Investment Cost	4.33	5.00	4.50	4.67	18.50	0.06
2.5 Repairs and Replacements	4.33	4.67	4.67	4.67	18.33	0.02
Total	21.67	23.33	22.90	24.00	91.90	0.23
Weighted Mean	4.33	4.67	4.58	4.80	4.60	
Verbal Interpretation	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	

Source: Adapted from Appendix B1

On Cronbach Alpha Calculation Part 2 User Perception on Financial Viability of Solar PV System,

The number of scale items is five (5) consisting of 2.1 Financial Savings using NPV, 2.2 Annual Electricity Consumption, 2.3 Electricity Inflation Rate, 2.4 Investment Cost, and 2.5 Repairs and Replacements.

The sum of variance of item scores is 0.94, and the sum of variance of total responses scores is 4.00.

Cronbach Alpha is calculated at 0.95 with a verbal interpretation as "Excellent".

The formula in computing the Cronbach Alpha is:

Number of scale items/(number of scale items - 1) x (1-sum of variance of item scores)/(sum of variance of total responses scores)

Table 8 shows Cronbach Alpha Part 2 User Perception of Financial Viability of Solar PV System.

Table 15. Cronbach Alpha Part 2 User Perception of Financial Viability of Solar PV System

Parameters	Koldstor	Arctic	Total	Variance
2.1 Financial Savings using Net Present Value	4.33	4.00	8.33	0.03
2.2 Annual Electricity Consumption	4.67	4.00	8.67	0.11
2.3 Electricity Inflation Rate	5.00	4.33	9.33	0.11
2.4 Investment Cost	5.00	4.00	9.00	0.25
2.5 Repairs and Replacements	5.00	3.67	8.67	0.44
Total	24.00	20.00	44.00	0.94
Weighted Mean	4.80	4.00	4.40	
Verbal Interpretation	Strongly Agree	Agree	Agree	

Source: Adapted from Appendix B2

1.17. Statistical Treatment of Data

To present, interpret, and analyze the data gathered by the researcher, certain statistical tools and techniques were used in this study.

Weighted mean was used to find out the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation. This weighted mean was also used to find out the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to the financial savings using the NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements.

Likewise, weighted mean was used to calculate the inflation rate in the next twenty-five (25) years based on the results of survey parts 3 and 4 of the Vendor and User respondents.

Weighted mean is an average computed by giving different weights to some of the individual values. If all the weights are equal, then the weighted mean is the same as the arithmetic mean. Weighted means generally behave in a similar approach to arithmetic means. They do have a few counter-instinctive properties. Data elements with a high weight contribute more to the weighted mean than the elements with a low weight (BYJU'S, 2020).

Formula of Weighted Mean:

The Weighted Mean for given set of non-negative data x1, x2, x3,….xn with non-negative weights w1, w2, w3,….wn can be derived from the formula given below.

$$\overline{x} = \frac{w_1x_1 + w_2x_2 + \ldots\ldots + w_nx_n}{w_1 + w_2 + \ldots\ldots w_n}$$

Where:

x is the repeating value
w is the number of occurrences of x weight
$\overline{x}$ is the weighted mean

In the estimate of the annual electricity consumption, time series analysis was adopted using the linear regression equation. The equation has the form Y= a + bX, where Y is the dependent variable (or the annual electricity consumption), X is the independent variable (or time t in number of years), b is the slope of the line and a is the y-intercept (Edwards, 2020).

$$a = \frac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2}$$

$$b = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$$

Test statistics, **t** was used to find out the significant difference in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty,

performance warranty, and degradation rate. In addition, to find out the significant difference in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to the financial savings using the NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements.

Test statistics, **t** is a statistical test that is used to compare the means of two groups. It is used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another (Bevans, 2020).

Pearson **r** was used to find out the significant relationship between the financial analysis of the cold storage industry respondents and the perceived operational viability of the solar PV. Also, Pearson **r** was to determine the significant relationship between the financial analysis of the cold storage industry respondents and the perceived financial viability of the solar PV.

Pearson's **r** is the degree of association between two (2) variables. It measures the linear relationship between two interval or ratio level variables.

Pearson's **r** squared is the coefficient of determination.

1.18. Financial Feasibility

The electricity cost savings of the two (2) User respondents of cold storages representing the cold storage industry in Greater Manila Area were calculated using the three-year historical cost before the implementation of solar PV system in comparison with the cost after the implementation of the solar PV system. In particular, the power rates (in cost per kWh) were calculated from average (arithmetic mean) of the three-year historical electricity cost before the implementation of solar PV and were compared to the power cost (in cost per kWh) after the implementation of solar PV system.

The financial savings of the cold storage industry User respondents on the implementation of the solar PV system were calculated using the NPV. The industry standard lifespan of the solar PV system is about 25 to 30 years (Berg, 2018).

On NPV

NPV is computed by determining the current value of all future cash flows generated by the system, including the initial capital investment (if any in the contract). It is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.

The following formula is used to calculate NPV:

$$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t}$$

where:

R_t = Net cash inflow-outflows during a single period t

i = Discount rate or return that could be earned in alternative investments

t = Number of timer periods

A positive NPV indicates that the projected earnings generated by a project or investment- in present peso- exceeds the anticipated costs, also in present peso. It is assumed that an investment with a positive NPV will be profitable, and an investment with a negative NPV will result in a net loss. This concept is the basis for the NPV Rule, which dictates that only investments with positive NPV values should be considered (Kenton, W, 2020)

On PB

PB period was calculated by determining the cost of investment divided by the annual cash flow. PB is the amount of time to recover the cost of investment. The cash flow can either be discounted or undiscounted. A discounted PB gives the number

of years it takes to break even from undertaking the initial expenditure by discounting future cash flows and recognizing the time value of money. In the undiscounted PB, cash flows are not adjusted to include the time value of money (Kenton, W, 2020). The shorter the PB, the more desirable the investment.

Figure 13 illustrates the formula for calculating the PB period:

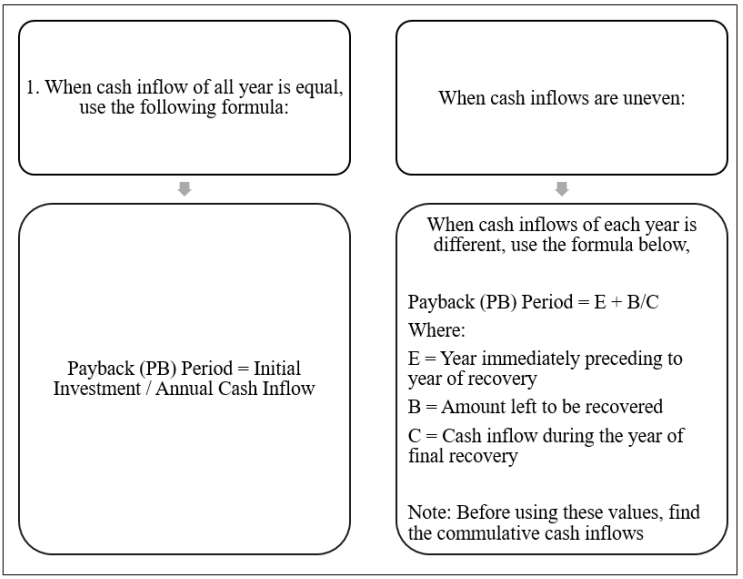

Figure 9. PB Period Formula

Note: Adapted from " Payback Period Formula", (Verma, 2019).

On ROI

Formula for calculating the ROI,

$$ROI = \frac{\text{Net Return on Investment}}{\text{Cost of Investment}} \times 100\%$$

ROI is calculated by subtracting the initial value of the investment from the final value of the investment (which equals the net return), then dividing this new number (the net return) by the cost of the investment, and, finally, multiplying it by 100. First, ROI is typically expressed as a percentage because it is intuitively easier to understand (as opposed to when expressed as a ratio). Second, the ROI calculation includes the net return in the numerator because returns from an investment can be either positive or negative. When ROI calculations yield a positive figure, it means that net returns are favorable (total returns exceed total costs). Alternatively, when ROI calculations yield a negative figure, it means that net returns are not favorable (total costs exceed total returns) (Beattie A. , 2020).

1.19. Presentation, Analysis, and Interpretation of Data

This chapter presents the data gathered from the results of the survey that were distributed to the SPV User and Vendor respondents of the cold storage industry in Greater Manila Area. The presentation of the results follows the order as presented in the statement of the problem and the objective of the study.

1.19.1. On the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate:

To answer this inquiry, Likert Scale was used to collect the data from the SPV Vendor and User respondents' perception of the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate by requesting the respondents to use the five-point Likert scale to specify their level of agreement to a statement (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

The Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Production Output is shown in Table 19.

Table 16. Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Production Output

Production Output	SPV User		SPV Vendor	
	WM	VI	WM	VI
1. Solar PV system generates electricity at its rated capacity.	4.50	Agree	5.00	Strongly Agree
2. Solar PV system output will not be significantly reduced.	4.50	Agree	5.00	Strongly Agree
3. A company has better confidence in its regular electricity supply when solar PV system is in place.	4.00	Agree	4.00	Agree
Average Weighted Mean	4.33	Agree	4.67	Strongly Agree
Standard Deviation	0.28868	0.57735		

Source: Appendix D1and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.33 and 4.67 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the operational viability of solar PV system referenced to Production Output.

SPV User respondents assert to "Agree" on the three (3) statements: "Solar PV system generates electricity at its rated capacity", " Solar PV system output will not be significantly reduced", and " A company has better confidence in its regular electricity supply when solar PV system is in place". The highest WM of 4.5 with VI of "Agree" are noted on the two (2) statements "Solar PV system generates electricity at its rated capacity", and "Solar PV system output will not be significantly reduced".

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements "Solar PV system generates electricity at its rated capacity" and "Solar PV system output will not be significantly reduced". The highest WM of 5.0 with VI of "Strongly Agree" are noted on the two (2) statements "Solar PV

system generates electricity at its rated capacity" and "Solar PV system output will not be significantly reduced".

The Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Efficiency is shown in Table 20.

Table 17. Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Efficiency

Efficiency	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
1. Consistent good performance of solar PV system with no increase in cost when power fluctuates.	4.50	Agree	5.00	Strongly Agree
2. Electricity cost from solar PV is less based on the overall assessment by the Sellers and Users.	5.00	Strongly Agree	5.00	Strongly Agree
3. Less manpower effort is needed to make storage and distribution efficient.	4.00	Agree	4.50	Agree
Average Weighted Mean	4.50	Agree	4.83	Strongly Agree
Standard Deviation	0.50000		0.28868	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.50 and 4.83 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the operational viability of solar PV system referenced to Efficiency.

SPV User respondents assert to "Strongly Agree" on one (1) statement "Electricity cost from solar PV is less based on the overall assessment by the Sellers and Users" and affirm to "Agree" on the two (2) statements- "Consistent good performance of solar PV system with no increase in cost when power fluctuates" and "Less manpower effort is needed to make storage and distribution efficient". The highest WM of 5.00 with VI of "Strongly Agree"

is noted on one (1) statement “Electricity cost from solar PV is less based on the overall assessment by the Sellers and Users".

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements "Consistent good performance of solar PV system with no increase in cost when power fluctuates" and "Electricity cost from solar PV is less based on the overall assessment by the Sellers and Users". The highest WM of 5.0 with VI of "Strongly Agree" are noted on the two (2) statements "Consistent good performance of solar PV system with no increase in cost when power fluctuates" and "Electricity cost from solar PV is less based on the overall assessment by the Sellers and Users".

The Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Product Warranty is shown in Table 21.

Table 18. Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Product Warranty

Product Warranty	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
1. No malfunction in the solar PV system is experienced as guaranteed by the Vendors.	4.50	Agree	5.00	Strongly Agree
2. Effective production of electricity from the solar PV is seen as a commitment by the Vendors.	4.50	Agree	5.00	Strongly Agree
3. No instance of work stoppage due Solar PV System.	4.50	Agree	4.25	Agree
Average Weighted Mean	4.50	Agree	4.75	Strongly Agree
Standard Deviation	0.0000		0.43301	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.50 and 4.75 with a verbal interpretation (VI) of “Agree” and "Strongly Agree” respectively on the perceptions of SPV User

and Vendor respondents on the operational viability of solar PV system referenced to Product Warranty.

SPV User respondents assert to "Agree" on the three (3) statements "No malfunction in the solar PV system is experienced as guaranteed by the Vendors", "Effective production of electricity from the solar PV is seen as a commitment by the Vendors", and " No instance of work stoppage due solar PV System". The highest weighted mean of 4.50 with VI of "Agree" are noted on all three (3) statements.

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements "No malfunction in the solar PV system is experienced as guaranteed by the Vendors" and "Effective production of electricity from the solar PV is seen as a commitment by the Vendors". The highest WM of 5.0 with VI of "Strongly Agree" are noted on the two (2) statements "No malfunction in the solar PV system is experienced as guaranteed by the Vendors " and "Effective production of electricity from the solar PV is seen as a commitment by the Vendors".

The Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Performance Warranty is shown in Table 22.

Table 19. Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Performance Warranty

Performance Warranty	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
1. The guarantee yield of electric power should be sufficient.	4.50	Agree	4.75	Strongly Agree
2. It renders good overall performance as a warranty commitment.	4.00	Agree	5.00	Strongly Agree
3. Extended performance in production output of electricity is expected and achieved as a quality of solar PV.	4.50	Agree	4.25	Agree

Performance Warranty	SPV User		SPV Vendor	
	WM	VI	WM	VI
Average Weighted Mean	4.33	Agree	4.67	Strongly Agree
Standard Deviation	0.28868	0.38188		

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.33 and 4.67 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the operational viability of solar PV system referenced to Performance Warranty.

SPV User respondents assert to "Agree" on the three (3) statements "The guarantee yield of electric power should be sufficient", "It renders good overall performance as a warranty commitment", and "Extended performance in production output of electricity is expected and achieved as a quality of solar PV". The highest weighted mean of 4.50 with VI of "Agree" are noted on the two (2) statements "The guarantee yield of electric power should be sufficient" and "Extended performance in production output of electricity is expected and achieved as a quality of solar PV".

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements- "The guarantee yield of electric power should be sufficient" and " It renders good overall performance as a warranty commitment.". The highest WM of 5.0 with VI of "Strongly Agree" is noted on the statement "It renders good overall performance as a warranty commitment".

The Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Degradation Rate is shown Table 23.

Table 20. Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System Referenced to Degradation Rate

Degradation Rate	SPV User		SPV Vendor	
	WM	VI	WM	VI
1. The solar PV will not perform less than what is expected.	4.50	Agree	5.00	Strongly Agree
2. Downcast state should not be experienced.	4.50	Agree	4.75	Strongly Agree
3. It will perform to a greater respectable state of function.	4.50	Agree	4.25	Agree
Average Weighted Mean	4.50	Agree	4.67	Strongly Agree
Standard Deviation	0.00000		0.38188	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.50 and 4.67 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the operational viability of solar PV system referenced to Degradation Rate.

SPV User respondents assert to "Agree" on the three (3) statements- "The solar PV will not perform less than what is expected", "Downcast state should not be experienced", and "It will perform to a greater respectable state of function". The highest weighted mean of 4.50 with VI of "Agree" are noted on the three (3) statements.

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements- "The solar PV will not perform less than what is expected" and "Downcast state should not be experienced", and assert to "Agree" on one (1) statement "It will perform to a greater respectable state of function". The highest WM of 5.0 with VI of "Strongly Agree" is noted on the statement "The solar PV will not perform less than what is expected".

The Contingency Table on Perception of the Two Groups of Respondents on the Operational Viability of Solar PV System is shown in Table 24.

Table 21. Contingency Table on Perception of the Two Groups of Respondents on the Operational Viability Of Solar PV System

Parameters	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
Production Output	4.33	Agree	4.67	Strongly Agree
Efficiency	4.50	Agree	4.83	Strongly Agree
Product Warranty	4.50	Agree	4.75	Strongly Agree
Performance Warranty	4.33	Agree	4.67	Strongly Agree
Degradation Rate	4.50	Agree	4.67	Strongly Agree

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results on the parameters used in the Perception of the Two Groups of Respondents on the Operational Viability of Solar PV system shown on the table are therefore summarized as SPV User respondents asserts to "Agree" on five (5) parameters "Production Output", "Efficiency", "Product Warranty", "Performance Warranty", and "Degradation Rate". The highest WM is 4.50 noted on the three (3) parameters "Efficiency", "Product Warranty" and "Degradation Rate", while SPV Vendor respondents affirm to "Strongly Agree" on five (5) parameters ""Production Output", "Efficiency", "Product Warranty", "Performance Warranty", and "Degradation Rate". The highest WM is 4.75 noted on one (1) parameter "Product Warranty".

1.19.2. On what significant difference exists in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate:

To answer this research inquiry, a t-test was used. A **t**-test is an inferential statistic used to determine if there is a significant difference between the means of two groups. A **t**-test looks at the

t-statistic, the **t**-distribution values, and the degrees of freedom to determine the statistical significance (Kenton & Westfall, 2020)

1.19.2.1. On Production Output

Calculating a **t**-test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, the data were obtained from the Vendor and the User respondents' perception rating on operational viability based on Production Output.

The Vendor Perception Rating Based on Production Output is presented in Table 25.

Table 22. Vendor Perception Rating Based on Production Output

1.1 Production Output	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. Solar PV system generates electricity at its rated capacity.	5	5	5	5	5.00
2. Solar PV system output will not be significantly reduced.	5	5	5	5	5.00
3. A company has better confidence in its regular electricity supply when solar PV system is in place.	4	4	4	4	4.00
Weighted Mean	4.67	4.67	4.67	4.67	4.67
Standard Deviation	0.57735	0.57735	0.57735	0.57735	0.57735

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Production Output is presented in Table 26.

Table 23. User Perception Rating Based on Production Output

1.1 Production Output	Koldstor	Arctic	Weighted Mean
1. Solar PV system generates electricity at its rated capacity.	5	4	4.50
2. Solar PV system output will not be significantly reduced.	5	4	4.50
3. A company has better confidence in its regular electricity supply when solar PV system is in place.	4	4	4.00
Weighted Mean	4.67	4.00	4.33
Standard Deviation	0.57735	0.00000	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 27 Vendor Difference on Perception Rating Based on Production Output and Mean Value and Table 28 User Difference on Perception Rating Based on Production Output and Mean Value.

The Vendor Difference on Perception Rating Based on Production Output and Mean Value is presented in Table 27.

Table 24. Vendor Difference on Perception Rating Based on Production Output and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5.00	4.67	0.33	0.11
2	5.00	4.67	0.33	0.11
3	4.00	4.67	(0.67)	0.44
4	5.00	4.67	0.33	0.11
5	5.00	4.67	0.33	0.11
6	4.00	4.67	(0.67)	0.44
7	5.00	4.67	0.33	0.11
8	5.00	4.67	0.33	0.11
9	4.00	4.67	(0.67)	0.44
10	5.00	4.67	0.33	0.11
11	5.00	4.67	0.33	0.11

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
12	4.00	4.67	(0.67)	0.44
Sum	56.00			2.67

Source: Appendix M **t**-Test Operational Viability Based on Production Output

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.667 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.67 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.492.

The User Difference on Perception Rating Based on Production Output and Mean Value is presented in Table 28.

Table 25 . User Difference on Perception Rating Based on Production Output and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5.00	4.33	0.67	0.44
2	5.00	4.33	0.67	0.44
3	4.00	4.33	(0.33)	0.11
4	4.00	4.33	(0.33)	0.11
5	4.00	4.33	(0.33)	0.11
6	4.00	4.33	(0.33)	0.11
Sum	4.33			1.33

Source: Appendix M **t**-Test Operational Viability Based on Production Output

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.33 calculated by obtaining the mean

(average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.33 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.27.

The formula for statistical test value is:

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating	n1	12.000
Number of perception rating - 1	n-1	11.000
Mean of the perception rating	x bar	4.667
Standard Deviation	S1	0.492

On User:

Number of data on perception rating	
n2	6.00
Number of data on perception rating - 1	
n-1	5.00
Mean of data on perception rating	
x bar	4.33

Standard deviation of data on perception rating S2 0.267

The calculated test value, t is 1.862

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 1.862 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.2.2. On Efficiency

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, data were obtained from the Vendor and the User respondents' perception rating on operational viability based on Efficiency.

The Vendor Perception Rating Based on Efficiency is shown in Table 29.

Table 26. Vendor Perception Rating Based on Efficiency

1.2 Efficiency	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**	**Weighted Mean**
1. Consistent good performance of solar PV system with no increase in cost when power fluctuates.	5	5	5	5	5.00
2. Electricity cost from solar PV is less based on the overall assessment by the sellers and users.	5	5	5	5	5.00

1.2 Efficiency	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
3. Less manpower effort is needed to make storage and distribution efficient.	4	5	4	5	4.50
Weighted Mean	4.67	5.00	4.67	5.00	4.83
Standard Deviation	0.57735	0.00000	0.57735	0.00000	0.28868

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Efficiency is presented in Table 30.

Table 27. User Perception Rating Based on Efficiency

1.2 Efficiency	Koldstor	Arctic	Weighted Mean
1. Consistent good performance of solar PV system with no increase in cost when power fluctuates.	5	4	4.50
2. Electricity cost from solar PV is less based on the overall assessment by the sellers and users.	5	5	5.00
3. Less manpower effort is needed to make storage and distribution efficient.	4	4	4.00
Weighted Mean	4.67	4.33	4.50
Standard Deviation	0.57735	0.57735	0.50000

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 31 Vendor Difference on Perception Rating Based on Efficiency and Mean Value and Table 32 User Difference on Perception Rating Based on Efficiency and Mean Value.

The Vendor Difference on Perception Rating Based on Efficiency and Mean Value is presented in Table 31.

Table 28. Vendor Difference on Perception Rating Based on Efficiency and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.833	0.167	0.028
2	5	4.833	0.167	0.028
3	4	4.833	(0.833)	0.694
4	5	4.833	0.167	0.028
5	5	4.833	0.167	0.028
6	5	4.833	0.167	0.028
7	5	4.833	0.167	0.028
8	5	4.833	0.167	0.028
9	4	4.833	(0.833)	0.694
10	5	4.833	0.167	0.028
11	5	4.833	0.167	0.028
12	5	4.833	0.167	0.028
Sum	58.000			1.667

Source: Appendix N **t**-Test Operational Viability Based on Efficiency

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.833 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.667 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.389.

The User Difference on Perception Rating Based on Efficiency and Mean Value is presented in Table 32.

Table 29. User Difference on Perception Rating Based on Efficiency and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250
4	4	4.50	(0.500)	0.250

5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix N **t**-Test Operational Viability Based on Efficiency

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.50 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.30.

The formula for statistical test value is:

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor,

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.833

Standard Deviation S1 0.389

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.500

Standard deviation of data on perception rating S2 0.300

The calculated test value, t is 2.005

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 2.005 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.2.3. On Product Warranty

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents their perception rating on operational viability based on Product Warranty.

The Vendor Perception Rating Based on Product Warranty is shown in Table 33.

Table 30. Vendor Perception Rating Based on Product Warranty

1.3 Product Warranty	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. No malfunction in the solar PV system is experienced as guaranteed by the vendors.	5	5	5	5	5.00

2. Effective production of electricity from the solar PV is seen as a commitment by the vendors.	5	5	5	5	5.00
3. No instance of work stoppage due solar PV System.	4	4	4	5	4.25
Weighted Mean	4.67	4.67	4.67	5.00	4.75
Standard Deviation	0.57735	0.57735	0.57735	0.00000	0.43301

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Product Warranty is presented in Table 34.

Table 31. User Perception Rating Based on Product Warranty

1.3 Product Warranty	**Koldstor**	**Arctic**	**Weighted Mean**
1. No malfunction in the solar PV system is experienced as guaranteed by the vendors.	5	4	4.50
2. Effective production of electricity from the solar PV is seen as a commitment by the vendors.	5	4	4.50
3. No instance of work stoppage due solar PV System.	5	4	4.50
Weighted Mean	5.00	4.00	4.50
Standard Deviation	0.00000	0.00000	0.00000

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 35 Vendor Difference on Perception Rating Based on Product Warranty and Mean Value and Table 36 User Difference on Perception Rating Based on Product Warranty and Mean Value.

The Vendor Difference on Perception Rating Based on Product Warranty and Mean Value is presented in Table 35.

Table 32. Vendor Difference on Perception Rating Based on Product Warranty an Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.750	0.250	0.063
2	5	4.750	0.250	0.063
3	4	4.750	(0.750)	0.563
4	5	4.750	0.250	0.063
5	5	4.750	0.250	0.063
6	4	4.750	(0.750)	0.563
7	5	4.750	0.250	0.063
8	5	4.750	0.250	0.063
9	4	4.750	(0.750)	0.563
10	5	4.750	0.250	0.063
11	5	4.750	0.250	0.063
12	5	4.750	0.250	0.063
Sum	57.000			2.250

Source: Appendix O **t**-Test Operational Viability Based on Product Warranty

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.750 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.250 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.452.

The User Difference on Perception Rating Based on Product Warranty and Mean Value is presented in Table 36.

Table 33. User Difference on Perception Rating Based on Product Warranty and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2

1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix O **t**-Test Operational Viability Based on Product Warranty

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.50 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.30.

The formula for statistical test value,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor,

Number of perception rating
n 12.000

Number of perception rating - 1 n-1
11.000

Mean of the perception rating
x bar 4.750

Standard Deviation
S 0.452

On User:

Number of data on perception rating
n 6.000

Number of data on perception rating - 1 n-1
5.000

Mean of data on perception rating x bar
4.500

Standard deviation of data on perception rating S
0.300

The calculated test value, t is 1.397

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 1.397 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.2.4. On Performance Warranty

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents their perception rating on operational viability based on Performance Warranty.

The Vendor Perception Rating Based on Performance Warranty is presented in Table 37.

Table 34. Vendor Perception Rating Based on Performance Warranty

1.4 Performance Warranty	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. The guarantee yield of electric	4	5	5	5	4.75

1.4 Performance Warranty	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
power should be sufficient.					
2. It renders good overall performance as a warranty commitment.	5	5	5	5	5.00
3. Extended performance in production output of electricity is expected and achieved as a quality of solar PV.	4	4	4	5	4.25
Weighted Mean	4.33	4.67	4.67	5.00	4.67
Standard Deviation	0.57735	0.57735	0.57735	0.00000	0.38188

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Performance Warranty is presented in Table 38.

Table 35. User Perception Rating Based on Performance Warranty

1.4 Performance Warranty	Koldstor	Arctic	Weighted Mean
1.The guarantee yield of electric power should be sufficient.	5	4	4.50
2. It renders good overall performance as a warranty commitment.	4	4	4.00
3. Extended performance in production output of electricity is expected and achieved as a quality of solar PV.	5	4	4.50
Weighted Mean	4.67	4.00	4.33
Standard Deviation	0.57735	0.00000	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 39 Vendor Difference on Perception Rating Based on Performance Warranty and Mean Value and Table 40 User Difference on

Perception Rating Based on Performance Warranty and Mean Value.

The Vendor Difference on Perception Rating Based on Performance Warranty and Mean Value is presented in Table 39.

Table 36. Vendor Difference on Perception Rating Based on Performance Warranty and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	4	4.583	(0.583)	0.340
2	5	4.583	0.417	0.174
3	4	4.583	(0.583)	0.340
4	5	4.583	0.417	0.174
5	5	4.583	0.417	0.174
6	4	4.583	(0.583)	0.340
7	5	4.583	0.417	0.174
8	5	4.583	0.417	0.174
9	4	4.583	(0.583)	0.340
10	5	4.583	0.417	0.174
11	5	4.583	0.417	0.174
12	4	4.583	(0.583)	0.340
Sum	55.000			2.917

Source: Appendix P **t**-Test Operational Viability Based on Performance Warranty

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.583 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.917 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.515.

The User Difference on Perception Rating Based on Performance Warranty and Mean Value is presented in Table 40.

Table 37. User Difference on Perception Rating Based on Performance Warranty and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix P **t**-Test Operational Viability Based on Performance Warranty

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.50 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.30.

The formula for statistical test value,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor,

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.583

Standard Deviation S1 0.515

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.500

Standard deviation of data on perception rating S2 0.300

The calculated test value, t is 0.433

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 0.433 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.2.5. On Degradation Rate

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents their perception rating on operational viability based on Degradation Rate.

The Vendor Perception Rating Based on Degradation Rate is presented in Table 41.

Table 38. Vendor Perception Rating Based on Degradation Rate

1.4 Performance Warranty	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. The solar PV will not perform less than what is expected.	5	5	5	5	5.00
2. Downcast state should not be experienced.	4	5	5	5	4.75
"3. It will perform to a greater respectable state of function.	4	4	4	5	4.25
Weighted Mean	4.33	4.67	4.67	5.00	4.67
Standard Deviation	0.57735	0.57735	0.57735	0.00000	0.38188

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Degradation Rate is presented in Table 42.

Table 39. User Perception Rating Based on Degradation Rate

1.5 Degradation Rate	Koldstor	Arctic	Weighted Mean
1. The solar PV will not perform less than what is expected.	5	4	4.50
2. Downcast state should not be experienced.	5	4	4.50
3. It will perform to a greater respectable state of function.	5	4	4.50
Weighted Mean	5.00	4.00	4.50
Standard Deviation	0.00000	0.00000	0.00000

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 43 Vendor Difference on Perception Rating Based on Degradation Rate and Mean Value and Table 44 User Difference on Perception Rating Based on Degradation Rate and Mean Value.

Table 40. Vendor Difference on Perception Rating Based on Degradation Rate and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.667	0.333	0.111
2	4	4.667	(0.667)	0.444
3	4	4.667	(0.667)	0.444
4	5	4.667	0.333	0.111
5	5	4.667	0.333	0.111
6	4	4.667	(0.667)	0.444
7	5	4.667	0.333	0.111
8	5	4.667	0.333	0.111
9	4	4.667	(0.667)	0.444
10	5	4.667	0.333	0.111
11	5	4.667	0.333	0.111
12	5	4.667	0.333	0.111
Sum	56.000			2.667

Source: Appendix Q **t**-Test Operational Viability Based on Degradation Rate

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.667 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.667 from the number of perception rating minus one (1) calculated at eleven (11). The standard

deviation is calculated at 0.492.

The User Difference on Perception Rating Based on Degradation Rate and Mean Value is presented Table 44.

Table 41. User Difference on Perception Rating Based on Degradation Rate and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix Q **t**-Test Operational Viability Based on Degradation Rate

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.50 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.30.

The formula for statistical test value is:

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor,

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.667

Standard Deviation S1 0.492

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.500

Standard deviation of data on perception rating S2 0.300

The calculated test value, t is 0.888

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the t Critical Value is derived at 2.120.

The statistical **t**-Test Value of 0.888 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.3. On the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to the financial savings using NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements:

The Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to NPV is presented in Table 45.

Table 42. Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to NPV

NPV	SPV User		SPV Vendor	
	WM	VI	WM	VI
1. There will be an improvement in cash inflows.	4.50	Agree	5.00	Strongly Agree
2. Better investment planning will be achieved.	4.00	Agree	4.25	Agree

3. Better profitability will be achieved using solar PV.	4.00	Agree	4.75	Strongly Agree
Average Weighted Mean	4.17	Agree	4.67	Strongly Agree
Standard Deviation	0.28868		0.38188	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.17 and 4.67 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the financial viability of solar PV system referenced to NPV.

SPV User respondents assert to "Agree" on the three (3) statements "There will be an improvement in cash inflows", "Better investment planning will be achieved", and "Better profitability will be achieved using solar PV". The highest weighted mean of 4.50 with VI of "Agree" is noted on one (1) statement." There will be an improvement in cash inflows."

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements "There will be an improvement in cash inflows" and "Better profitability will be achieved using solar PV." The highest WM of 5.0 with VI of "Strongly Agree" is noted on one (1) statement "There will be an improvement in cash inflows."

The Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Annual Electricity Consumption is presented in Table 46.

Table 43. Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Annual Electricity Consumption

Annual Electricity Consumption	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
1. Electricity consumption has been assessed to be lower in overall cost.	4.50	Agree	5.00	Strongly Agree

2. Millions are generated as savings using solar PV.	4.50	Agree	4.75	Strongly Agree
3. Savings have been utilized for other worthy investment in the organization.	4.00	Agree	4.25	Agree
Average Weighted Mean	4.37	Agree	4.67	Strongly Agree
Standard Deviation	0.28868		0.38188	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.37 and 4.67 with a verbal interpretation (VI) of "Agree" and "Strongly Agree" respectively on the perceptions of SPV User and Vendor respondents on the financial viability of solar PV system referenced to Annual Electricity Consumption.

SPV User respondents assert to "Agree" on the three (3) statements: "Electricity consumption has been assessed to be lower in overall cost," "Millions are generated as savings using solar PV"; and "Savings have been utilized for other worthy investment in the organization." The highest weighted mean of 4.50 with VI of "Agree" are noted on two (2) statements: "Electricity consumption has been assessed to be lower in overall cost" and "Millions are generated as savings using solar PV."

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements: "Electricity consumption has been assessed to be lower in overall cost", and "Millions are generated as savings using solar PV." The highest WM of 5.0 with VI of "Strongly Agree" is noted on one (1) statement "Electricity consumption has been assessed to be lower in overall cost."

The Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Electricity Inflation Rate is shown in Table 47.

Table 44. Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Electricity Inflation Rate

Electricity Inflation Rate	SPV User		SPV Vendor	
	WM	VI	WM	VI
1. Inflation rate on electricity cost does not have much effect because of savings in the solar PV system.	4.50	Agree	5.00	Strongly Agree
2. Increase in traditional cost of electricity is offset by the solar PV system.	5.00	Strongly Agree	4.75	Strongly Agree
3. Company has lesser worries over the fluctuation of electricity cost.	4.50	Agree	4.00	Agree
Average Weighted Mean	4.67	Strongly Agree	4.58	Strongly Agree
Standard Deviation	0.28868		0.54042	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.67 and 4.58 with a verbal interpretation (VI) of "Strongly Agree" on the perceptions of SPV User and Vendor respondents on the financial viability of solar PV system referenced to Electricity Inflation Rate.

SPV User respondents assert to "Strongly Agree" in one (1) statement "Increase in traditional cost of electricity is offset by the solar PV system" and affirm to "Agree" on two (2) statements "Inflation rate in electricity cost does not have much effect because of savings in the solar PV system" and "Company has lesser worries over the fluctuation of electricity cost." The highest weighted mean of 5.00 with VI of "Strongly Agree" is noted in one (1) statement- "Increase in traditional cost of electricity is offset by the solar PV system."

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements: "Inflation rate in electricity cost does not have much effect because of savings in the solar PV system" and "Increase in traditional cost of electricity is offset by the solar PV system." The highest WM of 5.0 with VI of "Strongly Agree" is

noted on one (1) statement “Inflation rate on electricity cost does not have much effect because of savings in the solar PV system."

The perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Investment Cost is presented in Table 48.

Table 45. Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Investment Cost

Investment Cost	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
1. Investment cost is well within the development phase of the company.	4.50	Agree	5.00	Strongly Agree
2. It has been used to provide greater modifications.	4.50	Agree	4.75	Strongly Agree
3. Solar PV has been used for development of new capabilities.	4.50	Agree	4.25	Agree
Average Weighted Mean	4.50	Agree	4.67	Strongly Agree
Standard Deviation	0.00000		0.38188	

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown in the table yield an average weighted mean of 4.50 and 4.67 with a verbal interpretation (VI) of “Agree” and "Strongly Agree", respectively, on the perceptions of SPV User and Vendor respondents on the financial viability of solar PV system referenced to Investment Cost.

SPV User respondents assert to "Agree" on three (3) statements “Investment cost is well within the development phase of the company", " It has been used to provide greater modifications", and " Solar PV has been used for development of new capabilities." The highest weighted mean is 4.50 with VI of "Agree” are noted on the three (3) statements.

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements- "Investment cost is well within the development phase of the company" and "It has been used to provide greater modifications." The highest WM of 5.0 with VI of "Strongly Agree" is noted in two (2) statements- “Investment cost is well within the development phase of the company" and "It has been used to provide greater modifications."

The perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Repairs and Replacements is presented in Table 49.

Table 46. Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System Referenced to Repairs and Replacements

Repair and Replacements	SPV User		SPV Vendor	
	WM	**VI**	**WM**	**VI**
1. While replacement parts are always available, they are seldom used.	4.50	Agree	5.00	Strongly Agree
2. Very minor repairs occurred; almost none throughout the years.	4.50	Agree	4.75	Strongly Agree
3. Almost no repair and the need for replacement parts has been normal.	4.00	Agree	4.00	Agree
Average Weighted Mean	4.33	Agree	4.58	Strongly Agree
Standard Deviation	0.28868	0.54042		

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results shown on the table yield an average weighted mean of 4.33 and 4.58 with a verbal interpretation (VI) of “Agree” and "Strongly Agree", respectively, on the perceptions of SPV User and Vendor respondents on the financial viability of solar PV system referenced to Repairs and Replacements.

SPV User respondents assert to "Agree" on three (3) statements: “While replacement parts are always available, they

are seldom used", "Very minor repairs occurred; almost none throughout the years" and "Almost no repair and the need for replacement parts has been normal." The highest weighted mean of 4.50 with VI of “Agree" is noted in two (2) statements- "While replacement parts are always available, they are seldom used" and "Very minor repairs occurred; almost none throughout the years."

SPV Vendor respondents affirm to "Strongly Agree" on the two (2) statements "While replacement parts are always available, they are seldom used" and “Very minor repairs occurred; almost none throughout the years." The highest WM of 5.0 with VI of "Strongly Agree" is noted on one (1) statement: “While replacement parts are always available, they are seldom used."

The Contingency Table on the Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System is shown in Table 50.

Table 47. Contingency Table on the Perception of the Two Groups of Respondents on the Financial Viability of Solar PV System

Parameters	**SPV User**		**SPV Vendor**	
	WM	**VI**	**WM**	**VI**
Net Present Value	4.17	Agree	4.67	Strongly Agree
Annual Electricity Consumption	4.33	Agree	4.67	Strongly Agree
Electricity Inflation Rate	4.67	Strongly Agree	4.58	Strongly Agree
Investment Cost	4.50	Agree	4.67	Strongly Agree
Repairs And Replacement	4.33	Agree	4.58	Strongly Agree

Source: Appendix D1 and D2 Vendor and User Survey Results Part 1 and 2

The results on the parameters used in the Perception of the Two Groups of Respondents on the Financial Viability of

Solar PV system shown on the table are summarized, therefore, as SPV User respondents assert "Strongly Agree" on one (1) parameter "Electricity Inflation Rate" and affirm to "Agree" on the four (4) parameters "Net Present Value", "Annual Electricity Consumption", "Investment Cost", and "Repairs and Replacements." The highest WM of 4.67 on parameter "Electricity Inflation Rate." Whereas, SPV Vendor respondents assert to "Strongly Agree" on five (5) parameters "Net Present Value", "Annual Electricity Consumption", "Electricity Inflation Rate", "Investment Cost", and "Repairs and Replacements." The highest WM of 4.67 on the three (3) parameters "Net Present Value", "Annual Electricity Consumption", and "Investment Cost."

1.19.4. On what significant difference exists in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to financial savings using NPV, annual electricity consumption, electricity inflation rate, investment costs, and repair and replacements:

To answer this research inquiry, a **t**-Test was used. A **t**-test is an inferential statistic used to determine if there is a significant difference between the means of two groups. A **t**-test looks at the **t**-statistic, the **t**-distribution values, and the degrees of freedom to determine the statistical significance (Kenton & Westfall, 2020)

1.19.4.1. On Financial Savings using NPV

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents their perception rating on financial viability based on the NPV.

The Vendor Perception Rating Based On NPV is presented in Table 51.

Table 48. Vendor Perception Rating Based on NPV

2.1 Calculated Financial Savings Based On NPV	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**	**Weighted Mean**
1. There will be an improvement in cash inflows.	5	5	5	5	5.00
2. Better investment planning will be achieved.	4	4	4	5	4.25
3. Better profitability will be achieved using solar PV.	4	5	5	5	4.75
Weighted Mean	4.33	4.67	4.67	5.00	4.67
Standard Deviation	0.57735	0.57735	0.57735	0.00000	0.38188

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on NPV is presented in Table 52.

Table 49. User Perception Rating Based on NPV

2.1 Calculated Financial Savings Based On NPV	**Koldstor**	**Arctic**	**Weighted Mean**
1. There will be an improvement in cash inflows.	5	4	4.50
2. Better investment planning will be achieved.	4	4	4.00
3. Better profitability will be achieved using solar PV.	4	4	4.00
Weighted Mean	4.33	4.00	4.17
Standard Deviation	0.57735	0.00000	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception

rating (x bar), and the standard deviation (S) using Table 53 Vendor Difference on Perception Rating Based on NPV and Mean Value and Table 54 User Difference on Perception Rating Based on NPV and Mean Value.

The Vendor Difference on Perception Rating Based on NPV and Mean Value is presented in Table 53.

Table 50. Vendor Difference on Perception Rating Based on NPV and Mean Value

Number of Observed Data	**Rating (x)**	**Mean (x bar)**	**x-x bar**	**(x- x bar)^2**
1	5	4.667	0.333	0.111
2	4	4.667	(0.667)	0.444
3	4	4.667	(0.667)	0.444
4	5	4.667	0.333	0.111
5	4	4.667	(0.667)	0.444
6	5	4.667	0.333	0.111
7	5	4.667	0.333	0.111
8	4	4.667	(0.667)	0.444
9	5	4.667	0.333	0.111
10	5	4.667	0.333	0.111
11	5	4.667	0.333	0.111
12	5	4.667	0.333	0.111
Sum	56.000			2.667

Source: Appendix R **t**-Test Financial Viability Based on NPV

On Vendor:

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11), the mean of perception rating (x bar) is 4.667 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.667 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.492.

The User Difference on Perception Rating Based on NPV and Mean Value is presented in Table 54.

Table 51. User Difference on Perception Rating Based on NPV and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix R **t**-Test Financial Viability Based on NPV

On User:

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5), the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.50 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.30.

The formula for statistical test value is,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.667

Standard Deviation S1 0.492

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.500

Standard deviation of data on perception rating S2 0.300

The calculated test value, t is 0.888

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t-**Test Value of 0.888 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t-**Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.4.2. On Annual Electricity Consumption

Calculating a **t-**Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents' perception rating on financial viability based on Annual Electricity Consumption.

The Vendor Perception Rating Based on Annual Electricity Consumption is presented in Table 55.

Table 52. Vendor Perception Rating Based on Annual Electricity Consumption

2.2 Annual Electricity Consumption	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. Electricity consumption has been assessed to be lower in overall cost.	5	5	5	5	5.00
2. Millions are generated as savings using solar PV.	4	5	5	5	4.75
3. Savings have been utilized for other worthy investment in the organization.	4	4	4	5	4.25
Weighted Mean	4.33	4.67	4.67	5.00	4.67
Standard Deviation	0.57735	0.57735	0.57735	0.00000	0.38188

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Annual Electricity Consumption is shown in Table 56.

Table 53. User Perception Rating Based on Annual Electricity Consumption

2.2 Annual Electricity Consumption	Koldstor	Arctic	Weighted Mean
1. Electricity consumption has been assessed to be lower in overall cost.	5	4	4.50
2. Millions are generated as savings using solar PV.	5	4	4.50
3. Savings have been utilized for other worthy investment in the organization.	4	4	4.00
Weighted Mean	4.67	4.00	4.33
Standard Deviation	0.57735	0.00000	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception

rating (x bar), and the standard deviation (S) using Table 57 Vendor Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value and Table 58 User Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value.

The Vendor Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value is shown in Table 57.

Table 54. Vendor Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value

Number of Observed Data	**Rating (x)**	**Mean (x bar)**	**x-x bar**	**(x- x bar)^2**
1	5	4.667	0.333	0.111
2	4	4.667	(0.667)	0.444
3	4	4.667	(0.667)	0.444
4	5	4.667	0.333	0.111
5	5	4.667	0.333	0.111
6	4	4.667	(0.667)	0.444
7	5	4.667	0.333	0.111
8	5	4.667	0.333	0.111
9	4	4.667	(0.667)	0.444
10	5	4.667	0.333	0.111
11	5	4.667	0.333	0.111
12	5	4.667	0.333	0.111
Sum	56.000			2.667

Source: Appendix S **t**-Test Financial Viability Based on Annual Electricity Consumption

On Vendor:

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11); the mean of perception rating (x bar) is 4.667 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.667 from the number of perception rating minus one (1)

calculated at eleven (11). The standard deviation is calculated at 0.492.

The User Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value is shown in Table 58.

Table 55. User Difference on Perception Rating Based on Annual Electricity Consumption and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.33	0.667	0.444
2	5	4.33	0.667	0.444
3	4	4.33	(0.333)	0.111
4	4	4.33	(0.333)	0.111
5	4	4.33	(0.333)	0.111
6	4	4.33	(0.333)	0.111
Sum	4.333			1.333

Source: Appendix S **t**-Test Financial Viability Based on Annual Electricity Consumption

On User:

The number of perception rating (n) is six (6); the number of perception rating minus one is five (5), the mean of perception rating (x bar) is 4.33 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.333 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.267.

The formula for statistical test value,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.667

Standard Deviation S1 0.492

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.333

Standard deviation of data on perception rating S2 0.267

T**he calculated test value, t is 1.862**

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t-**Test Value of 1.862 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t-**Test

Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.4.3. On Electricity Inflation Rate

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents' perception rating on financial viability based on Electricity Inflation Rate.

The Vendor Perception Rating Based on Electricity Inflation Rate is presented in Table 59.

Table 56. Vendor Perception Rating Based on Electricity Inflation Rate

2.3 Electricity Inflation Rate	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**	**Weighted Mean**
1. Inflation rate on electricity cost does not have much effect because of savings in the solar PV system.	5	5	5	5	5.00
2. Increase in traditional cost of electricity is offset by the solar PV system.	4	5	5	5	4.75
3. Company has lesser worries over the fluctuation of electricity cost.	4	4	4	4	4.00
Weighted Mean	4.33	4.67	4.67	4.67	4.58
Standard Deviation	0.57735	0.57735	0.57735	0.57735	0.52042

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Electricity Inflation Rate is presented in Table 60.

Table 57. User Perception Rating Based on Electricity Inflation Rate

2.3 Electricity Inflation Rate	**Koldstor**	**Arctic**	**Weighted Mean**
1. Inflation rate on electricity cost does not have much effect because of savings in the solar PV system.	5	4	4.50
2. Increase in traditional cost of electricity is offset by the solar PV system.	5	5	5.00
3. Company has lesser worries over the fluctuation of electricity cost.	5	4	4.50
Weighted Mean	5.00	4.33	4.67
Standard Deviation	0.00000	0.57735	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 61 Vendor Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value and Table 62 User Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value.

The Vendor Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value is presented in Table 61.

Table 58. Vendor Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value

Number of Observed Data	**Rating (x)**	**Mean (x bar)**	**x-x bar**	**(x- x bar)^2**
1	5	4.583	0.417	0.174
2	4	4.583	(0.583)	0.340
3	4	4.583	(0.583)	0.340
4	5	4.583	0.417	0.174
5	5	4.583	0.417	0.174
6	4	4.583	(0.583)	0.340

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
7	5	4.583	0.417	0.174
8	5	4.583	0.417	0.174
9	4	4.583	(0.583)	0.340
10	5	4.583	0.417	0.174
11	5	4.583	0.417	0.174
12	4	4.583	(0.583)	0.340
Sum	55.000			2.917

Source: Appendix T **t**-Test Financial Viability Based on Electricity Inflation Rate

On Vendor:

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11); the mean of perception rating (x bar) is 4.583 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.917 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.515.

The User Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value is presented in Table 62.

Table 59. User Difference on Perception Rating Based on Electricity Inflation Rate and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Source: Appendix T **t**-Test Financial Viability Based on Electricity Inflation Rate

On User:

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5); the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.500 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.300.

The formula for statistical test value,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating	n	12.000
Number of perception rating - 1	n-1	11.000
Mean of the perception rating	x bar	4.583
Standard Deviation	S1	0.515

On User:

Number of data on perception rating	n	6.000
Number of data on perception rating – 1	n-1	5.000
Mean of data on perception rating	x bar	4.500

Standard deviation of data on perception rating

S2 0.300

The calculated test value, t is 0.433

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 0.433 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.4.4. On Investment Cost

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents' perception rating on financial viability based on Investment Cost.

The Vendor Perception Rating Based on Investment Cost is shown in Table 63.

Table 60. Vendor Perception Rating Based on Investment Cost

2.4 Investment Cost	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**	**Weighted Mean**
1. Investment cost is well within the development phase of the company.	5	5	5	5	5.00
2. It has been used to provide greater modifications.	4	5	5	5	4.75
3. Solar PV has been used for development of	4	5	4	4	4.25

2.4 Investment Cost	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
new capabilities.					
Weighted Mean	4.33	5.00	4.67	4.67	4.67
Standard Deviation	0.57735	0.00000	0.57735	0.57735	0.38188

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Investment Cost is shown in Table 64.

Table 61. User Perception Rating Based on Investment Cost

2.4 Investment Cost	Koldstor	Arctic	Weighted Mean
1. Investment cost is well within the development phase of the company.	5	4	4.50
2. It has been used to provide greater modifications.	5	4	4.50
3. Solar PV has been used for development of new capabilities.	5	4	4.50
Weighted Mean	5.00	4.00	4.50
Standard Deviation	0.00000	0.00000	0.00000

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 65 Vendor Difference on Perception Rating Based on Investment Cost and Mean Value and Table 66 User Difference on Perception Rating Based on Investment Cost and Mean Value.

The Vendor Difference on Perception Rating Based on Investment Cost and Mean Value is shown in Table 65.

Table 62. Vendor Difference on Perception Rating Based on Investment Cost and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.667	0.333	0.111

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
2	4	4.667	(0.667)	0.444
3	4	4.667	(0.667)	0.444
4	5	4.667	0.333	0.111
5	5	4.667	0.333	0.111
6	5	4.667	0.333	0.111
7	5	4.667	0.333	0.111
8	5	4.667	0.333	0.111
9	4	4.667	(0.667)	0.444
10	5	4.667	0.333	0.111
11	5	4.667	0.333	0.111
12	4	4.667	(0.667)	0.444
Sum	56.000			2.667

Source: Appendix U **t**-Test Financial Viability Based on Investment Cost

On Vendor:

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11); the mean of perception rating (x bar) is 4.667 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.667 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.492.

The User Difference on Perception Rating Based on Investment Cost and Mean Value is shown in Table 66.

Table 63. User Difference on Perception Rating Based on Investment Cost and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix U **t**-Test Financial Viability Based on Investment Cost

On User:

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5); the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.500 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.300.

The formula for statistical test value:

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating	n	12.000
Number of perception rating - 1	n-1	11.000
Mean of the perception rating	x bar	4.667
Standard Deviation	S1	0.492

On User:

Number of data on perception rating n 6.000

Number of data on perception rating - 1 n-1 5.000

Mean of data on perception rating x bar 4.500

Standard deviation of data on perception rating S2 0.300

The calculated test value, t is 0.888

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 0.888 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the t Critical Value, then the result fails to reject the Null Hypothesis.

1.19.4.5. On Repair and Replacements

Calculating a **t**-Test requires three key data values: (1) the difference between the mean values from each data set (called the mean difference), (2) the standard deviation of each group, and (3) the number of data values of each group.

Initially, obtain the data from the Vendor and the User respondents' perception rating on financial viability based on Repair and Replacements.

The Vendor Perception Rating Based on Repair and Replacements is shown in Table 67.

Table 64. Vendor Perception Rating Based on Repair and Replacements

2.5 Repairs and Replacements	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
1. While replacement parts are always	5	5	5	5	5.00

2.5 Repairs and Replacements	Solar NRG	Upgrade Energy	Sasonbi Solar	Sunfish Solar	Weighted Mean
available, they are seldom used.					
2. Very minor repairs occurred; almost none throughout the years.	4	5	5	5	4.75
3. Almost no repair and the need for replacement parts has been normal.	4	4	4	4	4.00
Weighted Mean	4.33	4.67	4.67	4.67	4.58
Standard Deviation	0.57735	0.57735	0.57735	0.57735	0.52042

Source: Appendix D1 Survey Part 1 and 2 Results

The User Perception Rating Based on Repair and Replacements is shown in Table 68.

Table 65. User Perception Rating Based on Repair and Replacements

2.5 Repairs and Replacements	Koldstor	Arctic	Weighted Mean
1. While replacement parts are always available, they are seldom used.	5	4	4.50
2. Very minor repairs occurred; almost none throughout the years.	5	4	4.50
3. Almost no repair and the need for replacement parts has been normal.	5	3	4.00
Weighted Mean	5.00	3.67	4.33
Standard Deviation	0.00000	0.57735	0.28868

Source: Appendix D2 Survey Part 1 and 2 Results

Determine the number of perception rating (n); the number of perception rating minus one (1), the mean of perception rating (x bar), and the standard deviation (S) using Table 69 Vendor Difference on Perception Rating Based on Repair and Replacements and Mean Value and Table 70 User Difference on

Perception Rating Based on Repair and Replacements and Mean Value.

The Vendor Difference on Perception Rating Based on Repair and Replacements and Mean Value is shown in Table 69.

Table 66. Vendor Difference on Perception Rating Based on Repair and Replacements and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.583	0.417	0.174
2	5	4.583	0.417	0.174
3	4	4.583	(0.583)	0.340
4	5	4.583	0.417	0.174
5	5	4.583	0.417	0.174
6	4	4.583	(0.583)	0.340
7	5	4.583	0.417	0.174
8	5	4.583	0.417	0.174
9	4	4.583	(0.583)	0.340
10	5	4.583	0.417	0.174
11	4	4.583	(0.583)	0.340
12	4	4.583	(0.583)	0.340
Sum	55.000			2.917

Source: Appendix V **t**-Test Financial Viability Based on Repairs and Replacements

On Vendor:

The number of perception rating (n) is twelve (12); the number of perception rating minus one (1) is eleven (11); the mean of perception rating (x bar) is 4.583 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 2.917 from the number of perception rating minus one (1) calculated at eleven (11). The standard deviation is calculated at 0.515.

The User Difference on Perception Rating Based on Repair and Replacements and Mean Value is shown in Table 70.

Table 67. User Difference on Perception Rating Based on Repair and Replacements and Mean Value

Number of Observed Data	Rating (x)	Mean (x bar)	x-x bar	(x- x bar)^2
1	5	4.50	0.500	0.250
2	5	4.50	0.500	0.250
3	4	4.50	(0.500)	0.250
4	4	4.50	(0.500)	0.250
5	5	4.50	0.500	0.250
6	4	4.50	(0.500)	0.250
Sum	4.500			1.500

Source: Appendix V **t**-Test Financial Viability Based on Repairs and Replacements

On User:

The number of perception rating (n) is six (6); the number of perception rating minus one (1) is five (5); the mean of perception rating (x bar) is 4.50 calculated by obtaining the mean (average) of the perception rating (x). The calculated standard deviation (S) is obtained by dividing the sum of squared difference of perception rating and the rating mean calculated at 1.500 from the number of perception rating minus one (1) calculated at five (5). The standard deviation is calculated at 0.300.

The formula for statistical test value,

$$t = \frac{\left|\overline{x}^{1} - \overline{x}^{2}\right|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

On Vendor:

Number of perception rating n 12.000

Number of perception rating - 1 n-1 11.000

Mean of the perception rating x bar 4.583

Standard Deviation S1 0.515

On User:

Number of data on perception rating
n 6.000

Number of data on perception rating - 1
n-1 5.000

Mean of data on perception rating
x bar 4.500

Standard deviation of data on perception rating
S2 0.300

The calculated test value, t is 0.433

From Appendix L, **t** Distribution Critical Value Table at Degrees of Freedom (df) of sixteen (16), and level of significance alpha at 0.05, the **t** Critical Value is derived at 2.120.

The statistical **t**-Test Value of 0.433 is less than **t** Critical Value of 2.120, following the Decision Rule that if the **t**-Test Value is less than (<) the **t** Critical Value, then the result fails to reject the Null Hypothesis.

1.19.5. On the financial savings using NPV and the attractiveness of investment using PB period and ROI of the cold storage industry respondents on the implementation of the solar PV system:

To answer this inquiry, the researcher calculated the weighted mean of electricity inflation rate (IR) from the results of the survey of the SPV Vendor and User respondents in Appendix I, Survey Part 4 Inflation Rate. Also, this research uses the DR of 6.79 percent, the rate provided by the SPV Vendor and User respondents in response to the Survey Part 3 and 4 (Appendix F

User Survey Part 3 Results and Appendix H Vendor Survey Part 4 Results).

The weighted mean of survey part 4 inflation rate from the responses of Vendor respondents was calculated at 2.75 percent.

The Vendor Weighted Mean on Inflation Rate is presented in Table 71 and Part 4 Vendor Survey on Inflation Rate and Weighted Mean is shown in Figure 14.

Table 68. Vendor Weighted Mean on Inflation Rate

Vendor Respondents	**Inflation Rate**
Solar NRG	3.00%
Upgrade Energy	2.00%
Sasonbi Solar	2.50%
Sunfish Solar	3.50%
Weighted Mean	2.75%

Source: Appendix I Vendor Survey Part 4 Result, Inflation Rate

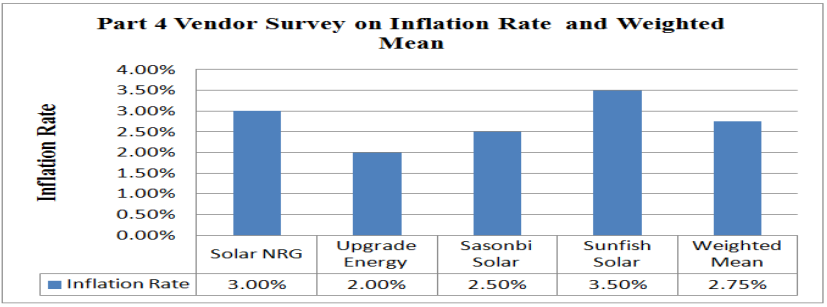

Figure 10. Part 4 Vendor Survey on Inflation Rate and Weighted Mean

And the weighted mean of survey part 4 inflation rate from the responses of SPV User respondents was calculated at 1.25 percent.

The User Weighted Mean on Inflation Rate is shown in Table 72 and Part 4 User Survey on Inflation Rate and Weighted Mean is presented in Figure 15.

Table 69. User Weighted Mean on Inflation Rate

User Respondents	Inflation Rate
Koldstor	1.00%
Arctic	1.50%
Weighted Mean	1.25%

Source: Appendix I User Survey Part 4 Result, Inflation Rate

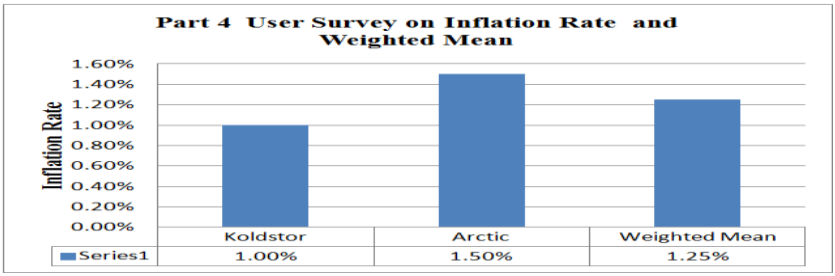

Figure 11. Part 4 User Survey on Inflation Rate and Weighted Mean

The NPV, PB Period, and ROI were calculated for the SPV User and Vendor respondents as it applies considering initial capital outlay in the acquisition of the solar PV system.

The NPV is calculated by determining the present value of the future cash inflows and the future cash outflow including the initial capital investment (Jagerson, 2021).

The Undiscounted PB (UPB) is computed by subtracting the undiscounted savings to the investment cost at the beginning of the year and the process is repeated by subtracting the undiscounted savings of the following year to the remaining balance of the investment cost until the balance reaches a break-even point or where the remaining balance becomes positive (savings). Count the number of periods where the remaining balance is negative (loss), then add the fraction of the last remaining negative balance as a proportion of the first positive undiscounted savings after the last negative remaining balance.

The Discounted PB (DPB) is computed by subtracting the discounted savings to the investment cost at the beginning of the year and the process is repeated by subtracting the discounted savings of the following year to the remaining balance of the investment cost until the balance reaches a break-even point or where the remaining balance becomes positive (savings). Count the number of periods where the remaining balance is negative (loss) then add the fraction of the last remaining negative balance as a proportion of the first positive discounted savings after the last negative remaining balance (Accounting Clarified, 2018).

. The ROI is calculated by taking the undiscounted net cash flow generated by the solar PV divided by the investment cost (Stobierski, 2020) .

1.19.5.1. On OP

NPV, PB Period, and ROI were calculated as User and Vendor respondents have initial capital outlay in the acquisition of the solar PV system.

On SPV User

Arctic Cold Refrigeration

The annualized NPV in peso is 3,432,096; Undiscounted PB Period in years is 5.87; Discounted PB Period in years is 7.63 and ROI in percent is 16.71.

Arctic Cold Refrigeration OP NPV, PB, ROI is shown in Table 73 and Figure 16.

Table 70. Arctic Cold Refrigeration OP NPV, PB, ROI

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	393,706,178	15,748,247	8,781,768	22,801,728
	Rate/kWh (+Inflation)		8.98	7.70	10.38

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
	Annual Cost	3,620,258,254	144,810,330	67,662,254	236,708,040
With Solar PV System	Annual Cost	3,275,534,522	131,021,381	56,968,020	218,827,705
Meralco Grid	Annual Cost	3,264,589,522	130,583,581	56,768,020	218,627,705
	Rate/kWh (+Inflation)	216	8.65	7.42	10.00
	kWh/Year	-		7,650,677	21,868,577
	% Share			87.12%	95.91%
Solar PV	Annual Cost		10,945,000	437,800	200,000	6,145,000
	kWh/Year (-Degradation)		25,711,978	1,028,479	933,151	1,131,092
	% Share			7.22%	4.09%	12.88%
	Rate/kWh (+Inflation)		0.00	0.00	0.00	0.00
	Annual Cost-Inverter Replacement		5,945,000	237,800	0.00	5,945,000
	Inverter		5,945,000	247,708	0.00	5,945,000
	Annual Cost-Maintenance		5,000,000	200,000	200,000	200,000
Total Savings/ (Loss)			344,723,732	13,788,949	7,324,842	17,880,335
Present Value of Cash Flow			152,386,411	6,095,456	3,460,278	10,040,530

Source: Appendix AC Arctic Cold Refrigeration OP NPV, PB, ROI

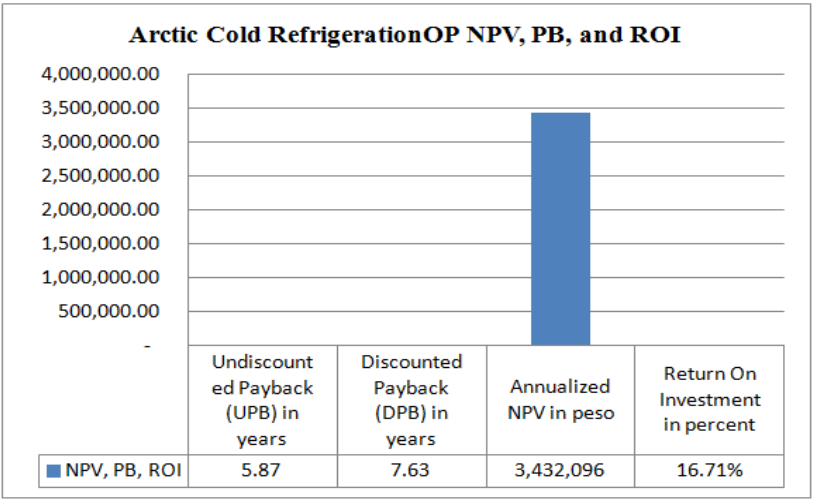

Figure 12. Arctic Cold Refrigeration OP NPV, PB, ROI

On SPV Vendor

Solar NRG

The annualized NPV in peso is 5,447,436, Undiscounted PB Period in years is 4.96, Discounted PB Period in years is 6.14 and ROI in percent is 24.75.

Solar NRG OP NPV, PB, ROI is shown in Table 74 and Figure 17.

Table 71. Solar NRG OP NPV, PB, ROI

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	393,706,178	15,748,247	8,781,768	22,801,728
	Rate/kWh (+Inflation)		10.87	7.70	14.78
	Annual Cost	4,505,054,775	180,202,191	67,662,254	336,896,250
With Solar PV	Annual Cost	4,026,507,639	161,060,306	55,055,857	308,760,204

Net Present Value (NPV)		Total	Average	Min	Max
System					
Meralco Grid	Annual Cost	4,008,062,639	160,322,506	54,555,857	308,260,204
	Rate/kWh (+Inflation)	263	11	7	14
	kWh/Year	360,767,697		7,332,777	21,606,310
	% Share			83.50%	94.76%
Solar PV	Annual Cost	18,445,000	737,800	500,000	6,445,000
	kWh/Year (-Degradation)	32,938,481	1,317,539	1,195,418	1,448,992
	% Share		9.21%	5.24%	16.50%
	Rate/kWh (+Inflation)	0.00	0.00	0.00	0.00
	Annual Cost-Inverter Replacement	5,945,000	237,800	0.00	5,945,000
	Inverter	5,945,000	247,708	0.00	5,945,000
	Annual Cost-Maintenance	12,500,000	500,000	500,000	500,000
Total Savings/ (Loss)		478,547,136	19,141,885	11,667,431	28,136,045
Present Value of Cash Flow		202,769,903	8,110,796	5,445,006	11,804,848

Source: Appendix AD Solar NRG OP NPV, PB, ROI

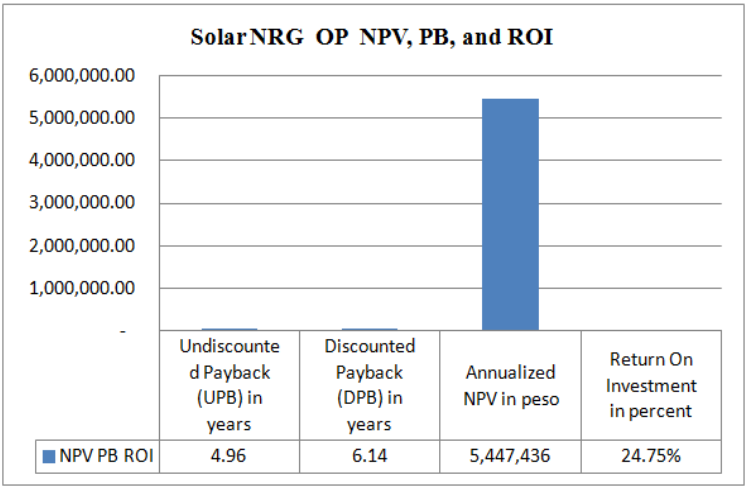

Figure 13. Solar NRG OP NPV, PB, ROI

Upgrade Energy

The annualized NPV in peso is 7,026,047, Undiscounted PB Period in years is 4.39, Discounted PB Period in years is 5.31 and ROI in percent is 32.00.

Upgrade Energy OP NPV, PB, ROI is shown in Table 75 and Figure 18.

Table 72. Upgrade Energy OP NPV, PB, ROI

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	393,706,178	15,748,247	8,781,768	22,801,728
	Rate/kWh (+Inflation)		10.87	7.70	14.78
	Annual Cost	4,505,054,775	180,202,191	67,662,254	336,896,250
With Solar PV	Annual Cost	3,924,511,074	156,980,443	54,002,572	300,528,383

Net Present Value (NPV)		Total	Average	Min	Max
System					
Meralco Grid	Annual Cost	3,906,251,074	156,250,043	53,502,572	300,028,383
	Rate/kWh (+Inflation)		10.22	7.24	13.88
	kWh/Year	361,413,859		7,389,858	21,610,253
	% Share			84.15%	94.77%
Solar PV	Annual Cost		18,260,000	730,400	500,000	6,260,000
	kWh/Year (-Degradation)		32,292,318	1,291,693	1,191,475	1,391,910
	% Share			9.00%	5.23%	15.85%
	Rate/kWh (+Inflation)		0.00	0.00	0.00	0.00
	Annual Cost-Inverter Replacement		5,760,000	230,400	0.00	5,760,000
	Inverter		5,760,000	240,000	0.00	5,760,000
	Annual Cost-Maintenance		12,500,000	500,000	500,000	500,000
Total Savings/ (Loss)			580,543,701	23,221,748	13,659,682	36,367,867
Present Value of Cash Flow			240,163,172	9,606,527	7,038,063	12,791,162

Source: Appendix AE Upgrade Energy OP NPV, PB, ROI

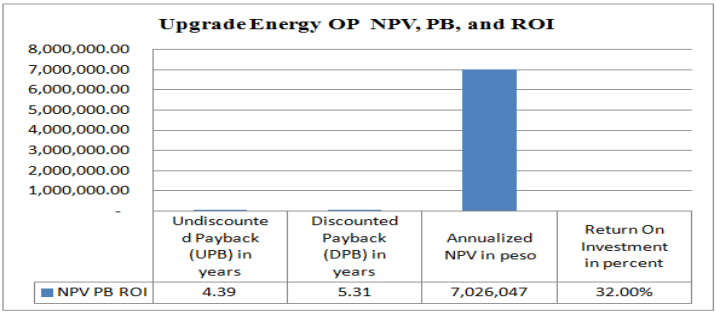

Figure 14. Upgrade Energy OP NRG NPV, PB, ROI

Sasonbi Solar

The annualized NPV in peso is 6,543,854, Undiscounted PB Period in years is 4.71, Discounted Payback (DPB) Period in years is 5.76 and ROI in percent is 30.20.

Sasonbi Solar OP NPV, PB, ROI is shown in Table 76 and Figure 19.

Table 73. Sasonbi Solar OP NPV, PB, ROI

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	393,706,178	15,748,247	8,781,768	22,801,728
	Rate/kWh (+Inflation)		10.87	7.70	14.78
	Annual Cost	4,505,054,775	180,202,191	67,662,254	336,896,250
With Solar PV System	Annual Cost	3,948,159,417	157,926,377	54,971,552	301,349,584
Meralco Grid	Annual Cost	3,929,844,249	157,193,770	54,471,552	300,849,584
	Rate/kWh (+Inflation)		10.16	7.20	13.81
	kWh/Year	365,853,482		7,565,493	21,789,787
	% Share			86.15%	95.56%
Solar PV	Annual Cost	18,315,168	732,607	500,000	6,315,168
	kWh/Year (-Degradation)	27,852,695	1,114,108	1,011,941	1,216,275
	% Share		7.78%	4.44%	13.85%
	Rate/kWh (+Inflation)	0.00	0.00	0.00	0.00
	Annual Cost-	5,815,168	232,607	0.00	5,815,168

Net Present Value (NPV)		Total	Average	Min	Max
	Inverter Replacement				
	Inverter	5,815,168	232,607	0.00	5,815,168
	Annual Cost-Maintenance	12,500,000	500,000	500,000	500,000
Total Savings/ (Loss)		556,895,359	22,275,814	12,690,702	35,546,666
Present Value of Cash Flow		228,726,229	9,149,049	6,803,472	11,883,792

Source: Appendix AF Sasonbi Solar OP NPV, PB, ROI

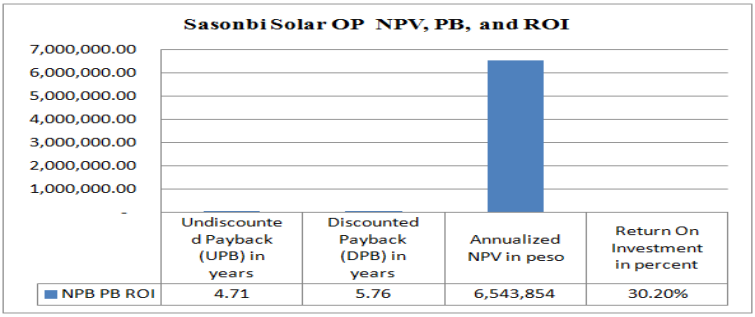

Figure 15. Sasonbi Solar NRG NPV, PB, ROI

Sunfish Solar

The annualized NPV in peso is 7,268,763, Undiscounted PB Period in years is 4.52, Discounted PB Period in years is 5.48 and ROI in percent is 33.15.

Sunfish Solar OP NPV, PB, ROI is shown in Table 77 and Figure 20.

Table 74. Sunfish Solar OP NPV, PB, ROI

Net Present Value (NPV)		Total	Average	Min	Max
Without	kWh/Year	393,706,178	15,748,247	8,781,768	22,801,728

Net Present Value (NPV)		Total	Average	Min	Max
Solar PV System	Rate/kWh (+Inflation)		10.87	7.70	14.78
	Annual Cost	4,505,054,775	180,202,191	67,662,254	336,896,250
With Solar PV System	Annual Cost	3,897,892,969	155,915,719	54,431,983	297,258,500
Meralco Grid	Annual Cost	3,879,556,169	155,182,247	53,931,983	296,758,500
	Rate/kWh (+Inflation)		10.01	7.09	13.60
	kWh/Year	366,833,914		7,606,768	21,826,947
	% Share			86.62%	95.72%
Solar PV	Annual Cost	18,336,800	733,472	500,000	6,336,800
	kWh/Year (-Degradation)	26,872,264	1,074,891	974,780	1,175,001
	% Share		7.51%	4.28%	13.38%
	Rate/kWh (+Inflation)			0.00	0.00
	Annual Cost-Inverter Replacement	5,836,800	233,472	0.00	5,836,800
	Inverter	5,836,800	243,200	0.00	5,836,800
	Annual Cost-Maintenance	12,500,000	500,000	500,000	500,000
Total Savings/ (Loss)		607,161,806	24,286,472	13,230,271	39,637,750
Present Value of Cash Flow		247,091,233	9,883,649	7,555,566	12,389,054

Source: Appendix AG Sunfish Solar OP NPV, PB, ROI

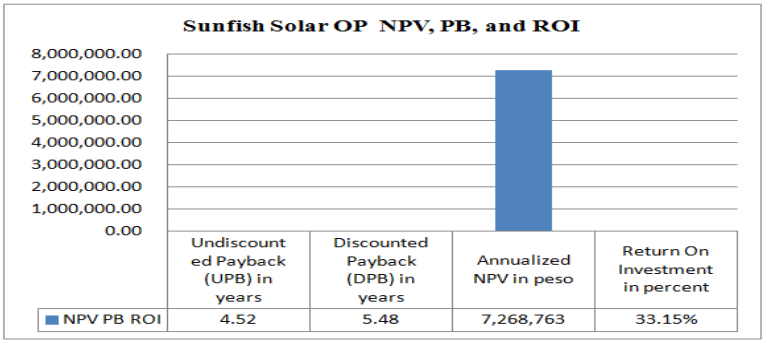

Figure 16. Sunfish Solar OP NPV, PB, ROI

On PPA

The NPV was calculated while the PB Period and ROI were not considered as User and Vendor respondents have no initial capital outlay in the acquisition of the solar PV system.

Koldstor Centre Philippines

The annualized NPV in peso is 4,536,368. Table 78 shows Koldstor Centre Philippines PPA NPV.

Table 75. Koldstor Centre Philippines PPA NPV

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	370,140,543	14,805,622	9,275,306	20,528,927
	Rate/kWh (+Inflation)		8.91	7.65	10.30
	Annual Cost	3,367,033,872	134,681,355	70,928,140	211,513,124
With Solar PV System	Annual Cost	3,084,124,718	123,364,989	65,878,791	193,697,029
Meralco Grid	Annual Cost	2,900,657,569	116,026,303	55,996,880	191,746,107
	Rate/kWh (+Inflation)		8.18	7.02	9.46

Net Present Value (NPV)		Total	Average	Min	Max
	kWh/Year	346,031,851		7,976,763	20,272,564
	% Share			86.00%	98.75%
Solar PV Solar PV	Annual Cost	183,467,149	7,338,686	1,950,922	10,588,000
	kWh/Year (-Degradation)	24,108,692	964,348	256,363	1,391,327
	% Share		7.51%	1.25%	14.00%
	Rate/kWh (+Inflation)			7.61	7.61
	Annual Cost-Inverter Replacement	0.00	0.00	0.00	0.00
	Inverter	0.00	0.00	0.00	0.00
	Annual Cost-Maintenance	0.00	0.00	0.00	0.00
	Annual Cost	183,467,149	7,338,686	1,950,922	10,588,000
Total Savings/ (Loss)		282,909,154	11,316,366	5,049,349	17,816,095
Present Value of Cash Flow		113,409,201	4,536,368	3,447,846	5,056,040

Source: Appendix AI Koldstor Centre Philippines NPV

Solar NRG

The annualized NPV in peso is 4,840,473. Table 79 shows Solar NRG PPA NPV

Table 76. Solar NRG PPA NPV

Net Present Value (NPV)		Total	Average	Min	Max
Without Solar PV System	kWh/Year	370,140,543	14,805,622	9,275,306	20,528,927
	Rate/kWh (+Inflation)		10.79	7.65	14.66

Net Present Value (NPV)		Total	Average	Min	Max
	Annual Cost	4,174,778,664	166,991,147	70,928,140	301,037,422
With Solar PV System	Annual Cost	3,871,065,696	154,842,628	66,359,252	282,624,686
Meralco Grid	Annual Cost	3,666,105,677	146,644,227	56,227,835	279,743,201
	Rate/kWh (+Inflation)		10.25	7.26	13.92
	kWh/Year	339,179,815		7,744,881	20,093,657
	% Share			83.50%	97.88%
Solar PV	Annual Cost		204,960,019	8,198,401	2,881,485	11,077,872
	kWh/Year (-Degradation)		30,960,728	1,238,429	435,270	1,673,395
	% Share			9.48%	2.12%	16.50%
	Rate/kWh (+Inflation)				6.62	6.62
	Annual Cost-Inverter Replacement		0.00	0.00	0.00	0.00
	Inverter		0.00	0.00	0.00	0.00
	Annual Cost-Maintenance		0.00	0.00	0.00	0.00
Total Savings/ (Loss)			303,712,968	12,148,519	4,568,888	18,412,736
Present Value of Cash Flow			121,011,834	4,840,473	3,563,310	5,596,360

Source: Appendix AJ Solar NRG NPV

Upgrade Energy

The annualized NPV in peso is 5,433,739. Table 80 shows Upgrade Energy PPA NPV.

Table 77. Upgrade Energy PPA NPV

Net Present Value (NPV)		Total	Average	Min	Max
Without Solar PV System	kWh/Year	370,140,543	14,805,622	9,275,306	20,528,927
	Rate/kWh (+Inflation)		10.79	7.65	14.66
	Annual Cost	4,174,778,664	166,991,147	70,928,140	301,037,422
With Solar PV System	Annual Cost	3,833,892,892	153,355,716	65,586,851	279,975,081
Meralco Grid	Annual Cost	3,642,360,447	145,694,418	56,119,175	277,282,371
	Rate/kWh (+Inflation)		10.15	7.19	13.79
	kWh/Year	340,399,480		7,805,170	20,110,804
	% Share			84.15%	97.96%
Solar PV	Annual Cost		191,532,445	7,661,298	2,692,710	10,352,126
	kWh/Year (-Degradation)		29,741,063	1,189,643	418,123	1,607,473
	% Share			9.10%	2.04%	15.85%
	Rate/kWh (+Inflation)				6.44	6.44
	Annual Cost-Inverter Replacement		0.00	0.00	0.00	0.00
	Inverter		0.00	0.00	0.00	0.00
	Annual Cost-Maintenance		0.00	0.00	0.00	0.00
Total Savings/ (Loss)			340,885,771	13,635,431	5,341,289	21,062,342
Present Value of Cash Flow			135,843,470	5,433,739	4,076,073	6,204,051

Source: Appendix AK Upgrade Energy NPV

Sasonbi Solar

The annualized NPV in peso is 5,190,965. Table 81shows Sasonbi Solar PPA NPV

Table 78. Sasonbi Solar PPA NPV

Net Present Value (NPV)		Total	Average	Min	Max
Without Solar PV System	kWh/Year	370,140,543	14,805,622	9,275,306	20,528,927
	Rate/kWh (+Inflation)		10.79	7.65	14.66
	Annual Cost	4,174,778,664	166,991,147	70,928,140	301,037,422
With Solar PV System	Annual Cost	3,839,144,831	153,565,793	66,422,741	278,337,155
Meralco Grid	Annual Cost	3,660,743,952	146,429,758	56,813,710	276,440,106
	Rate/kWh (+Inflation)		10.04	7.11	13.63
	kWh/Year	346,290,158		7,990,676	20,275,311
	% Share			86.15%	98.76%
Solar PV	Annual Cost		178,400,879	7,136,035	1,897,049	10,295,623
	kWh/Year (-Degradation)		23,850,385	954,015	253,616	1,376,420
	% Share			7.43%	1.24%	13.85%
	Rate/kWh (+Inflation)				7.48	7.48
	Annual Cost-Inverter Replacement		0.00	0.00	0.00	0.00
	Inverter		0.00	0.00	0.00	0.00
	Annual Cost-Maintenance		0.00	0.00	0.00	0.00
Total Savings/ (Loss)			335,633,833	13,425,353	4,505,399	22,700,268
Present Value of Cash Flow			129,774,116	5,190,965	4,218,933	5,809,031

Source: Appendix AL Sasonbi Solar NPV

Sunfish Solar

The annualized NPV in peso is 5,702,818. Table 82 shows Sunfish Solar PPA NPV

Table 79. Sunfish Solar PPA NPV

Net Present Value (NPV)		**Total**	**Average**	**Min**	**Max**
Without Solar PV System	kWh/Year	370,140,543	14,805,622	9,275,306	20,528,927
	Rate/kWh (+Inflation)		10.79	7.65	14.66
	Annual Cost	4,174,778,664	166,991,147	70,928,140	301,037,422
With Solar PV System	Annual Cost	3,805,563,611	152,222,544	65,869,034	275,725,503
Meralco Grid	Annual Cost	3,634,168,961	145,366,758	56,561,264	273,954,516
	Rate/kWh (+Inflation)		9.94	7.04	13.50
	kWh/Year	347,287,923		8,034,270	20,292,795
	% Share			86.62%	98.85%
Solar PV	Annual Cost		171,394,650	6,855,786	1,770,987	9,958,492
	kWh/Year (-Degradation)		22,852,620	914,105	236,132	1,327,799
	% Share			7.13%	1.15%	13.38%
	Rate/kWh (+Inflation)				7.50	7.50
	Annual Cost-Inverter Replacement		0.00	0.00	0.00	0.00
	Inverter		0.00	0.00	0.00	0.00
	Annual Cost-Maintenance		0.00	0.00	0.00	0.00
Total Savings/ (Loss)			369,215,052	14,768,602	5,059,107	25,311,920
Present Value of Cash Flow			142,570,440	5,702,818	4,737,435	6,319,845

Source: Appendix AM Sunfish Solar NPV

To summarize the results:

The financial savings (in peso) using NPV is good if it is greater than zero (Fernando & Mansa, 2020). The NPV takes into account the investor's investment cost, opportunity cost, and the risk tolerance through the DR. The DR use 6.79 percent in this research from Appendix F User Survey Part 3 Results and Appendix H Vendor Survey Part 4 Results in concurrence to the published bank lending rates (Trading Economics, 2020). The future cash flow generated by the solar PV system together with the time value of money are captured in the computation.

On SPV Vendor respondents, PPA NPV (in peso) generated a weighted mean of 5,291,999 and OP NPV at 6,571,525.

On SPV User respondents, PPA NPV (in peso) generated a weighted mean of 4,536,368 and OP NPV at 3,432,096.

Table 83 presents the Annualized NPV.

Table 80. Annualized NPV

NPV		**PPA**	**PERCENTAGE**	**OP**	**PERCENTAGE**
SPV Vendor	Solar NRG	4,840,473	23%	5,447,436	21%
	Upgrade Energy	5,433,739	26%	7,026,047	27%
	Sasonbi	5,190,965	25%	6,543,854	25%
	Sunfish	5,702,818	27%	7,268,763	28%
Total		21,167,994	100%	26,286,100	100%
WM		5,291,999		6,571,525	
SPV User	Arctic			3,432,096	
	Koldstor	4,536,368			
WM		4,536,368		3,432,096	

Source: Appendix AN OP Annualized NPV

PB Period and ROI

On SPV Vendor respondents, the generated weighted mean on ROI is calculated at 29.58 percent, indicative that there are more cash inflows than cash outflows. The Undiscounted PB is calculated at 4.73 years and the Discounted PB at 5.79 years.

On SPV User respondents, the generated weighted mean on ROI is calculated at 16.71 percent, indicative that there are more cash inflows than cash outflows. The Undiscounted PB is calculated at 5.87 years and the Discounted PB at 7.63 years.

The solar PV system is considered financially viable (and profitable) considering the attractiveness of investment in terms of the generated ROI and PB before 15-year product warranty and the 25-year production warranty and or economic life of the system. Table 84 shows OP PB and ROI.

Table 81. OP PB and ROI

OP PB AND ROI		**SPV User**	**SPV Vendor**			
		Arctic	**Solar NRG**	**Upgrade Energy**	**Sasonbi Solar**	**Sunfish Solar**
Undiscounted Payback (PB), in years	5.87	4.96	4.71	4.71	4.52	4.73
Discounted Payback (PB), in years	7.63	6.14	5.76	5.76	5.48	5.79
Return On Investment (ROI)	16.71 %	24.75 %	30.20 %	30.20%	33.15%	29.58 %

Source: Appendix AH OP PB, ROI

1.19.6. On what significant relationship exists between the financial savings using NPV of the cold storage industry respondents and the perceived operational viability of the solar PV:

To answer this research inquiry, Pearson **r** and test statistics **t** were calculated.

Pearson correlation coefficient is a measure of the strength of a linear association between two variables and is denoted by **r**. The Pearson correlation coefficient, **r**, can take a range of values from positive (+1) to negative (-1). A value of zero (0) indicates that there is no association between the two variables. A value greater than zero (0) indicates a positive association; that is, as the value of one variable increases, so does the value of the other variable. A value less than zero (0) indicates a negative association; that is, as the value of one variable increases, the value of the other variable decreases (LaerdStatistics, 2020).

Regarding test statistics, **t** is a statistical test that is used to compare the means of two groups. It is used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another (Bevans, 2020).

In this research, the Pearson **r** and test statistics **t** limits the calculation on the Vendor respondents' perceptions on operational viability and the annualized NPV on PPA and OP.

1.19.6.1. On PPA NPV and Operational Viability

Calculating Pearson **r**, the formula is:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where:

r is the correlation coefficient or Pearson **r**

xi are values of the x-variable in a sample or the perceived operational viability- mean scores

x bar is the mean of the values of the x-variable or the mean of the perceived operational viability- mean scores

yi are values of the y-variable in a sample or the calculated financial viability based on the NPV.

y bar is the mean of the values of the y-variable or the mean of the calculated financial viability based on the NPV.

The Correlation Calculation on PPA NPV and Operational Viability Part 1 and 2 are presented in Tables 85 and Table 86, respectively:

Table 82. Correlation Calculation Part 1 on PPA NPV and Operational Viability

Respondents	**(x) Perceived operational viability**	**(y) Calculated Annualized NPV**	**(x)(y)**	**(x-x mean)**	**(y-y mean)**
Solar NRG	4.53	4,840,473	21,943,479.218	(0.183)	(451,525.253)
Upgrade Energy	4.73	5,433,739	25,719,697.064	0.017	141,740.206
Sasonbi Solar	4.67	5,190,965	24,224,501.731	(0.050)	(101,033.953)
Sunfish Solar	4.93	5,702,818	28,133,900.208	0.217	410,819.000
Sum	18.867	21,167,994	100,021,578.221	0.000	(0.000)
Mean	4.717	5,291,999	25,005,394.555	0.000	(0.000)

Table 83. Correlation Calculation Part 2 on PPA NPV and Operational Viability

Respondents	**(x-x mean)(y-y mean)**	**(x-x mean)^2**	**(y-y mean)^2**
Solar NRG	82,779.630	0.034	203,875,054,131.753
Upgrade Energy	2,362.337	0.000	20,090,286,094.823
Sasonbi Solar	5,051.698	0.002	10,207,859,702.359
Sunfish Solar	89,010.783	0.047	168,772,250,686.218
Sum	179,204.447	0.083	402,945,450,615.153
Mean	44,801.112	0.021	100,736,362,653.788

Note. Using Average Grand Mean Score

Source: Appendix X Correlation PPA NPV and Operational Viability

From the equation of Pearson **r**,

$$\sum (x_i - \bar{x})^2 \qquad \sum (y_i - \bar{y})^2$$

= 179,204

And

$$\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}$$

= 183,245

Pearson r

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

= (179.204) divided by (183,245)

= 0.978

Calculating the test statistics, t

The formula.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}.$$

n is four (4), the number of paired data or number of paired perceived operational viability mean scores and the financial savings using NPV.

r is the correlation coefficient or Pearson **r** calculated at 0.978

The equation,

$$\frac{r * \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{1.383}{0.209}$$

And test statistics t = 6.622

Using the calculated **t** Value at 6.222 and degrees of freedom two (2), look up from the **t** Distribution Critical Value Table in Appendix W, the **p** Value is derived between 0.01 to 0.02 (0.01< **p** Value <0.02) or particularly computed at 0.0110. Using the Decision Rule that if the

p Value is equal to or less than (= <) **p** Alpha at 0.05, then the result reject the Null Hypothesis.

1.19.6.2. On OP NPV and Operational Viability

The formula in calculating Pearson **r** is:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r is the correlation coefficient or Pearson **r**

xi are values of the x-variable in a sample or the perceived operational viability- mean scores

x bar is the mean of the values of the x-variable or the mean of the perceived operational viability- mean scores

yi are values of the y-variable in a sample or the calculated financial viability based on the NPV.

y bar is the mean of the values of the y-variable or the mean of the calculated financial viability based on the NPV.

The Correlation Calculation on OP NPV and Operational Viability Part 1 and 2 are presented in Tables 87 and Table 88, respectively:

Table 84. Correlation Calculation Part 1 on OP NPV and Operational Viability

Respondents	**(x) Perceived operational viability**	**(y) Calculated Annualized NPV**	**(x)(y)**	**(x-x mean)**	**(y-y mean)**
Solar NRG	4.53	5,447,436	24,695,043.668	(0.183)	(1,124,088.853)
Upgrade Energy	4.73	7,026,047	33,256,621.983	0.017	454,521.942

Respondents	(x) Perceived operational viability	(y) Calculated Annualized NPV	(x)(y)	(x-x mean)	(y-y mean)
Sasonbi Solar	4.67	6,543,854	30,537,984.917	(0.050)	(27,671.045)
Sunfish Solar	4.93	7,268,763	35,859,230.368	0.217	697,237.956
Sum	18.867	26,286,100	124,348,880.936	0.000	0.000
Mean	4.717	6,571,525	31,087,220.234	0.000	0.000

Table 85. Correlation Calculation Part 2 on OP NPV and Operational Viability

Respondents	(x-x mean)(y-y mean)	(x-x mean)^2	(y-y mean)^2
Solar NRG	206,082.956	0.034	1,263,575,749,055.810
Upgrade Energy	7,575.366	0.000	206,590,195,504.864
Sasonbi Solar	1,383.552	0.002	765,686,746.445
Sunfish Solar	151,068.224	0.047	486,140,767,819.311
Sum	366,110.098	0.083	1,957,072,399,126.430
Mean	91,527.525	0.021	489,268,099,781.607

Note. Using Average Grand Mean Score

Source: Appendix Y Correlation OP NPV and Operational Viability

From the equation of Pearson **r**,

$$\sum (x_i - \bar{x})^2 \qquad \sum (y_i - \bar{y})^2$$

= 366,110

And

$$\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}$$

= 403,843

Pearson r

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

= (968.240) divided by (1,080,777)

= 0.9066

Calculating the test statistics t

The formula.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}.$$

n is four (4), the number of paired data or number of paired perceived operational viability mean scores and calculated financial viability based on the NPV.

r is the correlation coefficient or Pearson **r** calculated at 0.9066.

The equation,

$$\frac{r * \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{1.282}{0.422}$$

And test statistics, t = 3.038

Using the calculated **t** Value at 6.222 and degrees of freedom two (2), look up from the **t** Distribution Critical Value Table in Appendix W, the **p** Value is derived between 0.025 to 0.05 (0.025< **p** Value <0.05) or particularly computed at 0.0467. Using the Decision Rule that if the **p** Value is equal to or less than (= <) **p** Alpha at 0.05, then the result reject the Null Hypothesis.

1.19.7. On what significant relationship exists between the financial analysis of the cold storage industry respondents and the perceived financial viability of the solar PV:

To answer this research inquiry, Pearson **r** and test statistics **t** were calculated.

Pearson correlation coefficient is a measure of the strength of a linear association between two variables and is denoted by **r**. The Pearson correlation coefficient, **r**, can take a range of values from positive (+1) to negative (-1). A value of zero (0) indicates that there is no association between the two variables. A value greater than zero (0) indicates a positive association; that is, as the value of one variable increases, so does the value of the other variable. A value less than zero (0) indicates a negative association; that is, as the value of one variable increases, the value of the other variable decreases (LaerdStatistics, 2020).

Test statistics, **t** is a statistical test that is used to compare the means of two groups. It is used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another (Bevans, 2020).

In this research, the Pearson **r** and test statistics **t** limits the calculation on the Vendor respondents' perceptions on financial viability and the annualized NPV on PPA and OP.

1.19.7.1. On PPA NPV and Financial Viability

Calculating Pearson **r**, the formula is,

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r is the correlation coefficient or Pearson **r**

xi are values of the x-variable in a sample or the perceived financial viability- mean scores

x bar is the mean of the values of the x-variable or the mean of the perceived financial viability- mean scores

yi are values of the y-variable in a sample or the calculated financial viability based on the NPV.

y bar is the mean of the values of the y-variable or the mean of the calculated financial viability based on the NPV. The Correlation Calculation Part 1 and 2 on PPA NPV and Financial Viability are shown in Tables 89 and Table 90, respectively:

Table 86. Correlation Calculation Part 1 on PPA NPV and Financial Viability

Respondents	**(x) Perceived financial viability**	**(y) Calculated Annualized NPV**	**(x)(y)**	**(x-x mean)**	**(y-y mean)**
Solar NRG	4.33	4,840,473	20,975,384.546	(0.300)	(451,525.253)
Upgrade Energy	4.73	5,433,739	25,719,697.064	0.100	141,740.206
Sasonbi Solar	4.67	5,190,965	24,224,501.731	0.033	(101,033.953)
Sunfish Solar	4.80	5,702,818	27,373,524.527	0.167	410,819.000

Respondents	(x) Perceived financial viability	(y) Calculated Annualized NPV	(x)(y)	(x-x mean)	(y-y mean)
Sum	18.533	21,167,994	98,293,107.868	(0.000)	(0.000)
Mean	4.633	5,291,999	24,573,276.967	(0.000)	(0.000)

Table 87. Correlation Calculation Part 2 on PPA NPV and Financial Viability

Respondents	(x-x mean)(y-y mean)	(x-x mean)^2	(y-y mean)^2
Solar NRG	135,457.576	0.090	203,875,054,131.753
Upgrade Energy	14,174.021	0.010	20,090,286,094.823
Sasonbi Solar	(3,367.798)	0.001	10,207,859,702.359
Sunfish Solar	68,469.833	0.028	168,772,250,686.218
Sum	214,733.631	0.129	402,945,450,615.153
Mean	53,683.408	0.032	100,736,362,653.788

Note. Using Average Grand Mean Score

Source: Appendix Z Correlation PPA NPV and Financial Viability

From the equation of Pearson **r**,

$$\sum (x_i - \bar{x})^2 \quad \sum (y_i - \bar{y})^2$$

= 214,734

And

$$\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}$$

= 227,893

Pearson r

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

= (214,734) divided by (227,893)

= **0.9423**

Calculating the test statistics t

The formula.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}.$$

n is four (4), the number of paired data or number of paired perceived financial viability mean scores and the financial viability based on financial savings using NPV,

r is the correlation coefficient or Pearson **r** calculated at 0.9423

The equation,

$$\frac{r * \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{1.333}{0.335}$$

A**nd test statistics, t = 3.979**

Using the calculated **t** Value at 6.222 and degrees of freedom two (2), look up from the **t** Distribution Critical Value Table in Appendix W, the **p** Value is derived between 0.025 to 0.05 (0.025< **p** Value <0.05) or particularly computed at 0.0289. Using the Decision Rule that if the **p** Value is equal to or less than (= <) **p** Alpha at 0.05, then the result reject the Null Hypothesis.

1.19.7.2. On OP NPV and Financial Viability,

The formula in calculating Pearson **r** is:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r is the correlation coefficient or Pearson **r**

xi are values of the x-variable in a sample or the perceived financial viability- mean scores

x bar is the mean of the values of the x-variable or the mean of the perceived financial viability- mean scores

yi are values of the y-variable in a sample or the financial viability based on financial savings using NPV.

y bar is the mean of the values of the y-variable or the mean of the calculated financial viability based on the NPV. The Correlation Calculation Part 1 and 2 on OP NPV and Financial Viability are shown on Tables 91 and Table 92, respectively:

Table 88. Correlation Calculation Part 1 on OP NPV and Financial Viability

Respondents	(x) Perceived financial viability	(y) Calculated Annualized NPV	(x)(y)	(x-x mean)	(y-y mean)
Solar NRG	4.33	5,447,436	23,605,556.447	(0.300)	(1,124,088.853)
Upgrade Energy	4.73	7,026,047	33,256,621.983	0.100	454,521.942
Sasonbi Solar	4.67	6,543,854	30,537,984.917	0.033	(27,671.045)
Sunfish Solar	4.80	7,268,763	34,890,061.980	0.167	697,237.956
Sum	18.533	26,286,100	122,290,225.327	(0.000)	0.000
Mean	4.633	6,571,525	30,572,556.332	(0.000)	0.000

Table 89. Correlation Calculation Part 2 on OP NPV and Financial Viability

Respondents	(x-x mean)(y-y mean)	(x-x mean)^2	(y-y mean)^2
Solar NRG	337,226.656	0.090	1,263,575,749,055.810
Upgrade Energy	45,452.194	0.010	206,590,195,504.864
Sasonbi Solar	(922.368)	0.001	765,686,746.445
Sunfish Solar	116,206.326	0.028	486,140,767,819.311
Sum	497,962.808	0.129	1,957,072,399,126.430
Mean	124,490.702	0.032	489,268,099,781.607

Note. Using Average Grand Mean Score

Source: Appendix AA Correlation OP NPV and Financial Viability

From the equation of Pearson **r**,

$$\sum (x_i - \bar{x})^2 \quad \sum (y_i - \bar{y})^2$$

= 497,963

And

$$\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}$$

= 502,240

Pearson r

$$\frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

= (497,963) divided by (502,240)

= 0.991

The formula in calculating the Test statistics **t** is:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}.$$

Where:

n is four (4), the number of paired data or number of paired perceived financial viability mean scores and the financial viability based on financial savings using NPV

r is the correlation coefficient or Pearson **r** calculated at 0.991

The equation,

$$\frac{r * \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{1.402}{0.130}$$

A**nd test statistics, t = 10.767**

Using the calculated **t** Value at 6.222 and degrees of freedom two (2), look up from the **t** Distribution Critical Value Table in Appendix W, the **p** Value is derived between 0.0025 to 0.005 (0.025< **p** Value <0.005) or particularly computed at 0.0043. Using the Decision Rule that if the **p** Value is equal to or less than (= <) **p** Alpha at 0.05, then the result is reject the Null Hypothesis.

The Innovative Marketing Model:

In this chapter, findings are reported so as to draw the conclusion and recommendation of the study. The results are interpreted at length and provide the original work or contribution by the researcher. The communicative accuracy is required in this chapter and the text must be developed to ensure an effective ordering of the pieces of evidence.

1.20. Conclusions

1.20.1. On the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate:

The SPV User respondents assert to "Agree" one hundred (100) percent on the operational viability of solar PV system. The highest weighted mean (WM) is 4.50 on Efficiency, Product Warranty, and Degradation Rate, followed by WM 4.33 on Production Output and performance Warranty, while the SPV Vendor respondents assert to "Strongly Agree" one hundred (100) percent on the operational viability of solar PV system. The

highest weighted mean (WM) is 4.83 on Efficiency, followed by WM 4.75 on Product Warranty, then 4.67 on Production Output, Performance Warranty, and Degradation Rate.

Based on the results and findings on Perception of the Two Groups of Respondents on the Operational Viability of Solar PV, it can be deduced that the SPV User respondents assertion to "Agree" by one hundred (100) percent indicate their confidence on the use of solar PV system while the SPV Vendor respondents affirmation to "Strongly Agree" by one hundred (100) percent shows commitment to market the solar PV system to the potential SPV User in Greater Manila Area (and the rest of the country).

1.20.2. On what significant difference exists in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate:

The **t-**Test Values generated is less than **t** Critical Values which means there is no statistical significant difference existing between the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on all parameters.

Based on the calculated **t-**Test Values in comparison with the **t** Critical Value, it can be deduced that the perceptions of the SPV User and Vendor respondents had commonality in their agreement on responses (that no statistical significant difference in their perceptions) leading to confidence that the solar PV system is an operationally viable alternative sustainable energy solution.

1.20.3. On the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system referenced to financial savings using NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements:

The SPV User respondents assert to "Agree" eighty (80) percent and "Strongly Agree" twenty (20) percent on the financial

viability of solar PV system. The highest weighted mean is 4.67 on Electricity Inflation Rate, followed by WM 4.50 on Investment Cost. Then by WM 4.33 on Repairs and Replacements. The SPV Vendor respondents assert to "Strongly Agree" one hundred (100) percent on the financial viability of solar PV system. The highest weighted mean is 4.67 on NPV, followed by WM 4.58 on Electricity Inflation Rate.

Based on the results and findings on Perception of the Two Groups of Respondents on the Financial Viability of solar PV, it can be deduced that the SPV User respondents assertion to "Agree" by eighty percent and "Strongly Agree" twenty (20) percent indicate their confidence to invest more on solar PV system while the SPV Vendor respondents affirmation to "Strongly Agree" by one hundred (100) percent shows commitment to acquire more capital assets to enhance its market expansion in Greater Manila Area (and the rest of the country).

1.20.4. On what significant difference exists in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on financial savings using NPV, annual electricity consumption, electricity inflation rate, investment cost, and repair and replacements:

The **t**-Test Values generated is less than **t** Critical Value which means there is no statistical significant difference existing between the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on all parameters.

Based on the calculated **t**-Test Values in comparison with the **t** Critical Value, it can be deduced that the perceptions of the SPV User and Vendor respondents had commonality in their agreement on responses (that no statistical significant difference in their perceptions) leading to confidence that the solar PV system is a financially viable alternative sustainable energy solution.

1.20.5. On the NPV and the attractiveness of investment using PB Period and ROI of the cold storage industry

respondents on the implementation of the solar PV system:

On NPV

The SPV Vendor respondents PPA NPV weighted mean is calculated at 5,291,999 pesos. The highest PPA NPV is 5,702,818 from Sunfish Solar, followed by 5,433,739 from Upgrade Energy, and then 5,190.965 from Sasonbi Solar, while on OP NPV weighted mean is calculated at 6,571,525 pesos. The highest OP NPV is 7,268,763 from Sunfish Solar, followed by 7,026,047 from Upgrade Energy, and then 6,543,854 from Sasonbi Solar, while the SPV User respondents PPA NPV weighted mean is calculated at 4,536,368 pesos, while on OP NPV weighted mean is calculated at 6,571,525. The positive NPV generated by the solar PV system indicates that there are more inflows than outflows.

On PB and ROI

SPV Vendor respondents weighted mean on UDP at 4.73 years, DPB at 5.79 years, and ROI at 29.58 percent per year. The lowest UPB at 4.52 years, the highest at 4.96 years, while the lowest ROI at 24.75 percent per year and the highest ROI at 33.15 percent per year.

SPV User respondents weighted mean on UDP at 5.87years, DPB at 7.63 years, and ROI at 16.71 percent per year. The lowest UPB at 4.52 year, the highest at 4.96 years, while the lowest ROI at 24.75 percent per year and the highest ROI at 33.15 percent per year.

Based on the results and findings of the calculated NPV, it can be inferred that the positive NPV motivate the SPV User to invest more in the solar PV system while providing the SPV Vendor the stimulus to pursue product and market development of the PV system particularly in Greater Manila Area while allowing to expand in the adjacent areas and the rest of the country.

The solar PV system PB before the 15-year product warranty and the 25-year production warranty and or economic life of the system while the generated ROI is higher than 6.79 percent DR provided by the SPV Vendor and User respondents in the survey. It can be deduced then that the solar PV system of the cold storage industry in Greater Manila Area is financially viable.

1.20.6. On what significant relationship exists between the financial savings using NPV of the cold storage industry respondents and the perceived operational viability of the solar PV:

On PPA NPV and Perceived Operational Viability, the calculated **p** Value at 0.0110 is less than **p** Alpha at 0.05, while on OP NPV and Perceived Operational Viability, the calculated **p** Value at 0.0467 is less than **p** Alpha at 0.05.

It can be inferred then that "There is a statistically significant relationship existing between the calculated PPA NPV of the cold storage industry respondents and their perceived operational viability on the solar PV because the calculated **p** Value at 0.0110 is less than the level of significance Alpha at 0.05" and "There is a statistically significant relationship existing between the calculated OP NPV of the cold storage industry respondents and their perceived operational viability on the solar PV because the calculated **p** Value at 0.0467 is less than the level of significance Alpha at 0.05."

1.20.7. On what significant relationship exists between the financial savings using NPV of the cold storage industry respondents and the perceived financial viability of the solar PV:

On PPA NPV and Perceived Financial Viability, the calculated **p** Value at 0.0289 is less than **p** Alpha at 0.05, while on OP NPV and Perceived Financial Viability, the calculated **p** Value at 0.0043 is less than **p** Alpha at 0.05.

It can be inferred then that " There is a statistically significant relationship existing between the calculated PPA NPV

of the cold storage industry respondents and their perceived financial viability on the solar PV because the calculated **p** Value at 0.0289 is less than the level of significance Alpha at 0.05", and "There is a statistically significant relationship existing between the calculated OP NPV of the cold storage industry respondents and their perceived financial viability on the solar PV because the calculated **p** Value at 0.0043 is less than the level of significance Alpha at 0.05."

1.20.8. On the findings based on the results of the study, what alternative sustainable energy solution may be advanced:

On the basis of the results and findings of the study, the researcher strongly endorses the adoption and commercialization of the solar PV system of the cold storage industry in Greater Manila Area as an alternative sustainable energy solution.

That, the solar PV system of cold storage industry in Greater Manila Area is financially and operationally viable in view of the positive financial savings using NPV generated on PPA and OP options used by the SPV Vendor and User respondents. In addition, the attractiveness of an investment on OP option requiring an investment generates a positive ROI and PB before the 15-year product warranty and the 25-year performance warranty of the system. The useful life of the PV system considering the life expectancy of solar panel is between 25 to 30 years (Gambone S. , 2019) with an estimated remaining efficiency rate of more than 80 percent (Sunrun, 2018).

That, the perception of the Vendor and User respondents on the operational viability of solar PV system referenced to production output, efficiency, product warranty, performance warranty, and degradation rate has an average grand mean perception score of 4.72 with an interpretation “Strongly Agree" on Vendor and .4.43 with an interpretation "Agree" on User.

That, the perception of the Vendor and User respondents on the financial viability of solar PV system referenced to the financial savings using net present value (NPV), annual electricity consumption, electricity inflation rate, investment cost, and repair

and replacements has an average grand mean perception score of 4.63 with an interpretation of "Strongly Agree" on Vendor and 4.40 with an interpretation of "Agree" on User.

That, Part 1 on the operational viability of solar PV System concluded the following;

1. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on production output.
2. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on efficiency.
3. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on product warranty.
4. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on performance warranty.
5. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the operational viability of solar PV system based on degradation rate.

That, Part 2 on the Financial Viability of solar PV System concluded the following,

1. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the financial savings using NPV.
2. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the annual electricity consumption.
3. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the electricity inflation rate.

4. There is no statistically significant difference existing in the perception of the solar PV Vendor and User respondents on the financial viability of solar PV system based on the investment cost.
5. There is no statistically significant difference existing in the perception of the Solar PV Vendor and User respondents on the financial viability of solar photovoltaic (PV) system based on repair and replacements.

1.21. Recommendations

Based on the findings and conclusion, the researcher highly recommends the following,

1. Solar PV Vendors and Users should advance the application of solar PV system to all cold storages serving fast food companies in Greater Manila Area.
2. Researchers and other collaborators should conduct further related research on the application of solar PV system to all cold storages serving fast food companies outside Greater Manila, particularly nearby places in Far North and South Luzon, Visayas, and Mindanao.
3. Researchers and other collaborators should conduct further related research on the financial and operational viability of the solar PV system to include commercial businesses outside cold storage industry in Greater Manila Area and far-flung areas in Luzon, Visayas, and Mindanao.
4. Researchers and other collaborators should conduct further research on the financial and operational viability of off -grid application of solar PV system to commercial businesses and home-based use of the system particularly in far-flung areas of Luzon, Visayas, and Mindanao.
5. Solar PV Vendors to continuously market quality and least cost solar PV system in the Philippine Market to take advantage of the growing perceptions in the financial and operational viability of the solar PV system.

6. Solar PV Vendors to continuously promote and educate potential solar PV Users on the financial and operational viability of solar PV system.
7. Solar PV Vendors in partnership with the solar PV Users to continue monitoring the performance of the system to sustain User's confidence and be able to claim product and performance warranties in the event the system fails to perform in the warranty period.

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ARTICLE 3

Business Plan 1

Executive Summary

Title: **Go2Park (Mobile Application)**

Proponents: Barlahan, Jaylord C., Bas, Emily S., Castro, Carol C., Decena, Eva Behn N., Famarin, & Ma. Erika Ann F.

Subject: Project Research and Development

School Year: AY 2021-2022

Adviser: Dr. Paulo Noel Mazo

1.1. Objective of the Project

GO2PARK aims to earn a substantial profit, while creating the opportunity for parking space owners and the convenience to the vehicle owners and institutional customers. The company's overall goal is to become the largest marketplace app on the market, and this goal will be accomplished by exceeding the following objectives over it's first three operational years:

- To launch the app to the general market in Metro Manila by January 2023, grow its customer base to 3,000 parking owners and renters within a three-month period.
- To create an average recurring spend per parking owner of Php 525.00 per month.
- To expand the app to serve the provincial townships and business park market by June 2023, growing to 5,000 business customers by the end of the year.
- To reach profitability by Year 2; growing net profits by the end of Year 3 to over Php 6,000,000.00 after tax.

1.2. Type of Business Ownership

Go2Park is a corporation formed as its own legal entity, apart from the individuals who own and/or formed the organization. It has the rights to start and operate a business, to buy or sell property, to borrow money, to sue or be sued, and to enter into binding contracts. This corporation is owned by stockholders. It is managed by a board of directors elected by the stockholders and run day-to-day by officers appointed by the board of directors.

Our management team is comprised of people with many years of experience in diverse industries. Our philosophy is laser-like focus on the customer's needs. We have a Chief Financial Officer and two directors reporting to the President and CEO. Part-time positions staffing the customer support desk will be filled as needed and reporting to the Director of Operations. Seven regional sales managers will be contracted as commissioned resellers and reporting to the Director of Operations.

1.3. Organization Structure

Virtual presence of the organization and application based operational procedure enforces the business to develop flat organizational structure where the departments will be separately governed under individual authorities.

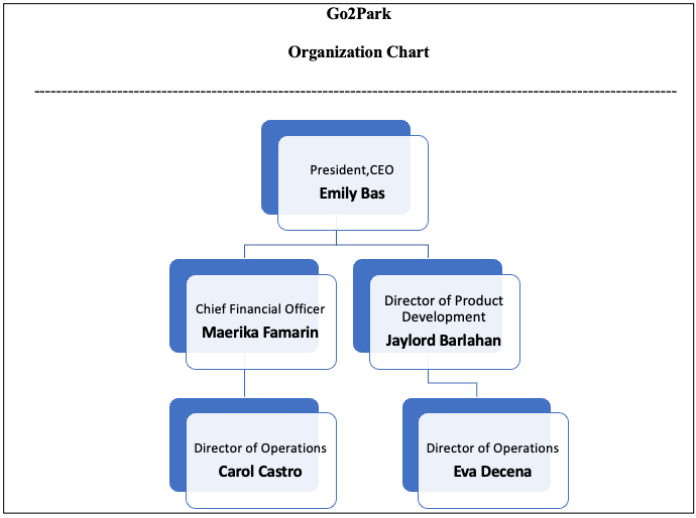

Figure 17 Organizational Chart

As the prime operation of this business will rely on the technical expertise and IT related intellect, other departmental operations will have initial contribution while the entire business will be operated through tracking devices and online payment system. IT experts will work under the ownership directly where financial and marketing operations will be executed by individuals associated to different teams.

1.4. Legal Requirements

Go2Park is a corporation formed as its own legal entity, apart from the individuals who own and/or formed the organization. It has the rights to start and operate a business, to buy or sell property, to borrow money, to sue or be sued, and to enter into binding contracts. This corporation is owned by stockholders. It is managed by a board of directors elected by the stockholders, and run day-to-day by officers appointed by the board of directors. The stockholders, directors, and officers of the company are protected from the liabilities of the company, including liabilities for their own negligence when acting in their corporate role, except in certain extraordinary circumstances. The

corporation files its own tax return and pays its own taxes. It may also be subject to state franchise taxes or other annual fees.

Liability: Limited

Taxes: Multiple Taxation

Advantages	Disadvantages
• Limited liability • Skilled management team • Ease of raising capital • Easy to transfer ownership by selling stock • Perpetual life • Legal-entity status • Economies of large-scale operations	• Double taxation • Difficult and expensive to start • Individual stockholder has little control over operations • Financial disclosure • Lack of personal interest unless managers are also stockholders • Credit limitations • Government regulation and increased paperwork

1.5. Location of the Project

GO2PARK will be strategically located within Manila as it adopts a Hybrid Office setup. Pop-up satellite offices will be installed across the Metro Manila and nearby Regions during the first 6 months of operations for a wider reach of car park hosts and customers, thus, enabling rapid onboarding to the mobile application, educate and provide assistance.

1.6. Mission

To be the most widely used mobile application for parking space advertisements and reservations across the Philippine islands.

1.7. Vision

To provide on-demand marketplace access to every parking space and vehicle owners, offering automated business and convenience at the same time.

1.8. Business Logo

Figure 18 Business logo

1.9. Market Survey and Analysis

1.9.1. Market Survey and Target Market:

As we launch Go2Park parking App, we focus on 7 business areas where hybrid set up of employees were mostly implemented as well mall goers. The following areas are as follows:

- Eastwood
- Araneta Center
- Capitol Commons
- BGC

- Makati
- New Port City
- Vertis North

We take down the existing parking lots around the area and know their parking rates:

Existing Numbers of Parking Lots:

Areas	Existing Outdoor parkings	Existing Indoor and Mall parkings
1. Eastwood	1	2
2. Araneta Center	1	13
3. Capital Commons	4	7
4. BGC	1	7
5. Makati	5	16
6. New Port City		4
7. Vertis North	1	2

**Prices were discussed in Marketing Plan 3.5

Most of the complaints of those people who are working or even just visiting these areas are the expensive parking rates, non-availability and inconvenient.

1.9.2. Market Analysis

After completing carefully, thorough research, we came up answer the four key questions:

Who are your potential customers?

The potential customers are the working and visiting people that are in need of parking spaces in that seven areas.

Where are they located?

All potential customers will be at our target seven areas mentioned in Market Survey

How large is your target market?

For a start we are aiming to have 1,500 parking spaces around the seven areas with 5,000 App users.

1.10. Demand and Supply Analysis

The high demand for parking spaces is increasing especially that the Market is going back to normal after COVID Pandemic.

Go2Park was created because of the need of more affordable parking space at the Metro Manila Market.

While residents of condominiums have the opportunity to gain additional income to rent their sleeping parking spaces to the public.

1.11. Product

GO2PARK is a user-friendly mobile parking application which will be the company's main product. This app will help manage user's time as well as money and will also provide a good value proposition to those people who are currently facing with parking problems.

The app involves three major stakeholders in the development process namely: User App, Parking Owner app and Admin panel.

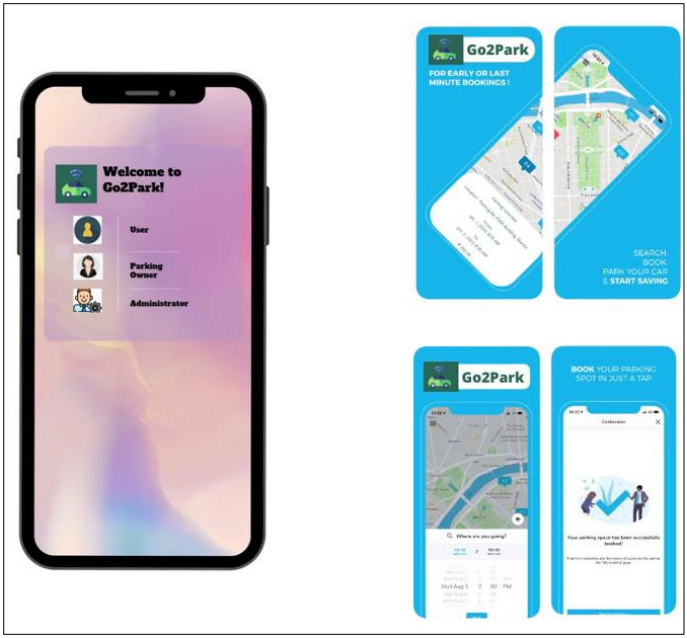

Figure 19 The Go2Park App Features

1.12. Business Facilities and Design

Go2Park will adopt the Hybrid office model and will leverage with a reduced facility requirement.

On the other hand, this is how the Go2Park app will look like once installed in the client's device.

Figure 20 The Go2Park Mobile Application

1.13. Service Flow and Process

To book a parking space, users simply need to follow the following steps:

1. **Search.** Using the Go2Park mobile app, users can either manually enter the details of their location or simply select "my current location" to automatically pin the address using the built-in GPS tracker feature of the app which will help them locate the nearest available parking spaces.
2. **Compare**. The app will provide its users with a range of parking options to choose from. The users can then compare the prices and distance from the vehicle location and filter, as desired, to find the perfect parking slot of choice.

3. **Book the Spot.** Once the driver or vehicle owner fixes the right parking slot, he can easily book the selected spot.
4. **Pay.** When a booking is placed, the user will be provided with payment options to choose from. Simply process the payment. Once payment has been successfully made, users will then be provided with a passcode for a hassle free and contactless parking experience.
5. **Driveaway.** The app has an in-built navigational assistance to drive away to the parking spot.
6. **Park.** Using the passcode generated earlier, the user can now directly access the parking space allotted to the booked vehicle without the need to contact the parking owner nor wait for a valet.

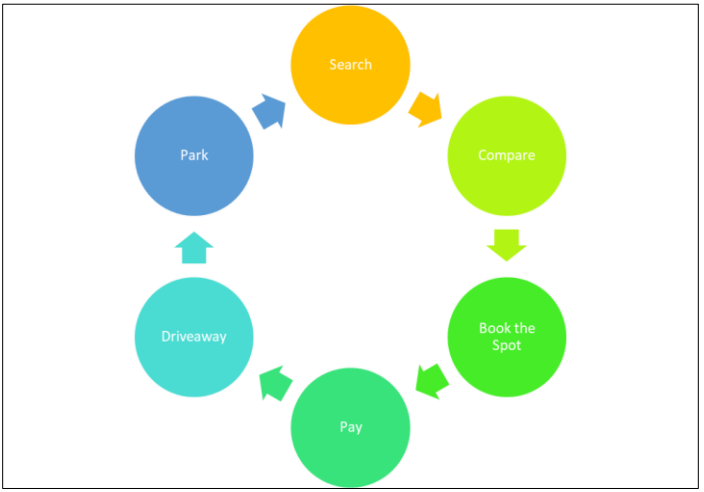

Figure 21 The Service Flow and Process

1.14. Major Assumptions

Upon careful evaluation and project feasibility studies, Go2Park Corporation will be formed and commence systems development by July 2022 with a 6-month project timeline for mobile application development. This is a conservative timeline, hence, buffers have been accounted for in lieu of unforeseen scope changes. The pre-operating period will include marketing and

user onboarding activities in time for the official mobile application launch by January 2023. Go2Park will operate in full swing including Customer Support, IT Support, Human Resources, Marketing and Accounting & Finance units.

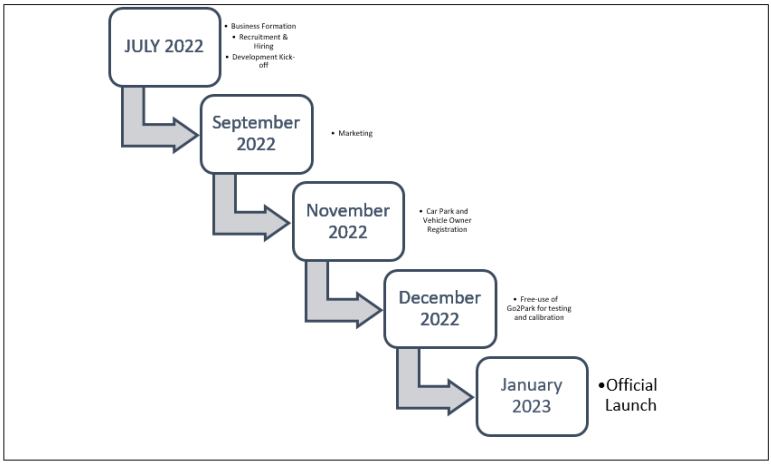

Figure 22 Major Assumptions

1.15. Total Project Costs

Pre-operating phase will include business formation costs, systems development and management man hours, and office administration. Go2Park will adopt the Hybrid office model and will leverage with a reduced facility requirement, hence lower overhead.

			2022					
			JUL	AUG	SEP	OCT	NOV	DEC
PROJECT DEVELOPMENT								
Headcount								
Chief Technology Officer			0	0	0	0	0	0
IT Development Manager			1	1	1	1	1	1
Sr Systems Development Officer			1	1	2	2	2	2
Systems Development Staff			2	2	2	2	2	2
			4.00	**4.00**	**5.00**	**5.00**	**5.00**	**5.00**
PEOPLE COST	**Fully Loaded**	**2022**						
Chief Technology Officer	532,705.00	-	-	-	-	-	-	-
IT Development Manager	175,705.00	**1,054,230.00**	175,705.00	175,705.00	175,705.00	175,705.00	175,705.00	175,705.00
Sr Systems Development Officer	125,705.00	**1,257,050.00**	125,705.00	125,705.00	251,410.00	251,410.00	251,410.00	251,410.00
Systems Development Staff	85,705.00	**1,028,460.00**	171,410.00	171,410.00	171,410.00	171,410.00	171,410.00	171,410.00
TOTAL PEOPLE COST		**3,339,740.00**	**472,820.00**	**472,820.00**	**598,525.00**	**598,525.00**	**598,525.00**	**598,525.00**
FACILITY COST (Hybrid)	**Cost per Seat**							
Seats			4.00	4.00	5.00	5.00	5.00	5.00
Hybrid Office Seats, fully loaded	7,500.00	**210,000.00**	30,000.00	30,000.00	37,500.00	37,500.00	37,500.00	37,500.00
Utilities	2,250.00	**63,000.00**	9,000.00	9,000.00	11,250.00	11,250.00	11,250.00	11,250.00
TOTAL FACILITY COST		**273,000.00**	**39,000.00**	**39,000.00**	**48,750.00**	**48,750.00**	**48,750.00**	**48,750.00**
TOTAL PROJECT COST		**3,612,740.00**	**511,820.00**	**511,820.00**	**647,275.00**	**647,275.00**	**647,275.00**	**647,275.00**

Figure 23 Project Cost

1.16. Initial Working Capital Requirements and Sources of Financing

Working Capital Requirement is derived based on phased office opening approach, whereby the manpower requirement will be mainly driven by the IT Development Project needs during the first three months with just the exact headcount needed for corporate support and slowly growing the team to support customer onboarding and Free-use of Go2Park for testing and calibration towards end of the year.

WORKING CAPITAL REQUIREMENT			2022					
		2022	JUL	AUG	SEP	OCT	NOV	DEC
HEADCOUNT								
TOTAL HEADCOUNT			**11.00**	**11.00**	**11.00**	**13.00**	**13.00**	**13.00**
PEOPLE COST	**Fully Loaded**							
TOTAL PEOPLE COST		**6,629,010.00**	**1,007,755.00**	**1,007,755.00**	**1,007,755.00**	**1,201,915.00**	**1,201,915.00**	**1,201,915.00**
FACILITY COST (Hybrid)	**Cost per Seat**							
Seats			8.00	8.00	8.00	8.00	8.00	8.00
Hybrid Office Seats, fully loade	7,500.00	**360,000.00**	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00
Utilities	2,250.00	**108,000.00**	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00
TOTAL FACILITY COST		**468,000.00**	**78,000.00**	**78,000.00**	**78,000.00**	**78,000.00**	**78,000.00**	**78,000.00**
OTHER OVERHEAD								
Marketing		**750,000.00**	-	-	-	250,000.00	250,000.00	250,000.00
Taxes & Licenses		**300,000.00**	300,000.00	-	-	-	-	-
Sundries		**300,000.00**	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
		1,350,000.00	**350,000.00**	**50,000.00**	**50,000.00**	**300,000.00**	**300,000.00**	**300,000.00**
WORKING CAPITAL REQUIREMENT		**8,447,010.00**	**1,435,755.00**	**1,135,755.00**	**1,135,755.00**	**1,579,915.00**	**1,579,915.00**	**1,579,915.00**

Figure 24 Working Capital Requirement

1.17. Financial Statements

a. Income Statement

Income Statement					
For the Year End					
Year	**2022**	**2023**	**2024**	**2025**	**2026**
Sales	-	72,900,000	121,500,000	182,250,000	191,362,500
Less: Cost of services	3,583,995	6,303,990	12,607,980	13,238,379	13,900,298
Gross profit	**(3,583,995)**	**66,596,010**	**108,892,020**	**169,011,621**	**177,462,202**
		91%	*90%*	*93%*	*93%*
Less: Operating Expenses					
Rent Expense	360,000	720,000	1,440,000	1,512,000	1,587,600
Utilities Expense	108,000	216,000	432,000	453,600	476,280
Marketing Expense	750,000	1,500,000	3,000,000	3,150,000	3,307,500
Supplies Expense	300,000	600,000	1,200,000	1,260,000	1,323,000
Salaries Expense	3,045,015	6,090,030	12,180,060	12,789,063	13,428,516
Business & Legal Expense	300,000	2,458,000	3,430,000	4,645,000	4,827,250
Depreciation Expense	165,000	660,000	990,000	990,000	990,000
Total Expense	***5,028,015***	***12,244,030***	***22,672,060***	***24,799,663***	***25,940,146***
Earnings Before Income Tax (EBIT)	***(8,612,010)***	***54,351,980***	***86,219,960***	***144,211,958***	***151,522,056***
		75%	*71%*	*79%*	*79%*
Income Tax 25%	-	13,587,995	21,554,990	36,052,990	37,880,514
Net income after Tax	(8,612,010)	40,763,985	64,664,970	108,158,969	113,641,542
		56%	*53%*	*59%*	*59%*

Figure 25 Exhibit a. Income Statement

b. Balance Sheet

Key assumptions include capitalization from direct investments, cash flow considerations where collections are mainly derived from 70% credit and debit card customers and 30% cash customers and trade payables mainly on industry standard credit terms that is 30 to 45 days. Capital expenditures are mainly on technology assets and is driven by growth assumptions year on year from 2023 to 2025.

Annual dividend declarations are forecasted and the board will maintain equal capital and retained earnings balances to anticipate growth opportunities and funding requirements.

	Balance of Sheet As of December 31				
	2022	2023	2024	2025	2026
Current Assets:					
Cash	1,902,990	16,728,000	12,937,667	9,781,300	10,167,615
Account Receivable	-	5,000,000	8,333,333	12,500,000	13,125,000
Inventories	-	-	-	-	-
Supplies	-	-	-	-	-
Prepaid Rent	-	-	-	-	-
Other Current Assets	-	-	-	-	-
Total Current Assests	***1,902,990***	***21,728,000***	***21,271,000***	***22,281,300***	***23,292,615***
Non-current Assets:					
Fixed Assets	1,650,000	3,300,000	4,950,000	4,950,000	4,950,000
Less: Accumulated Depreciation	165,000	825,000	1,815,000	2,805,000	3,795,000
Total Noncurrent Assests	***1,485,000***	***2,475,000***	***3,135,000***	***2,145,000***	***1,155,000***
Total Assests	***3,387,990***	***24,203,000***	***24,406,000***	***24,426,300***	***24,447,615***
Current Liabilities					
Accounts Payable	-	203,000	406,000	426,300	447,615
Other Current Liablities	-	-	-	-	-
Total Current Liabilities	***-***	***203,000***	***406,000***	***426,300***	***447,615***
Noncurrent Liablities					
Notes Payable	-	-	-	-	-
Other Non-Current Liabilities	-	-	-	-	-
Total Non-Current Liabilities	-	-	-	-	-
Total Liabilities	***-***	***203,000***	***406,000***	***426,300***	***447,615***
Equity					
Paid Capital	12,000,000	12,000,000	12,000,000	12,000,000	12,000,000
Retained Earnings/(Loss)	(8,612,010)	12,000,000	12,000,000	12,000,000	12,000,000
Total Equity	***3,387,990***	***24,000,000***	***24,000,000***	***24,000,000***	***24,000,000***
Total Liabilities & Equity	***3,387,990***	***24,203,000***	***24,406,000***	***24,426,300***	***24,447,615***

Figure 26 Exhibit b. Balance Sheet

c. Cash Flow Statement

The assumptions for cash flow accounts for capital investments infused during start-up pre-operating phase. 2022 expenditures represent the project development cost marketing activities, overhead payroll and operating expenses. Timing differences are accounted for receivables from credit card transactions and payables for occupancy and regular local vendors.

Statement of Cash Flows For the Year End	2022	2023	2024	2025	2026
Cash Flows from Operating Activities					
Cash Received from clients	-	67,900,000.00	118,166,666.67	178,083,333.33	190,737,500.00
Payments to suppliers	(300,000.00)	(397,000.00)	(997,000.00)	(1,239,700.00)	(1,301,685.00)
Payments to employees	(6,629,010.00)	(12,394,020.00)	(24,788,040.00)	(26,027,442.00)	(27,328,814.10)
Payment for marketing ads	(750,000.00)	(1,500,000.00)	(3,000,000.00)	(3,150,000.00)	(3,307,500.00)
Payment for business permits	(300,000.00)	(2,458,000.00)	(3,430,000.00)	(4,645,000.00)	(4,827,250.00)
Payment for rent	(360,000.00)	(720,000.00)	(1,440,000.00)	(1,512,000.00)	(1,587,600.00)
Payment for taxes	-	(13,587,995.00)	(21,554,990.00)	(36,052,989.50)	(37,880,513.98)
Payment for utilities	(108,000.00)	(216,000.00)	(432,000.00)	(453,600.00)	(476,280.00)
Net cash provided by (used in) operating activities	***(8,447,010.00)***	***36,626,985.00***	***62,524,636.67***	***105,002,601.83***	***114,027,856.93***
Cash Flows from Investing Activities					
Payments to acquire equipment	(1,650,000.00)	(1,650,000.00)	(1,650,000.00)	-	-
Payments to acquire furnitures & fixtures	-				
Payments for construction	-				
Net cash provided by (used in) investing activities	***(1,650,000.00)***	***(1,650,000.00)***	***(1,650,000.00)***	***-***	***-***
Cash Flows from Financing Activities					
Cash received as investments by owner	12,000,000.00	-	-	-	-
Cash received from borrowings	-				
Dividend Declaration	-	(20,151,975.00)	(64,664,970.00)	(108,158,968.50)	(113,641,541.93)
Net cash provided by (used in) financing activities	***12,000,000.00***	***(20,151,975.00)***	***(64,664,970.00)***	***(108,158,968.50)***	***(113,641,541.93)***
Net Increase (Decrease) in Cash	***1,902,990.00***	***14,825,010.00***	***(3,790,333.33)***	***(3,156,366.67)***	***386,315.00***
Cash balance at the **beginning** of the period		***1,902,990.00***	***16,728,000.00***	***12,937,666.67***	***9,781,300.00***
Cash balance at the **end** of the period	***1,902,990.00***	***16,728,000.00***	***12,937,666.67***	***9,781,300.00***	***10,167,615.00***
Cash amount in the Balance Sheet	***1,902,990.00***	***16,728,000.00***	***12,937,666.67***	***9,781,300.00***	***10,167,615.00***

Figure 27 Exhibit c. Cash Flow Statement

1.18. Financial Analysis

a. Financial Ratio

- 2022 as the Start-up year and is understood as the pre-operating period of the company and 2023 as the official business and operations launch, hence a fully operational year.
- Other than Cash activities, Accounts Receivable assumption is based on the monthly timing difference at year end related to Credit Card users of the mobile application. Accounts Payable assumption is based on the timing difference at year end related to Operating Expenses.
- Current Ratio, Quick Ratio and Net Working Capital takes into account that the business is highly liquid mainly because the revenue model derives fees from mobile application usage of both the Parking Owners and Parking Tenants.
- The high rate of profitability is mainly driven by the magnitude of technology based market reach whereas the cost to operate is proportionately low and fixed. Direct Investments are mainly the

technology assets acquired such as laptops and servers while Direct Costs considered are the mobile application Project Cost, Technology maintenance cost and Customer Support.

Liquidity	2022	2023	2024	2025	2026
Current Ratio	N/A	107.03	52.39	52.27	52.04
Quick Ratio	N/A	82.40	31.87	22.94	22.72
Net Working Capital	1.00	0.99	0.98	0.98	0.98

Profitability	2022	2023	2024	2025	2026
Return on Assets	(2.54)	1.68	2.65	4.43	4.65
Return on Equity	(0.72)	3.40	5.39	9.01	9.47
Net Profit Margin	N/A	56%	53%	59%	59%
Operating Margin Profit	N/A	91%	90%	93%	93%

Figure 28 Exhibit a Financial Ratio

b. Financial Planning

Financial projection is based on a business growth model which considers adoption of mobile application usage by targeted Parking Owners and Parking Users. Geographic reach of technology is undoubtedly limitless but to rapidly tap high-density population areas, marketing strategy will be placed heavily on these markets during the start-up phase. It is envisioned that as revenue targets increase year on year, the direct costs, technology assets, marketing and overhead will likewise increase.

	Year 1 2023	Year 2 2024	Year 3 2025
Fee on Hosts			
Average daily rental	₱ 350.00	₱ 350.00	₱ 350.00
x 30 days	30	30	30
Monthly Rental Income	₱ 10,500.00	₱ 10,500.00	₱ 10,500.00
x 5% Host Fee	5%	5%	5%
	₱ 525.00	₱ 525.00	₱ 525.00
Target # of Hosts	3,000	5,000	7,500
Fee on Hosts per Month	**₱ 1,575,000.00**	**₱ 2,625,000.00**	**₱ 3,937,500.00**

	Year 1	Year 2	Year 3
Fee on Rental App Users			
Booking Fee	₱ 50.00	₱ 50.00	₱ 50.00
x 30 days	30	30	30
Monthly Rental Income	₱ 1,500.00	₱ 1,500.00	₱ 1,500.00
Target # of Users	3,000	5,000	7,500
Fee on Users per Month	**₱ 4,500,000.00**	**₱ 7,500,000.00**	**₱ 11,250,000.00**

	Year 1	Year 2	Year 3
Fee on Hosts per Month	₱ 1,575,000.00	₱ 2,625,000.00	₱ 3,937,500.00
Fee on Users per Month	₱ 4,500,000.00	₱ 7,500,000.00	₱ 11,250,000.00
Total Income per Month	**₱ 6,075,000.00**	**₱ 10,125,000.00**	**₱ 15,187,500.00**
Annualized Revenues	**₱ 72,900,000.00**	**₱ 121,500,000.00**	**₱ 182,250,000.00**
Growth		*67%*	*50%*

Figure 29 Exhibit b Financial Planning (Revenue Model)

c. Capital Recovery

The projected annual dividend declaration takes into account local financial reporting compliance requirements. Go2Park has taken the position of maintaining Retained Earnings up to the same extent of Paid-up Capital to appropriate for growth opportunities and the excess is to be appropriated for annual dividend declaration.

		2022	2023	2024	2025	2026
Dividend Declaration		**-**	**20,151,975**	**64,664,970**	**108,158,969**	**113,641,542**
Incorporators						
Jaylord Barlahan	8%		1,612,158	5,173,198	8,652,717	9,091,323
Emily Bas	8%		1,612,158	5,173,198	8,652,717	9,091,323
Carol Castro	8%		1,612,158	5,173,198	8,652,717	9,091,323
Eva Behn Decena	8%		1,612,158	5,173,198	8,652,717	9,091,323
Ma. Erika Famarin	8%		1,612,158	5,173,198	8,652,717	9,091,323
Fil-Tech Start-up Ventures	60%		12,091,185	38,798,982	64,895,381	68,184,925
TOTAL (PHP)	**100%**		**20,151,975**	**64,664,970**	**108,158,969**	**113,641,542**

Figure 30 Exhibit c Dividend Declaration

1.19. Project Contribution and Opportunities

a. Government

Go2Park will generate an estimated net income of 54,351,980.00 on the year 2023 up to 151,522,056.00 on the year 2026 and will contribute revenue to the Government in the form of tax not lower than 13,588,995.00 on the first year of operation up to 37,880,514.00 on its fourth year of operation. Additional taxes in the form of withholding tax will be generated by the government from salary of employees that is consider as major source of revenue of the government.

b. Customers

This business proposal will benefit car owners who are willing to pay for their parking space but no available space at a low cost and convenient way because it offers its service on a fully automated way.

c. Employees

Go2Park will create an employment opportunity both permanent and contract based to at least 11 individuals on year 2022 up to 50 individuals by year 2026. Individual who will work permanently will enjoy benefits provided by the company on top of government mandated benefits.

d. Environment

Go2Park does not only focus on its low cost and convenient way but also care about the environment. The business will also focus on organize parking system, it aims to reduce carbon emission because once you go in a place and you made a reservation through the application, you will directly proceed to the parking area, unlike if you go to a place and you will still be looking at place to park and go round and round, you will be consuming more gas and will increase carbon emission that harm the environment.

The company will also practice using renewable energy like solar power to reduce consumption of electricity on lights on the parking area and other office appliances.

It will also practice proper waste disposal and will initiate three planting and will participate on programs that will protect the environment.

e. Community

Go2Park is aiming to help enhance the technological capability of the country by contributing funds to potential individuals who has passion on developing technology that will define the future of the industry in the country.

Go2Park will also aim granting scholars to less fortunate and deserving students at any course to uplift their status in life once graduated and be on their respective jobs.

It will also participate on programs of the government in helping those in need during and after calamities like typhoon, flood and earthquake.

The company has also plan to donate solar panel to help those community that are not yet reach by electric power provided by electric companies.

1.20. Corporate Social Responsibility

Go2Park will focus on sustainable business, low-cost service, giving back to community and healthy work environment for employees.

The company is aiming to use renewable energy to reduce the consumption of electricity and at the same time will reduce cost on the operation. It also aims helping the environment by reducing carbon emission coming from cars.

The company is serving low-cost service on a convenient way using the application. The customer will only need to install the application via phone and everything will be on flow.

In partnership with different organizations, the company is participating in different programs to give back to the community like granting scholarship to less fortunate, giving access to electricity using solar power and giving relief pack to families affected by calamities.

The company is also developing a healthy environment for the employee to work with and be the top option. It will make sure that employees are well compensated and will be held accountable on actions made by employees that benefits the company.

1.21. Summary of Findings and Recommendations

The feasibility of a parking mobile app project is highly probable in a technology driven society such as the Metro Manila and the provincial technology hub population such as Cebu, Iloilo and Davao.

Various business formation concepts may be explored other than a corporation structure such as what is proposed on this business plan. In a corporation structure, much complexities such as legal and regulatory requirements are to be considered, hence the need for significant funding.

In case of limited funding, a small-business approach can be explored whereby a mobile app is developed and marketed in a restricted environment to limit the scale and mitigate higher legal and regulatory exposures such as marketing it in a condominium community or commercial buildings.

1.22. References

CREATE - Bureau of Internal Revenue (bir.gov.ph)

Home - SEC - Securities and Exchange Commission

ARTICLE 4

Business Plan 2

Executive Summary

Title: **Namit Bento & Bilao**

Proponents: James Rey M. Aponte, Rovel B. Villadelgado, Honey Grace B. Estoque, Chona T. Vasquez, & Kuhlyn S. Sendaydiego

Subject: Project Research and Development

School Year: AY 2021-2022

Adviser: Dr. Paulo Noel Mazo

1.1. Objective of the Project

Our basic objective is to achieve a gain of Php50,000.00 monthly, however, in the long run, we hope to grow our business by creating new products with exceptional taste, and by capturing the patronage of every niche market.

1.2. Location of the Project

The business is located at #10, Prince Street, Victory Hills, Brgy. Fortune, Marikina City. The city has 2,314.47 hectares and a population of 531,128. Nearby are churches, establishment and manufacturing companies which we can offer our products; however, to conquer a wider market by being mobile, they chose to be virtual – by employing different online social media platforms such Facebook, Instagram, and etc.

1.3. Legal Requirements

Namit Bento & Bilao is registered at the DTI (Department of Trade and Industry) as Sole Proprietor, with the understanding that the rest of the group also owns the business as silent partners. They chose this type of business ownership given the minimal capital invested and to avoid time-consuming regulation.

This certifies that

NAMIT BENTO&BILAO FOOD STORE
(BARANGAY)

FORTUNE, CITY OF MARIKINA NCR, SECOND DISTRICT - NCR - NATIONAL CAPITAL REGION

is a business name registered in this office pursuant to the provisions of Act 3883, as amended by Act 4147 and Republic Act No. 863, and in compliance with the applicable rules and regulations prescribed by the Department of Trade and Industry.
This certificate issued to

JAMES REY MACALUA APONTE

is valid from 09 July 2022 to 09 July 2027 subject to continuing compliance with the above-mentioned laws and all applicable laws of the Philippines, unless voluntarily cancelled

In testimony whereof, I hereby sign this

Certificate of Business Name Registration

and issue the same on 09 July 2022 in the Philippines.

ALFREDO E. PASCUAL
Secretary

Business Name No. 3997913

This certificate is not a license to engage in any kind of business and valid only at the scope indicated herein.

SYFZ593113732964

Figure 31 Legal Requirement

1.4. Brief Description of the Project

"Namit" is a Hiligaynon or also often referred to as Ilonggo term which means extremely attractive or appealing or scrumptiously delicious. Namit Bento & Bilao food store is a start-up business operating in Marikina. Among other luscious products, we serve the best, high-quality, and reasonably priced food items such as our best-selling seafood platter, mouth-watering pancit palabok, and delightfully satisfying egg pies.

1.5. Vision

Namit Bento & Bilao Food Store aims to excel in providing meals that will satisfy the cravings of every Customers within Marikina City and making sure they come back every time to buy again.

1.6. Mission

Namit Bento & Bilao Food Store's mission is to give convenience to the customer by serving affordable best tasting food.

1.7. Company Logo

shows the Namit Bento & Bilao Food Store's Company Logo.

Figure 32 Namit Company Logo

1.8. Type of Business Ownership

Namit Bento & Bilao belongs to the MSME (Micro, Small, and Medium Enterprise) food manufacturing industry and is a Sole Proprietorship type of business. There are several existing small to medium scale businesses engaged in creating food and the likes. Various restaurants have sprouted in its target geographical market, and they would like to take advantage of these markets – those who enjoy different kinds of food.

1.9. Organization Structure

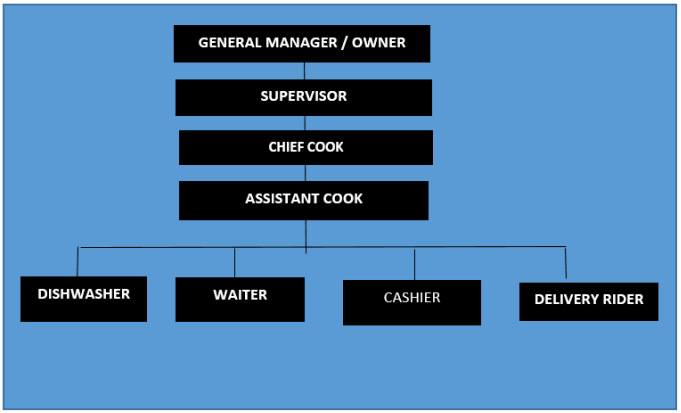

Figure 33 Organization Structure

1.9.1. Compensation and Benefits

Position	No.	Daily Salary	Overtime Pay	Monthly Salary	Annual Salary	13th Month Pay	SSS (8% Employer, 4% Employee)	PhilHealth
General Manager	1	P 884.62	P 221.16	P 23,000.12	P 276,001.44	P 23,000.12	P2,760.01	P 805.00
Supervisor	1	692.31	173.08	18,000.06	216,000.72	18,000.06	2,160.01	630.00
Chief Cook	1	692.31	173.08	18,000.06	216,000.72	18,000.06	2,160.01	630.00
Assistant Cook	1	615.38	153.85	15,999.98	191,999.76	15,999.98	1,920.00	560.00
Cashier	1	570.00	142.50	14,820.00	177,840.00	14,820.00	1,778.40	518.70

Dishwasher	1	570.00	142.50	14,820.00	177,840.00	14,820.00	1,778.40	518.70
Waiter	1	570.00	142.50	14,820.00	177,840.00	14,820.00	1,778.40	518.70
Delivery Rider	1	570.00	142.50	14,820.00	177,840.00	14,820.00	1,778.40	518.70
TOTAL	**12**	**P5,164.62**	**P1,291.17**	**P134,280.22**	**P 1,611,362.64**	**P 134,280.22**	**P 16,113.63**	**P 4,699.81**

Table 3.1

Compensation and Benefits

1.9.1.1. Salaries and Wages

Permanent employment of the staff will be confirmed at the end of the probationary period subject to your satisfactory performance with the sole discretion of the company.

All employees shall receive their respective salaries or wages as provided in their contracts of employment every 15th and last day of the month. Cut-off for payroll computation is every 10th and 25th of the month. The employees will be observed under probationary period (6 months) for his/her performance. Once observed as excellent performer, he/she will be automatically regularized in the store.

1.9.1.2. Overtime Pay

Overtime pay is the additional compensation payable to an employee for services or work rendered beyond the normal eight hours of work. Work performed beyond eight hours a day shall be compensated with an additional compensation of at least 25% of the basic salary.

1.9.1.3. Cancelled Day-off/Holiday Pay

The following shall be considered regular holidays:

- New Year's Day (January 1)
- Maundy Thursday
- Good Friday
- Araw ng Kagitingan (April 9)
- Labor Day (May1)
- Independence Day (June 12)
- National Heroes Day

- Ramadan
- Bonifacio Day (November 30)
- Christmas Day (December 25)
- Rizal Day (December 30)

The following shall be considered special holidays:

- All Saints' Day (November 1)
- Last Day of the Year (December 31)

Work performed on a regular holiday shall be compensated with an additional compensation equivalent to 100% of the regular salary. Work performed on an employee's rest day or on a special holiday shall be paid an additional compensation of 30% of the regular salary.

1.9.1.4. 13th Month Pay

This benefit of the employees must be given at the end of the year not later than December 24 equivalent to its 1-month basic salary and will be given pro-rata.

1.9.1.5. Paternity and Maternity Leave

Paternity and maternity leave benefits, as provided by law, shall be given to every employee entitled thereto.

1.9.1.6. SSS, Phil Health, HMDF, Withholding Tax Contribution

All employees shall have a monthly contribution. Benefits under SSS, Phil Health, and HMDF shall be granted in accordance with applicable laws.

1.9.1.7. Employee Benefits

Retirement pays benefits, as provided by law, shall be given to all qualified employees upon their retirement from the company.

1.9.1.8. Service Incentive Leave

Every employee who has rendered at least one year of service shall be entitled to a yearly service incentive leave of five days with pay.

1.9.1.9. Separation Pay

The employee is not entitled to separation pay as it is stipulated in the contract but the last salary will be given pro-rata.

1.10. Target Market

Bento and Bilao Food Store targets to serve food to Filipino families such as:

- Health workers
- Residents nearby the physical store
- Corporate

1.10.1. Health Workers

With over hundreds of employees in 'Amang' Rodriguez Memorial Hospital and considering a 'No noon break" for public service sectors, health workers are our target market as they have no spare time to go out. With the help of technology, target markets can avail pre-order food.

1.10.2. Corporate

We focused on the BPO industry, where people are sleep deprive, tired and hungry after long night of their shift and or providing at home feasts with their family. We also focused on medical representatives who are engaged on presenting and getting all the attention of the doctors, during meetings they provide bento meals for them after presentation.

1.10.3. Residents

Nearby the physical store is one of the primary targets as some of them are preparing for work early in the morning and want an instant breakfast to feed them their family.

We also provide Bento Meals on Gatherings like Wake, Church Mass and Blow out celebrations that due to pandemic, it does have strict compliance and health protocols when it comes to distributing meals during different gatherings

1.11. Demand and Supply Analysis

Economic aspect serves as the basis of the financial section through the projected demand. There can be no discussion of profitability or of the other aspects of the study; if in the first place, there is no demand or market.

This aspect includes the following topics: demand analysis, supply analysis, and the demand and supply gap analysis. However, we started the economic aspect with the survey chart and its summary to provide the necessary information for the demand and supply analysis. It is the basis for the computation.

Namit Bento & Bilao Food Store aims to provide services to clients from all class of society. Growth of the firm is expected to achieve in a short period of time. It is also the partners aim to set up branches in the years ahead.

The proponents conducted surveys in the location, and we found out that there was an existence of considerable demand and if supply would be taken into consideration, the proponents is indeed willing and surely able to meet the demands of the products to be offer. Base on the characteristics and features stated in our area description which the customer may enjoy the product and its reasonable amount and in addition the excellent and satisfying service; with all of this, there is no doubt that we will meet the demand of the customers.

Based on the presented market study, the existence of substantial demand, proven by the positive results of the survey presented below which was conducted a demand may be created by the partners and due to the strategic locations. It is ascertained by large market size as its target. Secondly, the demand is fully met by services supplied by Namit Bento & Bilao Food Store because partners are willing to provide high quality of services and reasonable price of the product.

1.11.1. Survey

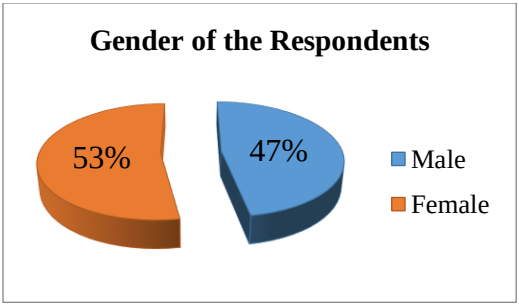

Figure 34 Survey Chart 1

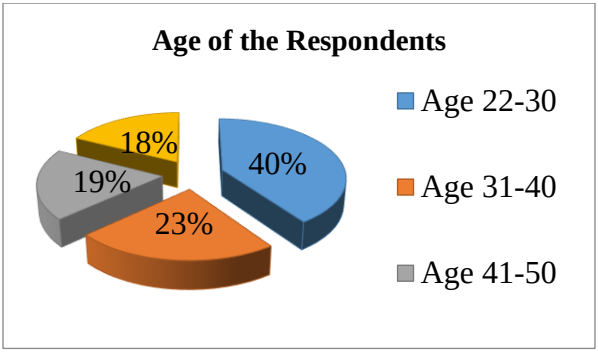

Figure 35 Survey Chart 2

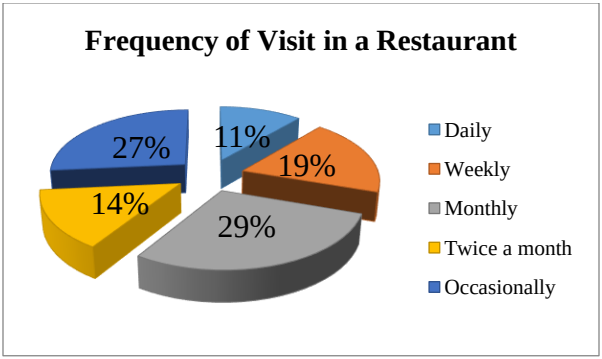

Figure 36 Survey Chart 3

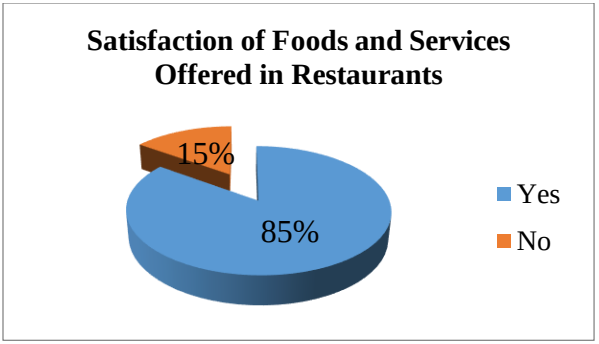

Figure 37 Survey Chart 4

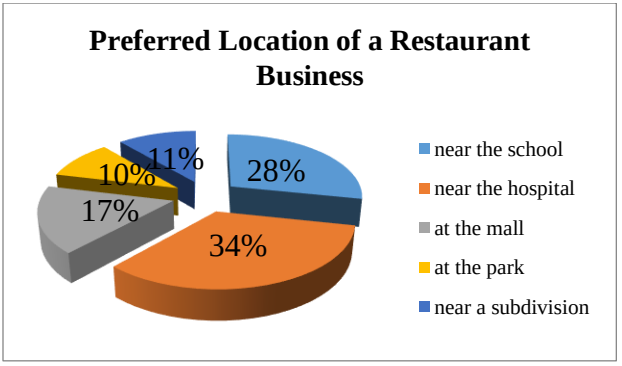

Figure 3.4 Survey Chart 5

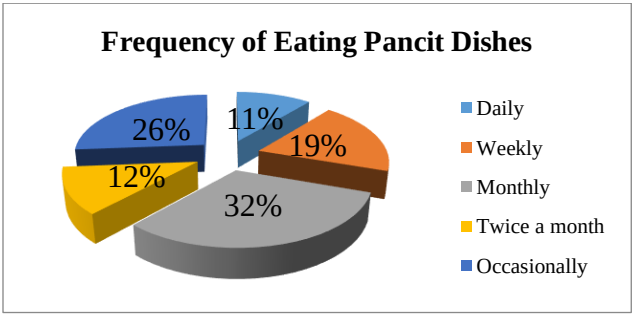

Figure 38 Survey Chart 6

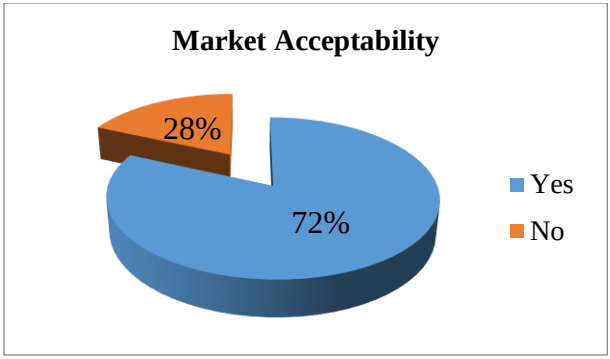

Figure 39 Survey Chart 7

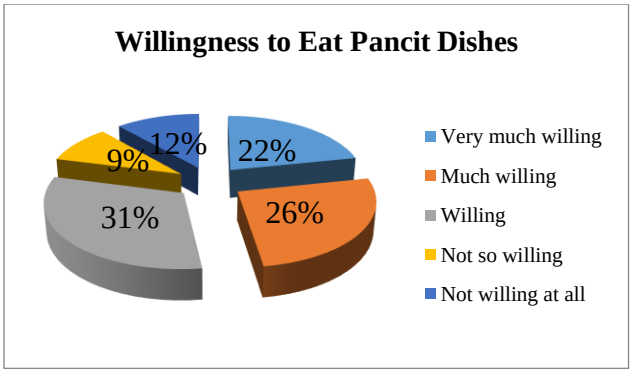

Figure 40 Survey Chart 8

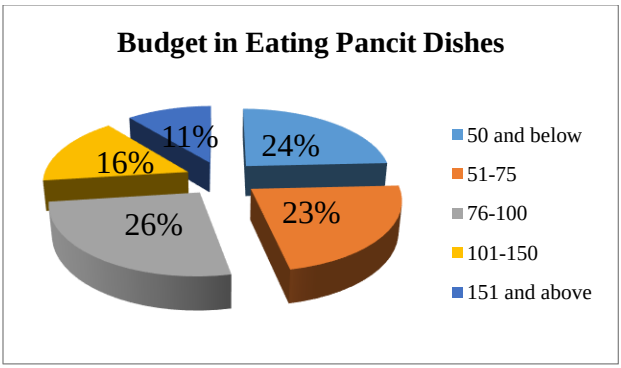

Figure 41 Survey Chart 9

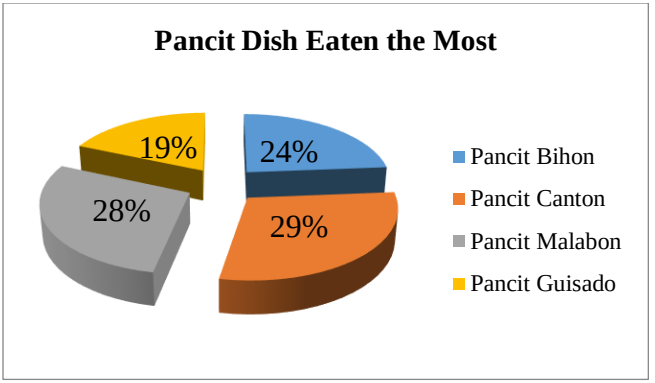

Figure 42 Survey Chart 10

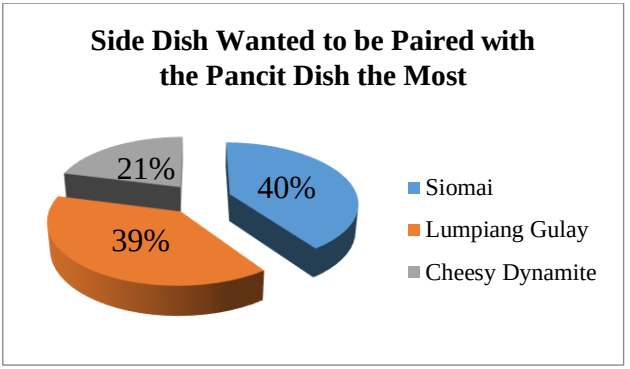

Figure 43 Survey Chart 11

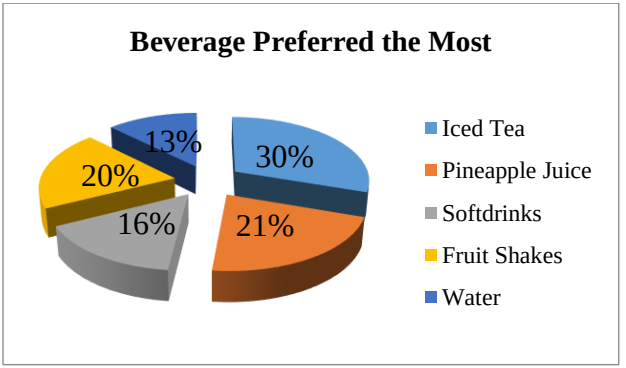

Figure 44 Survey Chart 12

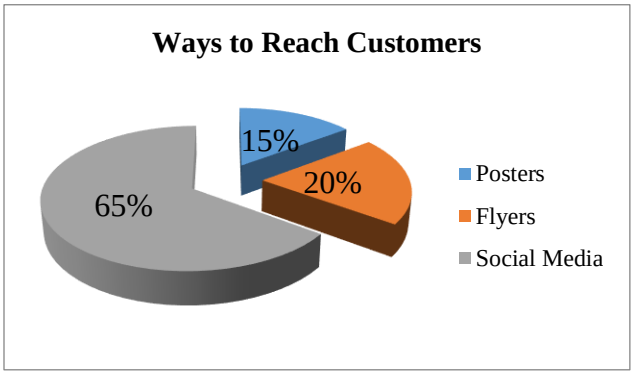

Figure 45 Survey Chart 13

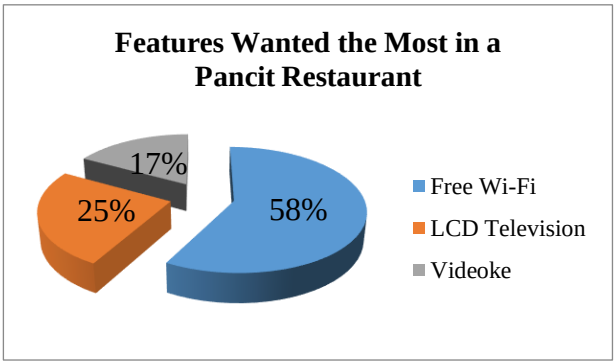

Figure 46 Survey Chart 14

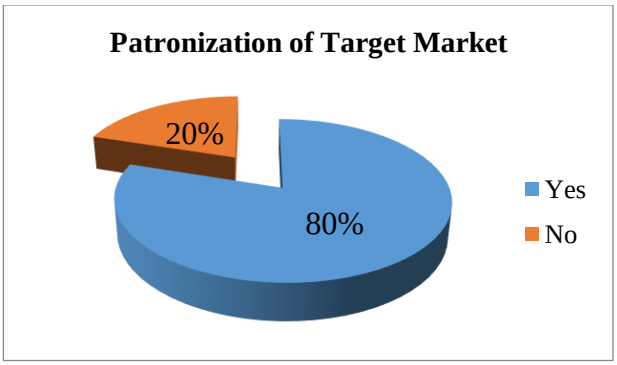

Figure 47 Survey Chart 15

1.12. Demand Analysis

a. Projected Market based on population

The population of Marikina City for the year 2022 is 424,610. Using the 0.25% growth rate on population on population of Marikina City, we will be using this as basis of our projection.

Year	Growth Rate	Target Population
2023	0.25%	425,672
2024	0.25%	426,736
2025	0.25%	427,803
2026	0.25%	428,872
2027	0.25%	429,944

Table Projection

Formula:

Projected Market based on population= Previous population * (1 + Growth Rate)
The table shows the projected population of Marikina City measured using the formula above. It will help the researchers to identify the size of target industry and to cater the needs of the target market.

b. Projected Demand

Year	Projected Market Based on Population	Acceptance Rate	Projected Market Demand
2023	425,672	72%	306,484
2024	426,736	72%	307,250
2025	427,803	72%	308,018
2026	428,872	72%	308,788
2027	429,944	72%	309,560

Table Projected Demand

Table 4.18 provides information about the population of our target market, which is the whole population of the location for years 2023-2027. The historical population had increased thus, indicating that the demand for our business had likewise increased.

c. Supply Analysis

At present we have eleven existing competitor which consisted of two direct competitors and nine indirect competitors. Most of our competitors are Fast Food restaurant. Our competitors are well established and are patronized by the customer. However, the existing direct competitors cannot satisfy the potential demand because they offer limited variety of pancit dishes, expensive prices of its products and quite poor quality of services.

Projected Supply

Year	Demand	Share in the Market	Supply
2023	306,484	30%	91,945
2024	307,250	30%	92,175
2025	308,018	30%	92,405
2026	308,788	30%	92,636
2027	309,560	30%	92,868

Table Projected Supply

d. Demand Supply Gap Analysis

No. of Competitors	11
x No. of Persons Served in a Month	6,000
Total Persons Served by Competitors	66,000
/ Percentage Share of Unsatisfied Customers	25%
Percentage of Satisfied Demand	264,000
/ Total Population	424,610
Percentage of Satisfied Demand	62.17%

62.17% of the market is already supplied by our competitors. 37.83% is the unsatisfied demand.

Demand Supply Analysis

Year	Demand	Share of the Competitors in the Market	Supply Satisfied by the Competitors
2023	306,484	62.17%	190,541
2024	307,250	62.17%	191,017
2025	308,018	62.17%	191,495
2026	308,788	62.17%	191,974
2027	309,560	62.17%	192,453

Table Demand Supply Analysis

Demand Supply Gap Analysis

Year	Projected Demand	Projected Supply

2023	306,484	91,945
2024	307,250	92,175
2025	308,018	92,405
2026	308,788	92,636
2027	309,560	92,868

Table Demand Supply Gap Analysis

1.13. Business Facilities and Design

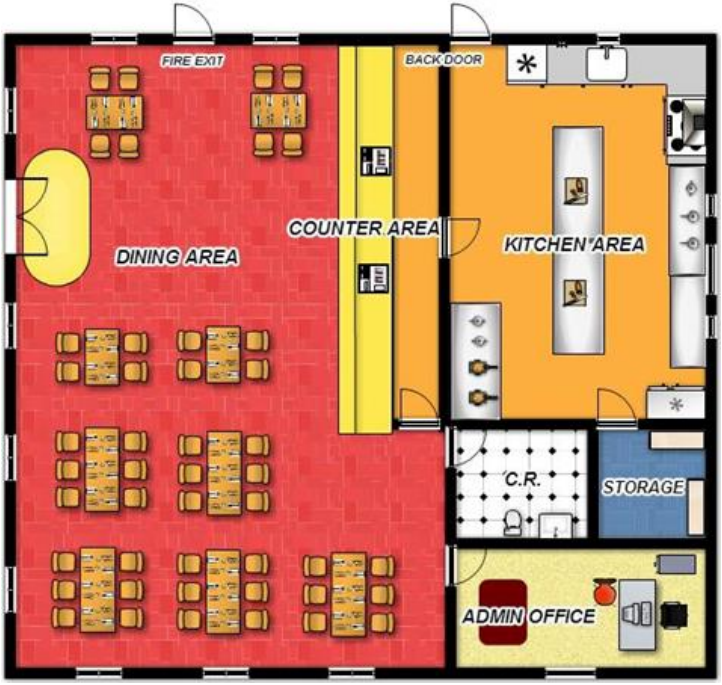

Figure 48. Business Facilities and Design

- The figure shows the floor plan of Namit Bento & Bilao Food Store. The whole area is 50 square meters divided in to six parts namely: Dining area, Counter area, Kitchen area, Comfort room, Storage room and Admin office.
- Dining area has 50 seating capacity, fully air conditioned and Wi-Fi ready. It has 9 windows for the light to come in.
- Counter area has two cash registers for faster service.
- Kitchen area is spacious enough for a comfortable workstation. It has exhaust fan and a range hood for proper ventilation.
- Comfort room would be for men and women to maximize space in the restaurant.
- Storage room is for the proper storage of non-food items such as cleaning supplies.
- Admin office is for the workstation of the manager and supervisor and to answer for the inquiries of the customers.
- There is a fire exit as a precautionary measure of the customers and staff for emergency and a back door as an entrance for the goods to be delivered

1.14. Production Flow and Process

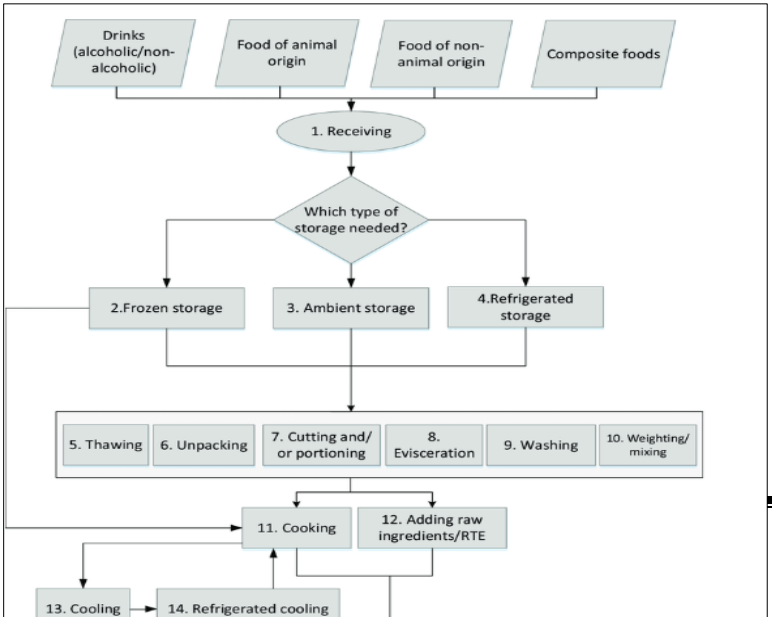

Figure 49. Production Flow and Process

This shows a step-by-step manufacturing process on how to prepare the products from raw materials to the customers. Restaurant provides a systemized way of operations in the kitchen to ensure proper sanitation and quality.

1.14.1. Pre-operating Period

Beginning Capital		P 1,250,000.00
Less: Projected Costs		
Fixed Investment		
Machineries and Equipment	20,597.8	
Furniture and Fixture	135,833.00	
Total Fixed Investment		P 156,430.80
Pre-operating Expenses		
Legal Fees Requirements	P 6,435.00	
Advertisement or Promotions	P 5,000.00	
Non-depreciable Machineries and Equipment	P103,216.00	
Non-depreciable Furniture and Fixtures	127,733.00	
Utensils	15,936.00	
Total Pre-operating cost		258,320.00
Working Capital		

Cost of Ingredients	P 112,270.00	
LPG	3,500.00	
Utilities	14,000.00	
Supplies	P 1,687.00	
Employees Salary	P 134,280.22	
Employee's Benefits	11,277.90	
Total Working Capital		277,015.12
Total Projected Cost		P 691,765.92
Beginning Cash Balance		**P558,234.08**

1.15. Financial Plan

1.15.1. Major Assumptions

It will take the business to reach the projected sales of P390, 000.00 per month.
The business will have monthly expenses of P 277,015.12.
The business will have a net income per month of P80, 000.00.

1.15.2. Total Project Costs

Beginning Capital		P 1,250,000.00
Less: Projected Costs		
Fixed Investment		
Leasehold Improvements	P 50,000.00	
Machineries and Equipment	99,216.00	
Furniture and Fixtures	115,500.00	
Total Fixed Investment		P 264,716.00
Pre-operating Expenses		
Legal Fees Requirements	P 15,685.00	
Engineer's Fee	3,500.00	
Salary for Construction Workers	6,400.00	
Advertisement or Promotions	8,562.00	

Non-depreciable Machineries and Equipment	4,000.00	
Non-depreciable Furniture and Fixtures	20,333.00	
Utensils	25,135.00	
Total Pre-operating cost		85,615.00
Prepaid Expenses		
Rent in Advance	P 25,000.00	
Rent Deposit	25,000.00	
Total Prepaid Expenses		50,000.00
Working Capital		
Cost of Ingredients	P 624,557.95	
LPG	2,500.00	
Utilities	28,550.00	
Supplies	1,687.00	
Employees Salary	174,330.00	
Employee's Benefits	11,277.90	
Total Working Capital		842,902.85
Total Projected Cost		P 1,243,233.85
Beginning Cash Balance		**P 6,766.15**

1.15.3. Initial Working Capital Requirements and Sources of Financing

The initial investment of Namit Bento & Bilao Food Store is P 1,250,000 which came from the General Manager/Owner, Mr. James Rey M. Aponte. There are no other sources of capital aside from the owner, himself. The financial statement proved that the business is profitable enough to pursue and continue to operate. The owner also found out that the proposed business will be possible and has high amount of Return of Investment (ROI).

1.16. Financial Analysis

1.16.1. Financial Ratios

1. Profitability Ratios

a. Return on Sales

It measures the management's capability to optimize returns for its resources.
It shows the measure of cost of efficiency.
Return on sales' formula is net income divided by net sales.

	Year 1	Year 2	Year 3	Year 4	Year 5
Net Income	P 264,647.72	P 324,811.49	P 402,440.83	P 483,804.99	P 573,063.93
/ Net Sales	12,142,721 .70	12,992,599 .41	13,902,087 .33	14,875,271 .88	15,916,565 .91
Return on Sales	**2.18%**	**2.50%**	**2.89%**	**3.25%**	**3.60%**

Based on the above computation for return on sales, the business is performing well since the annual income is increasing. The income increased to 3.60% from year 1 to year 5 even though there are withdrawals occurred. This net income may increase more in the future years.

b. Return on Assets

- It measures the productivity of a company's assets.
- It indicates how the firm's management will have used the assets under its control to generate income.
- Return on asset's formula is net income divided by average total assets.

	Year 1	Year 2	Year 3	Year 4	Year 5
Net Income	P 264,647. 72	P 324,811. 49	P 402,440.8 3	P 483,804.9 9	P 573,063.9 3

/ Average Total Assets	2,383,831.41	2,403,956.05	2,422,023.84	2,458,804.06	2,584,502.48
Return on Assets	**11.10%**	**13.51%**	**16.62%**	**19.68%**	**22.17%**

Based on the above computation for return on assets, the assets of the business were properly used to generate profit. It increased in the succeeding years after the first year but may also decrease because of idle cash and drawings.

c. Return on Equity

- It measures management's ability to recover cost of capital.
- It shows a measure of the effectiveness with which partner funds have been invested.
- Return on equity's formula is net income divided by equity.

	Year 1	Year 2	Year 3	Year 4	Year 5
Net Income	P 264,647.72	P 324,811.49	P 402,440.83	P 483,804.99	P 573,063.93
/ Equity	1,429,032.70	1,253,844.20	1,156,285.05	1,140,090.05	1,213,154.00
Return on Equity	**18.52%**	**25.91%**	**34.80%**	**42.44%**	**47.24%**

2. Payback Period

- It is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows generated by the investment.
- It measures the ability of the business to recover the investments contributed by the capitalists.
- Net cash inflow is net income plus depreciation.
- Payback period's formula is investment divided by net cash flow.
- Initial investment is P 1,250,000.

Year	Net Cash Inflow	Recovery of Investment	Payback Period
1	P 313,296.60	P 313,296.60	1

2	373,460.37	373,460.37	1
3	451,089.71	451,089.71	1
4	532,453.87	112,153.32	0.21
5	621,712.81		
Total		P 1,250,000.00	3.21

Based on the computation, the business is acceptable or feasible because the payback period is 3.21 year

1.17. Corporate Social Responsibility

Knowing that Marikina is flood prone area, Namit Bento & Bilao Food Store will participate the tree planting program conducted by Department of Environment and Natural Resources (DENR) – National Capital Region (NCR as part of Corporate Social Responsibility (CSR). Planting trees is recognized worldwide as a direct climate solution intervention in urban and rural areas. It helps lower carbon emissions, protects vulnerable communities, and even contributes to well-being to reconnect with nature.

D. References

https://www.scribd.com/document/343559214/Marikina-City-Waste-Management-Office?fbclid=IwAR0dwvDE3hEFEzIHUJ3I1WwILFGw9S6Ur51l9qezslwLVpn2F8jOz7gE3As

https://www.fastcapital360.com/blog/restaurant-floor-plan/

https://www.facebook.com/messenger_media?thread_id=5594592230551317&attachment_id=444055744007243&message_id=mid.%24gABPgQIKQrxWIN6d2zGCBmIjYsBRA

https://www.investopedia.com/terms/s/swot.asp

Saul McLeod (2018). Questionnaire: Definition, Examples, Design and Types. https://www.simplypsychology.org/questionnaires.html

ARTICLE 5

Information Technology Project 1

Title: ***Quezon City Unified Database System towards Physical and Development Planning***

Proponents: Dela Cruz, Nathalie April C., Gener, Edwin Brandon, Laureta, Rainheardth N., Rosales, John Anthony Z., Simbulan, Sheila Johana G.

Degree: Master of Business Administration

School Year: 20-20-

Adviser: Prof. Dr. Tabassam Raza

1.1. Introduction

This Quezon City Ecological Profile (variously called "Socio-Economic Profile", "Socio-Economic and Physical Profile", or "Socio-Ecological Profile") presents a number of important updates. First, this profile will be digital. All of the information will be on a centralized database. For one, the year 2020 is a national population census year and it is possible to make a direct correlation between the number of inhabitants and the actual conditions of their social, economic and physical environment at the time they were counted.

This reality has tremendous significance for planning and policy making. For another, a new Chapter on Risk Profile details various meteorological, geological, anthropogenic industrial and other hazards that cut across various sectors. This will serve as a vital resource for the city's climate change and disaster risk reduction efforts. And lastly, the year 2022 is an election year and it marks another term for this administration at all levels of political jurisdiction except at the barangay level. In a very real sense, the data compiled in this Ecological Profile represent to a significant degree the accomplishments of this administration from the previous terms and the effects and outcomes of said accomplishments. The current administration may also use the updated data to continuously craft programs that will have the effect of building and improving on the record from previous terms. This will ensure both continuity and progress.

This Ecological Profile is a comprehensive collection of information about practically every aspect of Quezon City. As such it should be open to a wide range of readership. Even casual visitors who happened to pick up a copy may find a wealth of detail between covers interesting enough to make them want to take a second look. Movers and migrants who, by chance or by choice, have taken up residence in the city may find in the Profile enough advantages of staying in Quezon City to make them decide to become permanent residents. Old-time residents may yet find new and unique features of their city and rekindle their sense of loyalty and pride of place.

This Profile comprises Geophysical, Demographic, Social Development, Economic, Environmental Management, Institutional, and Development Risk.

1.2. Rationale and Significance

The obvious objective of such an undertaking is to document the accomplishments of the stewardship of the Belmonte administration on one hand, and to generate updated socio-ecological information about the city and the succeeding administration, on the other. This updated Profile served as the main database for the crafting of the Comprehensive Development Plan, Local Development Investment Plan, QC Disaster Risk

Reduction Management Plan, and others which are major undertakings of the Belmonte administration.

While the Profile was prepared principally for use in planning and policy making by responsible officials, staff, and department of the city government, it can likewise be used by other readers for their own purposes. The compilation of data contains minimal analysis and interpretation to allow different users to apply their own analytical frameworks to extract the desired interpretations and conclusions from the same data sets. High school and undergraduate college students will find the Profile a rich resource for school reports and term papers. To graduate students the Profile can be an aide to identifying areas for in-depth investigations towards the production of theses and dissertations.

1.3. Project Requirement and Layout

A. Software

No.	Requirement	Specification	Quantity	Estimated Cost
1	Operating Systems	Windows 10 Pro	1	Php 8,000.00
2	Python Software	Multi-paradigm programming language. It's design philosophy emphasizes code readability	1	Open source
3	Kaspersky	Anti Virus & Total Network	1	Php 7,000.00

B. Hardware

No.	Requirement	Specification	Quantity	Estimated Cost

1	Cloud Server	Yearly subscription; key-value and document database that deliver single-digit millisecond performance at any scale; 1 TB, with built-in security, backup, and restore, write and read settings are 100%; 1 year term	1	Php 205,062.00
2	Desktop Computer Asus ROG GR8 II - 6GT044Z	Intel Core i7-7700 Processor, 16GB DDR4 Memory | 256GB SSD | NVIDIA GeForce GTX1060 6GB GDDR5 VRAM | 802.11AC WiFi + BT | HDMi Port | USB3.1 Port |	1	Php 77,975.00
3	Monitor		1	Php

		Lenovo ThinkVision S22e-19 21.5-inch		5,500.00
4	Lan Cable	CAT 6 20 M	1	Php 692.00
5	Internet Connection	% IT Dev't. Department	1	% IT Dev't. Department

C. Manpower

No.	Job Title	Job Description	Quantity	Estimated Cost
1	Senior Developer	Consultancy Service	1	Php 50,000.00 (monthly) = Php. 600,000.00 (annual)

1.4. Proposed Layout

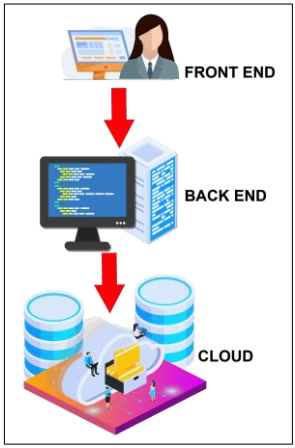

Figure 50. (from front end to cloud)

The encoders (front end) are using user interface or computer friendly. The inputted information will be needing a computer language called Python Software (back end). The information will be stored in a huge server or Cloud Server.

Figure 51. (CPDD Main Server)

All departments / offices are simultaneously working in the system. The CPDD Main Server can monitor the incoming information from different agencies. Information coming from different agencies will be evaluated by the computer.

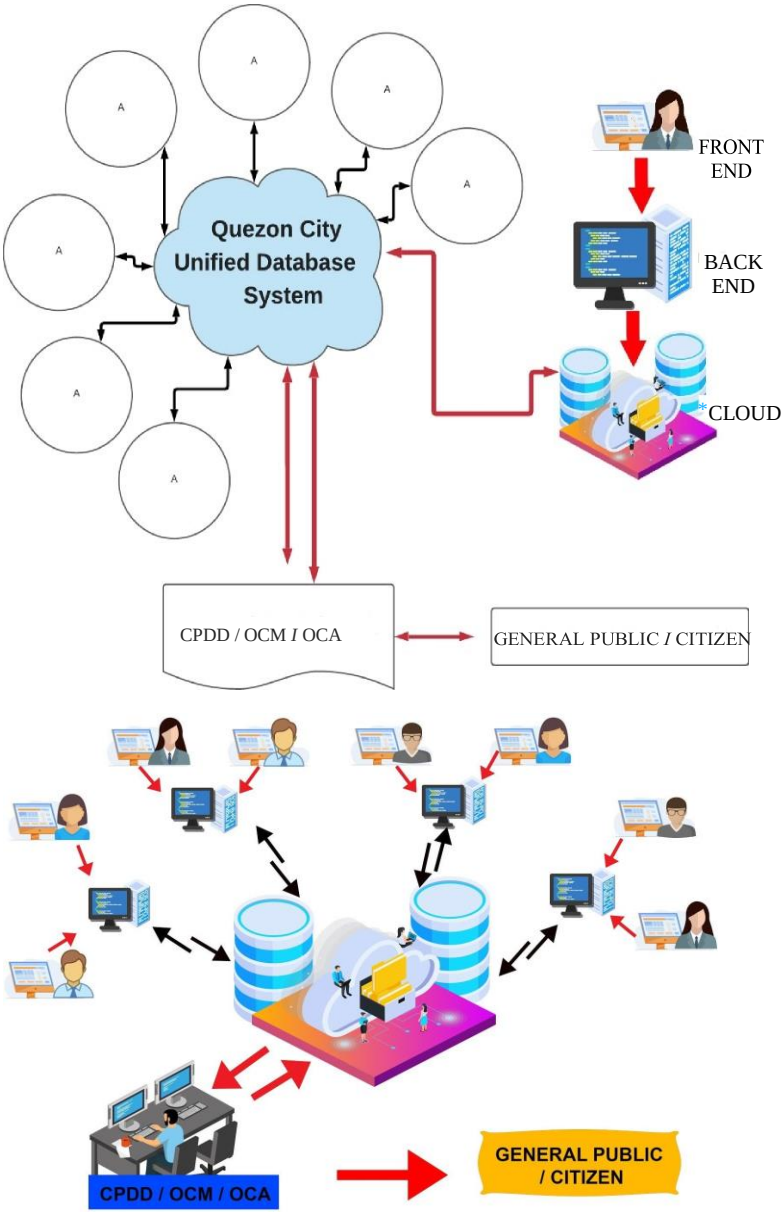

Figure 52. (QC-UDS)

The CPDD together with OCM and OCA can monitor the system. Each agency has access to the system. The system will

generate quarterly reports and will be available for the general public.

1.5. Proposed Plan and Activities

No	Task Name	Duration	Timeline	Activity
	Canvassing of resources and meeting with prospect suppliers	1 month	1st week of February 2021 - 1st week of March 2021	Looking for prospect suppliers and canvassing of each resources that will be needed
	Network Analysis, Product Development and Design	3 months	1st week of March 2021 - 1st week of June 2021	The prospect suppliers will develop the system based on targeted specification
	Procurement and delivery of resources	3 months	1st week of June 2021 - 1st week of September 2021	All government purchases must be in accordance with the Procurement Act. After the bidding, the supplier will now deliver the resources for demo.
	Product Demo	2 weeks	1st week of Sept. 2021 - 3rd week of	The supplier will demonstrate how to use the system.

			Sept. 2021	
	Network Cabling	1 week	4th week of Sept. 2021 - 1st week of Oct. 2021	Installation of network cables (% IT Dev.t. Department
	Configuration of Network related tools	2 weeks	1st week of Oct. 2021 - 3rd week of Oct. 2021	Configuring the capacity of the network cables.
	Network Testing and Debugging	1 month	4th week of Oct. 2021 - 4th week of November 2021	Removing viruses and networking debugging
	Trainings, Seminars, Workshops	1 month	1st week December 2021 - last week of December 2021	Conducting capacity development for the users of the system
	Initial Implementation	1 month	1st week of Jan. 2022 - last week of Jan. 2022	1st month dry run of the system
	Assessment and Evaluation	1 month	1st week of February 2022 - last week of Feb. 2022	The TWG will evaluate if the system is okay or if it will be needed for some adjustments
	Full Implementation	monthly	1st week of March 2022	The system is now available for use

1.6. Plan to Recover the Cost

The City Government allocated a supplemental budget with the total amount of Php 1,000,000.00 for this system which gives no reason to recover the expenses, provided the materials and

other resources are properly reflected with supporting requirements as part of liquidating.

1.7. Social Responsibility

This will be available for public use every quarter. It can be used for making future plans and projects of the city as a reference. Also, the researchers and other proponents can get if for free that can be used for educational purposes.

1.8. References

A. Books:

Quezon City Ecological Profile 2015

ARTICLE 6

Information Technology Project 2

Title: ***Value-Added Human Resource Management System for Spotify Accounts/Clients***

Proponents: Lysa Banquiray, Bo Ngoc Bui, Rhett Dela Cruz

Degree: Master of Business Administration

School Year: First Semester 2017-2018

Adviser: Prof. Dr. Tabassam Raza

1.1. Introduction

Human Resource Management is the process of recruitment and selecting employee, providing orientation and induction, training and development, assessment of employee (performance of appraisal) providing compensation and benefits, motivating, maintaining proper relations with employees and with trade unions, maintaining employees' safety, welfare and healthy measures in compliance with labor laws of the land (Whatishumanresource.com, N/A,).

Spotify, one of famous music application is supported by a few BPO companies in the Philippines. In this proposal, we will be adding some new features of Human Resources Management System for Spotify account in Concentrix Company (Tom Noda, 2014,).

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Spotify account in Concentrix has more than 300 employees, and is currently using Human Resources Management system. The tool includes the basic feature for staffing, forecasting, scheduling, and real-time adjustments. However, some available features need to be intensified to be able to quantify the performance of the employees, and at the same time to be able to be transparent to the employees (……).

With this proposed Value Added Human Resource Management System, attendance will be extensively monitored, criteria for performance rating will be transparent to employees, human resource planning and forecasting will also be intensified.

1.2. Rationale and Significance

The effects of the new value added features in Human Resources Management system can empower the organization to:

- Improve speed of answer and service levels through better schedule adherence and proactive intraday management.
- Empower employees by increasing workforce planning transparency and information distribution, through efficient and effective communication tools.
- Improve operational efficiency by developing optimal staffing schedules that make the most out of resources and incorporate all types of activities into the customer service operations.
- Reduce administration and manual handling of schedules, holiday bookings, shift trades and changes, with automatic and self-service tools.
- Reduce staff turnover by giving employees the ability to fit their work around their life – with preferences, availability and automatic request handling tools

1.3. Project Requirement and Layout

A. Software

Item	Requirement	Specification	Estimated Cost (Php)
1	Human Resource Management System	System master set up, configuration and implementation which includes activities such as: Set-up master file Education, family, employment, contact, compensation, bank	450,000.00

		account, awards, promotion, skills details Attendance monitoring Leave monitoring Scheduling	
2	Installation and Training	Module on employee master file, attendance monitoring, leave monitoring and performance rating. 24/7 access with scanning features and digitization with editing features Cost up to the implementation (does not include the salary of the IT)	50,000.00
	TOTAL		**500,000.00**

B. Hardware

Item	**Requirement**	**Specification**	**Quantity**	**Estimated Cost (Php)**
1	IBM Server	Use for archiving with internet network – router	1	100,000.00
2	PC Workstation	Intel Pentium Dual Core, 2GB DDR3, 500G high-end with editing features, super VGA colored monitor set at 800x600 resolution	1	80,000.00

Item	Requirement	Specification	Quantity	Estimated Cost (Php)
3	Printer	Colored high-end	1	15,000.00
4	Hub		1	5,000.00
5	Cable and Connectors			6,000.00
	TOTAL			**206,000.00**

C. Proposed technical staff for the installation, training and simulation

Function	No. of staff	Compensation
Assigned IT	1	25,000.00

D. Summary of Estimated Financial Requirements

Particulars	Amount
Estimated software cost with training and installation	500,000.00
Estimated hardware requirement	206,000.00
Estimated technical professional fee	25,000.00
TOTAL	**731,000.00**

1.4. Proposed Layout

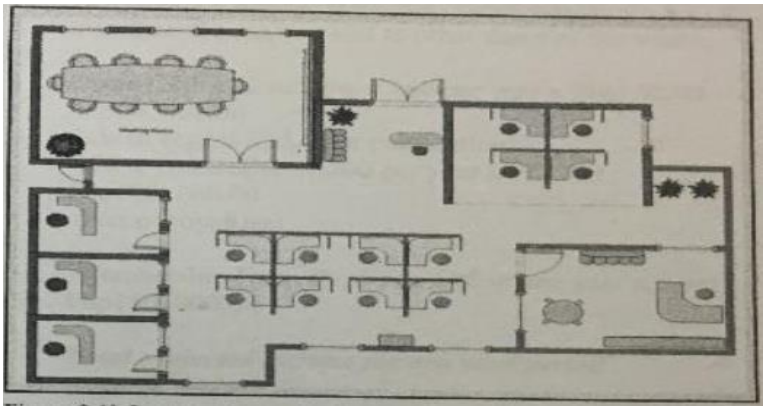


Figure 53. Proposed Layout

1.5. Proposed Plan and Activities

Timeline: Four (4) Months

I. Presentation of the proposed set-up with its prototype when needed

II. System Administration
- Set-up the system
- Coordinate with the Human Resource Manager for the details of the information to be set up
- If everything is in order, installation of the program

III. Training and sampling
- Coordinate with the HR personnel as the key user for designing of the training plan.
- Design the training plan.
- Execute the training on each module.

IV. Simulation
- Administer the testing of the design through Master Set up and uploading of data of employees needed in each module.

V. Evaluation of simulated data

- Check the system if the data is linked to different modules
- Check if the reports will generated is accurate

VI. Data Administration Subsystem

- Help users manage the database by providing
- Security Management
- Review of the Human Resource policies
- Hardware maintenance
- Software maintenance

1.6. Plan to Recover the Cost

Considering the cost of improving capabilities of the system and all the costs incurred in careful planning, pre-development, developments, implementation and evaluation of this this project proposal, there will be regular meetings (weekly) to review performance of the system and its benefits within the next 3 months. This will also identify system weaknesses for improvement and corrective action.

Average salary	20, 000 per employee
Average time lost per employee for confusion of schedule	10 minutes
Working days per month	22 days
Working hour per day	8 hours (480 minutes)

Computation to Recover Cost:

Salary of employee per day = average salary per month/Working days

= Php 20, 000/22 days
= Php 909.09

Cost for the 10 minutes time lost per employee

= Salary per day/Working hour
= Php 909.09/480 minutes
= Php 1.89 x 10
= Php 18.90

Money lost per day = Amount lost per employee x total number of employees

= Php 18.90 x 300

= Php 5, 670

- **If the value-added human resource management system is used, Spotify accounts can save P5,670 per day.**
- **Total month to recover the cost: P731,000/ P5,670 = 129 days or 4 months and 9 days.**

1.7. Social Responsibility

Corporate social responsibility is a natural part of our organization. The company wishes to work with integrity and transparency towards all its stakeholders, including shareholders, customers and employees.

These initiatives include ´green offices´ and measures in the field of sustainable mobility leading to a growing interest in HR System. HR's CSR projects can be translated into the three famous Ps: People, Planet and Profit:

HR recruits and assesses employees exclusively in terms of their potential and capacities for a specific job. We also do our utmost to create a positive working environment based on open and honest lines of communication, and free of discrimination, bullying and/or intimidation. HR aims to create a multicultural environment and currently employs people of different nationalities. Employees have access to all the available information within HR system to be transparent and build trust and loyalty.

1.8. References

Tom Noda, 2014, Spotify music streaming service aims to help curb piracy in PH, [Retrieved on September 16, 2018], https://newsbytes.ph/2014/04/09/spotify-music-streaming-service-aims-to-help-curb-piracy-in-ph/

WhatisHumanResource.com, What is Human Resource Management? - HRM Definitions - Functions - Objectives - Evolution of HRM from Personnel Management, [Retrieved on September, 29 2018], https://www.whatishumanresource.com/human-resource-management

ARTICLE 7

Information Technology Project 3

Title: ***Prowdooz: Virtual Organic Product Productions System***

Proponents: Wilven John C. Gadian, Dominador C. Pammittan, Ariel Q. Deinla, Lady Lee Cabriga

Degree: Master of Business Administration

School Year: First Semester 2017-2018

Adviser: Prof. Dr. Tabassam Raza

1.1. Introduction

Organic Farm products have not yet hit the mainstream market since they were recently re-introduced. Organic farming is a method of growing crops and/or raising livestock without the use of chemicals. The proponent brings in an innovative idea through creating a virtual production system for organic farming and trade, (Wachter, & Reganold, 2014). For the appreciation and potential business partnership with Philippine Tech-Suite, Inc. president, Ms. Lady Lee Cabriga.

This is a conception of a highly techno-commercial approach that puts high regard in Philanthropic business by providing this platform readily available and free for its beneficiaries. Key Implementers have been identified to put this idea into reality, Mr. Dominador Pamitan, Asst. Secretary of the Department of Agriculture, through its Organic team, National Organic Agriculture of the Philippines department, to identify 5000 organic farmers all over the country, with the help of Chairman of Oganiko CALABARZON, Mr. Ariel Deinla, to be the Pilot sector.

1.2. Rationale and Significance

Over the years, the government agencies and the organic farming economies have identified that it is not about farming and

trading that makes organic product under-stream. It is simply a battle of market awareness and campaign that hinders the potential growth on its demand. Filipino farmed products are well patronized outside the country while domestic patronage is very minimal or even low.

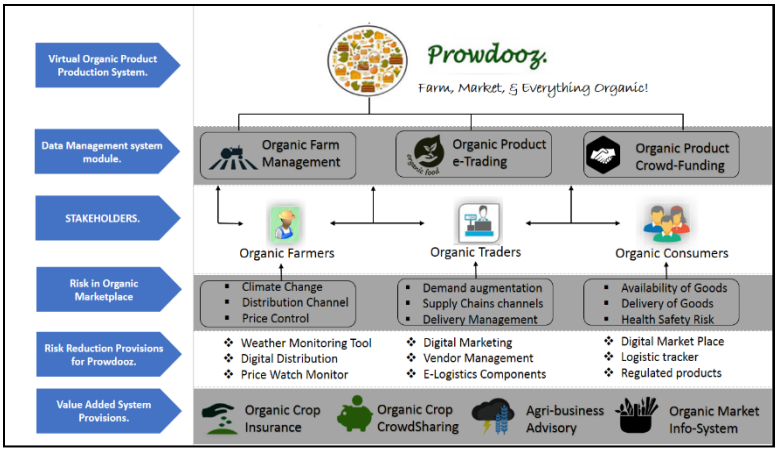
In the verge of climate change and some other risks, a collaborative approach between consumers, organic farmers, and traders must be done to offer business continuity and sustainable organic farmed products. This concept has been put in mind to further create a better community of healthier and natural goods exchange.

1.3. Project Requirement and Layout

Prowdooz *(prOHw-dooZz')* is a mobile based Virtual Organic Product Production System that will revolutionize Organic farming and Organic Farmed Products Industry to its mainstream level in the Philippines. This will bring in new approach in managing the farm, simplify farm to market business, and improve the lives of every organic farming practitioner in the Philippines.

The structure of the product includes Farm management tool, e-commerce, and crowdfunding community. Prowdooz was developed by Pink Lemon Innovative Solutions, Inc., a Web and Mobile Software publishing company based in Manila. Produce has developed its own concept in reinterpolating farming with the use of e-commerce, social media and online applications; thru well-nigh farming.

Focused on its founding mission of saving family farms through organic farming, Prowdooz produces a variety of organic foods nationwide.



1.3.1. Project Requirement

This project is a logic based algorithm system software that can manipulate and calculate data based on parameters set by general users, government pre-set values like price, etc., and Prowdooz system rules and filters. Development of this project will be outsourced and awarded to a Third-Party Developers for both Web and Mobile Applications.

The Application will be available for both Web and Mobile platform and will be designed considering our stakeholders and its functionalities. This will be outsourced and instead of investing in large amount of capital to purchase assets, we will then have this developed by a third-party developer following a set delivery milestone.

The functional requirements for this system include:

- The application shall be available to any browser without any interchange appearance.
- The application shall be available on the iOS™ or Android™ which can be downloaded from their respective app store.
- The system shall enable the customer to create an account, login to the system, and incorporate user's bank account or credit card into the system.

- The system shall have an encrypt security authentication, then can be user's finger print, voice authentication or facial authentication.
- Payment transaction shall be done initially via COD until such time it is capable in implementing on its own.
- The system shall also provide dashboard summary of user's transaction, farming activities.
- GPS shall enable to source for nearby suppliers, vendors, traders, consumers, etc.
- A domain host and web and mobile hosting shall be identified to established its source, with at least 500 GB to 1 TB cloud storage capabilities.
- The system shall enable displaying of news links from Department of Agriculture.
- The system's social component as one the main features shall enable link to Facebook™.
- The system shall enable optimization through interconnected links to social networking sites and email engines.
- The system shall not be downloaded heavily, graphics is set to minimum of 4 main colors only.
- User interface shall be scrolled down with dropdown menu bars only. There shall be no pop up window.
- Cookies and cache shall be minimal.
- 6-8 months development to BETA testing to actual release, unless sprint dev entails lesser cost.
- All transaction shall have a single repository of data hosted via cloud service so only updates shall be stored in the user's device.
- The system shall have tick options for insurance and mobile payment shall be considered and a third-party provider shall be linked initially until the app can manage that transaction independently.

1.4. Production Milestones for Websites (Cost, Equipment, and Timeline)

This is the production/development milestone in creating the web application.

PHASE	SPECIFICS TASK (MILESTONE)	COST	EQUIPMENT	TIMELINE (COMPLETION DATE)
1	Build Graphics layout	TO BE DISCUSSED (1-lot project estimated at around PHP 890,000 – 1,870,000) Bid to Infomax: Web App and Mobile App 1 lot development project	9 PC and accessories 5 web developers 4 mobile dev Internet Phone Domain hostings Server host (testing) Cloud Storage Cloud host for testing Web and Mobile device for testing	November 10 – December 14, 2017
2	Generate link framework			
3	Backend Framework (complete)			
4	Front end layout complete			January 5 – March 15, 2018
5	Build Modular functionalities			
6	Features completion			March 21, 2018
7	Integration of Modules			April 25, 2018
8	Main components testing			April 30, 2018
9	Features Testing			May 2, 2018
10	Modular testing			
11	BETA for upload			
12	Stress test			
13	Consultant (Evaluation)			June 6- 25, 2018
14	Contingency (Back job)			June 2018
15	Beta Release			July 28, 2017
16	User Accetance			September 15, 2017
17	Pilot release			September 20- Ovtober 20, 2018
18	Launch			November 15-20, 2018

Table Website Delivery Milestone

A. Required Setup

Note: the above Hardware and Software setup shall be the basis of bidding requirements for a third-party vendor. Failure to comply will be oust from the bid.

1.4.1. Software

A. Web Application:

SPECS	DETAILS	RATIONALE
Website URL	http://www.prowdooz.ph	**Easy to Memorize**
Website Type	Web Based Application	High Performance
Browser	Compatible to all	Chrome/Firefox/IE
Website technology	website hosting/Cloud storage	Commonly used
Web Version	WEB 3.0	New Trend
Programming language	JAVA and/or HTML5	Light in up/downloading

B. Mobile Application:

SPECS	DETAILS	RATIONALE
App Agent Name	prowdooz.ph	Easy to recall
Version	Prowdooz v1.0.1	----
Upgrade Schedule	Annual	TBA
Hotfixes	Available	schedule (TBA)
App Type	Mobile Application	High Performance
OS compatibility	Available	Android™/iOS™/Windows™
Version compatibility	Available	TBA
In Memory	Available (LOW)	TBA

1.4.2. Hardware

Note: Initially, we rely on the outsource provider with all the hardware and software requirement. While these are in place, we are to fully utilize their capacity. For our operation here are the estimated hardware required for building capacity.

1.4.3. Proposed Project Development

QTY	PERSONNEL	ROLE	COMPENSATION
5	Developers	Web Dev	Estimated at 26,000-34,000/month
4	Developers	Mobile Dev	Estimated at 26,000-34,000/month
1	QA Analyst	QA/Testing	Estimated at 26,000-34,000/month
1	Project Manager	Project Dev Management	Estimated at 36,000-40,000/month
	Total		1 lot cost estimate via Infomax Solutions Inc. at **PHP 2,504,000.00**

1.4.4. Summary of Estimated Financial Requirements

Product production cost (Outsourced Service)			
PARTICULARS	**PRICE/ BUDGET**	**QTY**	**TOTAL COST**
Website Development	PHP 1,080,000	1	PHP 1,080,000.00
Mobile App Development	PHP 1,080,000	1	PHP 1,080,000.00
Domain Hosting	PHP 25,000	1 year	PHP 25,000.00
Cloud Hosting	PHP 95,000	500GB-1TB with Fail-over service	PHP 95,000.00
Web hosting	PHP 52,000	1 year	PHP 52,000.00
QA testing	PhP 194, 000		PHP 194, 000.00
Support and Maintenance	PHP 172,000	1	PHP 172,000.00
TOTAL INVESTMENT NEEDED			**PHP 2,504,000.00**

1.5. Proposed Layout (proof of concept deliverables)

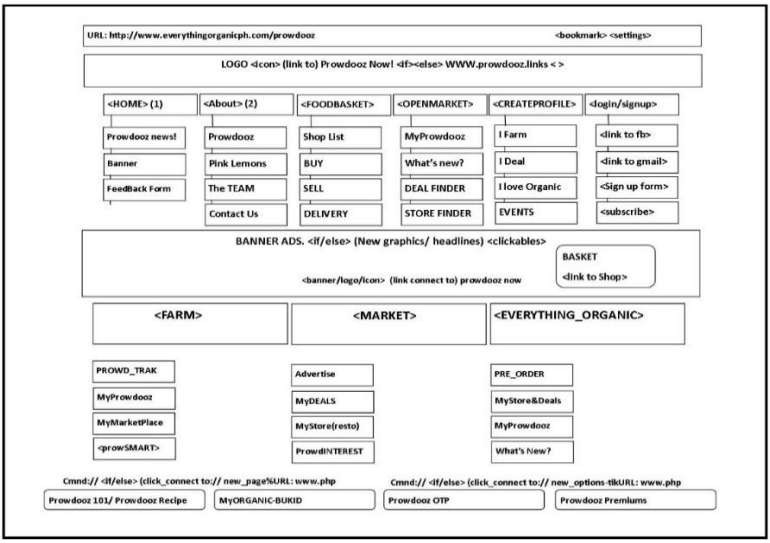


Figure: Web and Mobile Application Controller

This describes the general web and mobile based process and general usability framework. This will be the lay-out of the user interface. As you can see, this design is generally based on all the feature of Prowdooz.

1.6. Proposed Plan and Activities

A. Presentation of the proposed set-up with its prototype when needed.

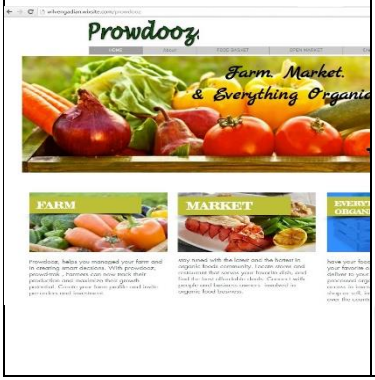
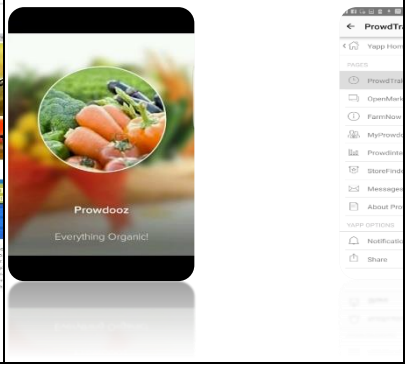
Web Application	Mobile Application
	

Figure 54. Proposed set up with its prototype

B. System Administration

1st level	Prowdooz Sys-Ad that monitors integration System Integration and Policy setting. • Network Admin Support – Ensures Interconnectivity and net speed reliability
2nd Level	Outsourced developers as their after sales support for bug fixes and maintenance for 3 years. • HelpDesk support: aids in receiving queries and quick response and risk mitigation support.

C. Training and sampling

The Web and Mobile application is designed to be user friendly and does not require trainings and seminars. For Pilot project, The enablement will be in partnership with NOAP and the department of Agriculture handling the Organic Farming and Business Industry. A series of presentation to Identified stakeholders and free trials will be in place.

1.7. Plan to Recover the Cost

A. User Size and Acquisition Strategies.

"BOTTOM_LINE: We need to convert apps download and site usage to profit (in PhP)."

1st Quarter after Product Launch		
Stage	**Deliverables**	**Schedule**
Initial Phase	3,000 farmer profile 500 Dealer profile 5,000 farmer and dealer partners DA, NOAP partnership for OTP engagement	(1-3) 1st month after launch (4) 2nd Month
2nd Phase	10,000 Consumer Profiles from prowdooz 5,000 consumers download from farmers key networks 5,000 consumers download from Dealers key networks	(#1) 1st Month after launch (2-3) 2nd Month
3rd Phase	1st 1,000 online transactions 1st 100 free advertisements	(1-2) 2nd-3rd Month

B. Pricing Policies

Role	**Function**	**Type**	**Cost**	**Profit gain**
Farmer	Crowdfunding	Profit Sharing	50% investor 48% Farmer 2% Prowdooz	2% profit share
Dealer	Advertisements	Cost per Click MCC services	P 12 per click P 7,000.00	Traffic, Reach, Services
Consumer	Buy,Sell, Invest	Online Transaction	P12 per transaction	Assigned Commission

C. ROI

User	Popu-lation	#Transaction	Amount	1 month (single Transaction) Accumulated return	1 year (single Transaction) Accumulated return

Farmer	3,000	2% comms	Ex. P350.00	1,050,000	P 12,600,000
		Logistics	P38 @NCR on top of freight cost	P114,000	P 1,368,000
Trader	500	Advertisements	P 12 per click	open	
		Managed Ads	P 7,000.00	P3,500,000	P 42,000,000
Consumer	10,000	Logistics	P38 @NCRon top of freight cost	P3,800,000	P 45,600,000
TOTAL 1 Month Single transaction				**P 8,464,000**	**P 101,568,000**
Total Investment				**PHP 2,504,000.00**	

1.8. Social Responsibility

Prowdooz was established as a concrete expression of deep concern of developing innovative solutions for improving the quality of life of every small to medium Filipino entrepreneurs and the community. We will always identify impending issues and come up with ways to alleviate the challenges. It is our duty and responsibility to create technology that will not only disrupt technology for profit, but rather interrupt traditional ways towards community growth.

We hereby commit that our services will not cause harm to the community and the environment. We intend to improve the lives of our employees and all shareholders, with more emphasis on the lives of farmers we work with.

1.9. References

Wachter, & Reganold, 2014), Organic Agricultural Production: Plants, [Retrieved on October 18, 2018], https://www.sciencedirect.com/topics/earth-and-planetary-sciences/organic-farming/

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