Economic viability: A bibliometric study in the Scopus database.

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Abstract —*The present work aimed to perform a detailed search on the methods applicable to the calculation of economic viability. The database used to develop this systematized literature review was Scopus Elsevier, accessed through the Capes Journal Portal. The study allowed to obtain a theoretical contribution to the accomplishment of the general objective of this dissertation. For each method, the resulting articles 3 were analysed and selected for presentation of a brief summary in order to exemplify the content available. It was possible to observe the state of the art of the theme, since the methodology allowed to identify the years with the highest frequency of periodical publication, and authors who published that subject, the countries with more engagement in this context, the types of mostly used publication and the areas of knowledge with the highest volume of published articles .It is also, possible to verify that the method tends to be increasingly applied, mainly within the area of Engineering, which was the area that stood out in this study ,due to its flexibility to apply it in different scenarios. It was also found that China is the country with the most indexed documents on this basis, according to this issue.*
Keywords— *Financial Methods; Economic viability; Bibliometric Study.*

I. INTRODUCTION

According to Capaz and Nogueira (2016), although energy efficiency projects have great benefits in reducing energy, it losses and contributes to the environment, only these factors are not enough to attract investors. Energy efficiency projects also need to be economically viable, so that an external investment can be better justified by those who intend to execute it. Thus, before choosing to raise investment for a particular project, it is necessary to calculate its economic viability.

According to Neumann (2017), the economic viability of a project is calculated through methods that aim at analysing data in comparison to the target for this particular project. That is different, companies have different goals and therefore can make use of different methods. What all companies have in common, regardless of the method used, is the need to analyse the economic efficiency of a particular project, by grouping all costs, the value obtained must be less than the estimated value that it can generate as revenues or benefits.

Based on this scenario, this study intends to address eight financial methods that are considered more compatible and recommended for economic feasibility analysis for projects such as the application of photovoltaic panels in a company located Macaé city / RJ - Brazil. For this purpose,concepts and a bibliometric study will be carried out regarding the selected methods, with the objective of analyzing and identifying the authors, periodicals, countries, type of publication and areas of knowledge with the greatest publications on financial methods. The aim of this study was to present three practical application studies for each method selected.

II. REVIEW OF LITERATURE

According to Jaffe et al. (2015, p.443), "when evaluating a project, we begin by determining the correct discount rate and use the cash flows counted to determine the Net Present Value." The author goes on to point out that the first measure to be taken when determining the flow of a company's cash flow is to analyse the activities related to its operation, that is, all the movement that composes its transactions involving products or services, according to the purpose of the For Marques (2007, p. 07), "the true strength of the company, which really matters for shareholders, is based on cash flow." The

author bases his assertion on the justification that the cash flow presents a great variety of information to be analysed, for example, payment deadlines in comparison with the payment deadlines, reduction in the volume of revenues, extrapolation of costs against the planned, among others. According to Sebrae (2018), cash flow is a "financial management instrument that projects for future periods all the inflows and outflows of the company's financial resources, indicating how the cash balance will be for the projected period". cash flow becomes a tool that allows for more conscious decisions that affect the overall outcome of the company. In the same way, cash flow can be segmented according to the information to be analysed, making the results more precise. For example, the returns on investment and the costs of obtaining resources are the interest paid, the interest dividends and the interest (CRCRJ, 2018) Marques (2007, p.82) states that "NPV is the difference between inflows and outflows of money from an investment brought at prices of the same date by the opportunity cost ". In practice, a basis for comparison needs to be defined so that a more in-depth analysis can be carried out and based on other available investment options. To carry out the calculation, attention must be paid to the use of a Minimum Attractiveness Rate - TMA or Capital Cost adequately. According to Camargo (2007, p.25), the minimum rate of attractiveness - TMA corresponds to the devaluation rate imposed on any future gain because it is not available at the time. Your choice requires great care, because the analysis of the same investment can show different results ". This statement reinforces the importance of using a set of indicators to carry out the analysis of the financial viability of any project in order to mitigate the risks of a partial and poorly-based analysis.

Chenço (2009) points out that in the case of discounted cash flow, for external factors and that may directly interfere with their future results, such as the country's economic situation or even at the global level. This means that not always a project with good NPV - Net Present Value or Internal Rate of Return will be, in fact, good investment. In order for the investor to be able to protect himself from the risks that cause incorrect decision making, the author gives tips such as, for example, asking about the reasons that lead the project to present a positive NPV; if it is possible to produce and distribute the product or service efficiently, and whether it will be possible to market the product or service at an attractive price to the final consumer. Regarding the discount rate, Jaffe et al. (2015, p. 139), states that "conceptually, the discount rate of a risky project is the return that can be expected to be earned on a financial asset of comparable risk." That is, discount rate is the rate used so that the following portions of the cash flow are deducted.

These three instruments are related to each other, as affirmed by Chenço (2009, p. 113), when stressing that "present value, discount rate and equivalence of cash flows are absolutely interconnected concepts."

The Internal Rate of Return (IRR) central importance in the decision-making process. Jaffe et al. (2015, p.143) state that "as a general rule, IRR is the rate that makes the NPV of the project zero." This method has as main objective to gather the maximum information to facilitate the analysis of the investor, taking into account internal aspects of the project in question and focusing its analysis on the issue that has the greatest impact on the overall economic viability: the expected cash flow. According to Gitman (2010) the Internal Rate of Return is composed by the discount rate at which the NPV - Net Present Value is equal to zero, since it reaches the same value of the initial investment as the investment opportunity in question. In practice, knowing the IRR of the project has as purpose to compare this percentage with the interest rates offered by the market, arriving at the conclusion that it is a profitable investment or not (Jaen, 2009) Jaffe et al. (2015) states that Payback is a way to focus attention only on the projects that interest the company, according to its estimated term of return. That is, if the company expects to work with a maximum return of three years, it can discard projects that have a return in term and analyse in greater detail only those that meet the established requirement. Chenço (2009) makes a comparison between the use of Payback and NPV for the analysis of investments, stating that the former is more suitable for projects with higher risk involved, since the latter does not take into account the time aspect of the investment. When you talk about Payback, your analysis can still be segmented according to the type of analysis you want to do, which in the case of this method can be classified as Simple Payback and Discounted Payback. According to Fapan (2018), Simple Payback is the attainment of the point at which the net related income is equal to the total amount of the investment previously made.

Jáno Payback Discounting the amounts received in the form of net income are then counted so that they can be compared to the initial investment volume, according to the analysis method used. "Another method used to evaluate projects is the so-called ILL. It is the quotient of the present value of the future cash flows expected after the initial investment divided by the amount of the initial investment. "(JAFFE ET AL, 2015, p.154) The profitability index is used to evaluate capital budget projects. This considers the value of money at current time, and can be used at the beginning for the selection of projects under capital rationing conditions (GITMAN, 2010).

The analysis of the result obtained in the operation performed to find out the IL of the determined project is

quite simple, as stated by Bourdeux-Rego et al. (2013) by checking that the result is smaller, greater than or equal to 1. If it is less than 1, it means that the investor will at least get his investment back, and will have a return proportional to how much greater than 1 is the result. If the IL is equal to 1, the investor should know that he will have his investment recovered, however, at the same rate as was initially required. However, if the IL is less than 1, it means that there will be no return of the invested amounts, meaning losses to the investor.

According to Romeiro Filho (2011) Return on Investment - ROI "measures the return on investment made and accounted for in months in which it will be amortized and then start to generate profits." The author stresses that the calculation of ROI can be done in several ways, according to the need for analysis. For example, by dividing net income by total assets, the investor will know the percentage of return offered by the company. Already dividing liquid by the invested amount, it will be possible to know the percentage value of investments. By doing this last operation in reverse, the investor will find the time it takes to recover the invested capital.

III. METHODOLOGY

The methodology selected for the elaboration of this work was the bibliometric study, since this one has the intention to present the scientific contributions on a certain theme or phenomenon (JUNG, 2004). It performs the state of the art through investigation or screening of the scientific production (OKUBO, 1970). In this way, a research will be carried out using key words related to eight different financial methods of economic analysis, having as base the Base Scopus, being accessed through the CAPES Platform. Financial methods are used to aid in the control and achievement of a company. This study intends to address eight financial methods that are most commonly used to analyse economic viability in companies, and thus, analyse them from the point of view of the application of the photovoltaic panels in a company located in the municipality of Macaé / RJ. For this purpose, concepts and a bibliometric study will be carried out regarding the selected methods.

The model used is the one proposed by Costa (2010), which is divided into six steps. The definition of the sample of the research, the research in the sample, the identification of the periodicals and of the authors with the greatest number of publications on the subject, a survey of the production chronology, identifying cycles of higher production and the selection of articles for composition of the "starting nucleus" for the bibliographical research. In this scenario, the objective is to analyze and identify the authors, periodicals, countries, type of publication and areas of knowledge in a large number of publications about eight financial methods.

The aim was to present three practical applications of the studied theme for each selected method.

3.1 Regarding the purpose

Concerning technical procedures, this is a theoretical-conceptual article, exploratory in nature and approach to qualitative research, inspired by the method, suggested by Costa (2010), to carry out the systematized literature review.

3.2 As to the methods

The work will follow six proposed steps: definition of the sample of the research, use of the keywords in the research of the samples, identification of the journals with the largest number of articles published on the theme, to carry out the identification of the authors with the greatest number of publications, the chronology of production is lifted, so that the cycles of greater production are identified. Finally, the articles are selected for the composition of the "starting nucleus" for the bibliographic research to be carried out. The database used was Scopus Elsevier, accessed in January of 2018, through the Portal of Periodicals of Capes. Exclusion filters were not used so that the document range of the area found was larger. The search criterion were established for the purpose of broadening the publications on the eight financial methods chosen. Table 1 shows the results obtained in the research.

Table.1: Keywords

Method	Keywords	Results
Valor Presente Líquido – VPL	*"Net" AND "Present" AND "Value"*	17.187
Taxa Interna de Retorno – TIR	*"Internal" AND "Rate" AND "of" AND "Return"*	4.610
Índice de Lucratividade – IL	*"Profitability" AND "Index"*	2.797
Payback Simples	*"Simple" AND "Payback"*	769
Payback descontado	*"Discounted" AND "Payback"*	304
Taxa Mínima de Atratividade - TMA	*"minimum" AND "attractiveness" AND "rate"*	55
Fluxo de Caixa	*"Cash" AND "Flow"*	14.521
Retorno sobre Investimento _ ROI	*"Return" AND "on" AND "Investment"*	35.152

IV. RESULTS AND DISCUSSION

In this stage, the documents were analysed and a sample of articles was designed for each of the eight methods, and of these samples, three will be presented in brief summary formats. These were considered by the

author as the most relevant on the topics, since they are the most cited according to the Scopus data base. Thus, using this nucleus, graphs are presented here containing these publications, insofar as it relates to the quantity of publications per year, which authors published on the topic, where are the origins of the articles, as well as their affiliations. The amounts of publications by country and by area are also shown, presenting those that are highlighted

4.1 Net Present Value – VPL

For this method, the words "Net" AND "Present" AND "Value" were used as search terms, returning a total of 17,187 results.

4.1.1 Year of publication

The data contained in figure 1, illustrated below, demonstrate through graphic the frequency between 2000-2018.
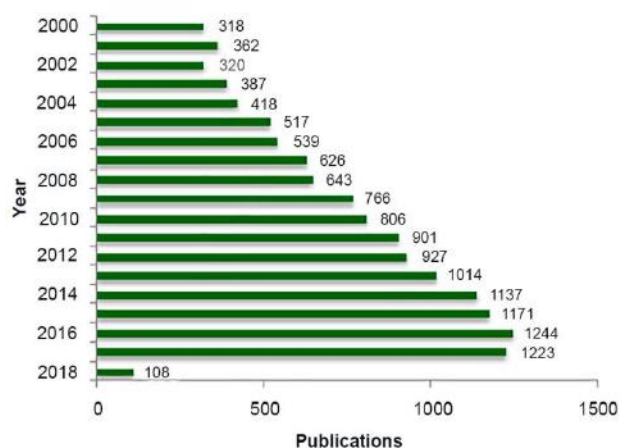
Figure 1 Graph of frequency of publications per year in the period 2000-2018
Source: Adapted from Scopus (2018).

It is possible to observe that, as of 2003, there was a progression in the publication values. The year 2017 is the one with the highest volume of publication, while the year 2018 presents 108 articles published until the date of the research.

4.1.2 Authors who published on the subject

The data contained in Figure 2, illustrated below, demonstrate through the graphic the authors with the highest frequency of publications per year in the period 2000-2018ch.
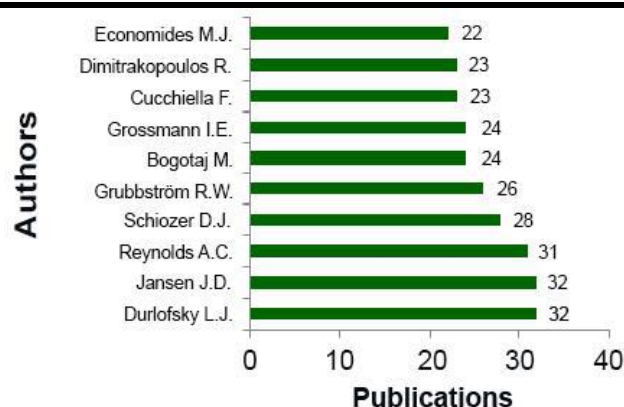

Figure 2 Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018)

It can be verified with the image that among the authors who publish more on the subject, stand out Durlofsky L.J. and Jansen J.D., with 32 publications.

4.1.3 Source of publication

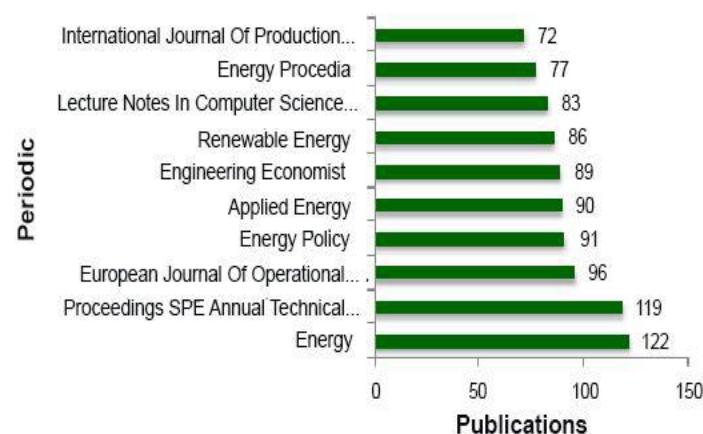The data contained in Figure 3, illustrated below, demonstrate through the graphic.

Figure 3 Graph of journals with higher frequency of publication
Source: Adapted from Scopus (2018)

4.1.4 Affiliation

The data contained in Figure 4, illustrated below, demonstrate the most frequently affiliated frequently published.

Figure 4 Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

4.1.5 Number of publication by country

The data contained in Figure 5, illustrated below, demonstrate the most frequently published countries through the graphic.
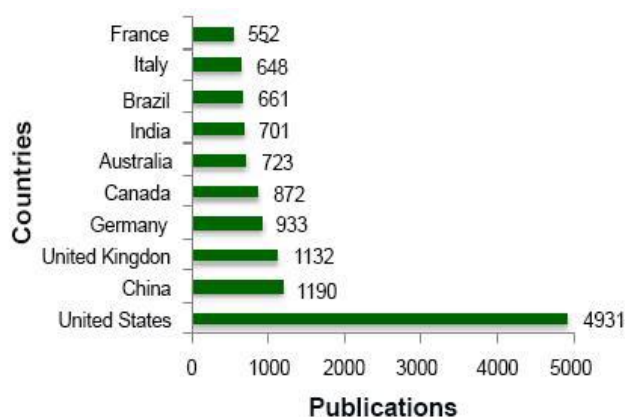

Figure 5 Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

As shown in the image, the United States continues to lead among the countries that publish on the financial method in question, with 4,931 publications, far above the others, such as China (1,190), United Kingdom (1,132) and Germany (933).

4.1.6 Number of publication by areas

The data contained in Figure 6, illustrated below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication.
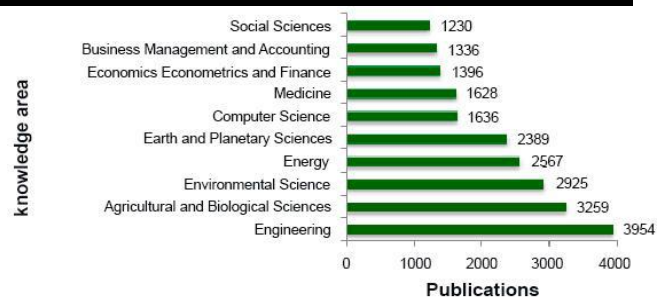

Figure 6 Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

Among the areas that can be seen, we highlight Engineering, Agriculture and Biological Sciences and Environmental Sciences.

4.1.7 Analysis of articles

In Table 2 we present the articles selected as most relevant by the author, which were provided by the data base.

Table 2: Selected Articles for the Net Present Value Method - NPV

Title	Author	Year	Citations
Managerial discretion and optimal financing policies	STULZ, R.	1990	1105
Valuation and clean surplus accounting for operating and financial activities	FELTHAM G. A. et al.	1995	732
The effects of management buyouts on operating performance and value	KAPLAN, S.	1989	456
On the welfare significance of national product in a dynamic economy	WEITZMAN, M. L.	1976	365
A real option approach to renewable electricity generation in the Philippines	AGATON, C. B. et al.	2018	0

Source: Adapted from Scopus (2018)

Stulz (1990) examined the financing policies of a holding company owned by atomistic shareholders that did not observe cash flows or management investment decisions. It was observed that the administration receives investment benefits and invests as much as possible. Once the cash flow is very low, the author guides the financing of all projects net present positive value, thus, their claim will not be credible when cash outflow is really low. Consequently, management will be forced to invest very little when cash flow is low and should choose to invest more when it is high. Funding policies, by influencing resources under management's control, can reduce the costs of overinvestment.

Kaplan (1989) presented evidence of changes in operating results for a sample of 76 large management buyouts of public enterprises that were completed between 1980 and 1986. It was noted that in the three years following the purchase, these companies experienced increases in operating income (before depreciation) and a decrease in capital expenditures and increases in the cash flow. Thus, according to operational changes, the average increases in market value (adjusted for market returns) are 96% and 77% of the two months before the purchase announcement for the post-purchase sale. It has been noted that the evidence suggests that operational changes are due to improved incentives rather than layoffs or managerial exploitation of shareholders through inside information.

The authors evaluated the attractiveness of investing in renewable energy sources by continuing to use oil for electricity generation. The method used was the real options approach to analyze how the time of investment in renewable energy depends on the volatility of the price of diesel, the price of electricity and the externality for the use of oil. In their results, they presented a Net Present Value - NPV positive for investment in renewable energy. Under uncertainty in oil prices, dynamic optimization looks at how it expects or delays investment in renewable energy in losses. Reducing the local price of electricity and incorporating negative externalities favors investment in renewable energy over continued use of oil for electricity generation. They concluded that the real options approach emphasizes flexibility when making investment decisions. In the latest energy regime in the Philippines, replacing renewable energy is a better option than continuing to import oil for electricity generation. Politics should aim to support investment in maize-sustainable energy sources, imposing externalities for the use of oil or reducing the price of electricity (AGATON et al, 2018)

4.2 Internal Return Rate - IRR
Using the keywords "Internal" AND "Rate" AND "of" AND "Return", search done for publications on the

Internal Rate of Return (IRR) method returned 4,610 results, which were incorporated into the database for the analysis.

4.2.1 Year of publications
The data contained in Figure 7, illustrated below, demonstrate through the graphic the frequency of publications per year in the period 2000-2018.
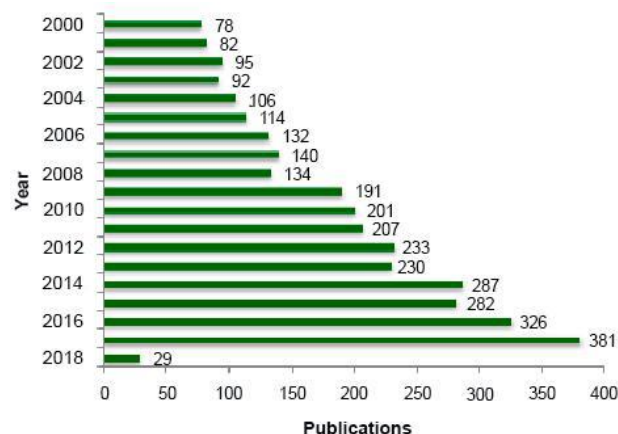

Figure 7 Graph of frequency of publications per year in the period 2000-2018.
Source: Adapted from Scopus (2018)

The same behaviour was observed previously, that is, the one with the greatest publication was 2017 and the year 2018 already presents 29 publications until the publication of this research.

4.2.2 Authors who published on the subject
The data contained in Figure 8, illustrated below, demonstrate through the graphic the authors with greater frequency of publication.
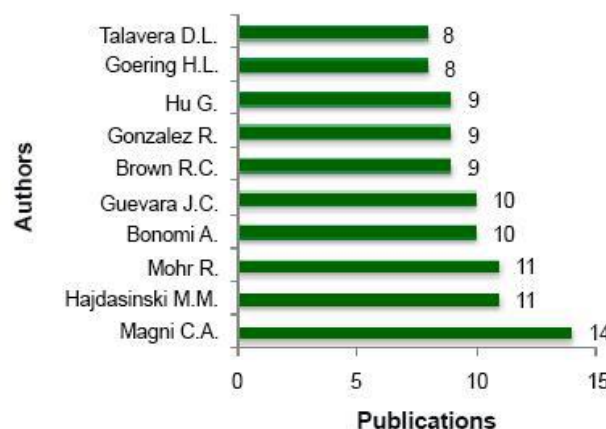

Figure 8: Graph of authors with higher frequency of publication.
Source: Adapted from Scopus (2018)

The data collected allow us to verify that, among the authors, we highlight Magni, CA with 14 articles

published, and Hajdasinski, MM and Mohr, R. with 11 publications each.

4.2.3 Source of publication

The data contained in Figure 9, illustrated below, demonstrate through THE GRAPHIC the periodicals with greater frequency of publication.
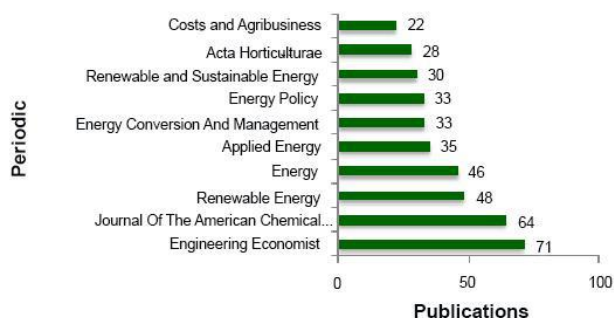

Figure 9: Graph of journals with higher frequency of publication
Source: Adapted from Scopus (2018)

In Figure 9, it is noticed that a Brazilian newspaper called Cost agrobusiness is among the list, however, it occupies the last position among the most published. The highlight is for the Engineering Economist, with 71 publications.

4.2.4 Affiliation

The data contained in Figure 10, illustrated below, demonstrate through the graphic the affiliations with the highest frequency of publication.
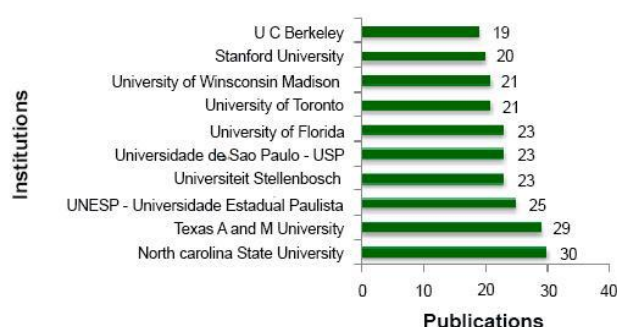

Figure 10. Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

It is possible to observe that there are two Brazilian universities in the list, being University of São Paulo (USP) with 23 publications and the State University of São Paulo (UNESP) with 25. However, the main ones are North Carolina State University with 30 publications and Texas A and M University with 29 published articles.

4.2.5 Number of publication by country

The data contained in Figure 11, illustrated below, show the most frequently published countries through the graphic.
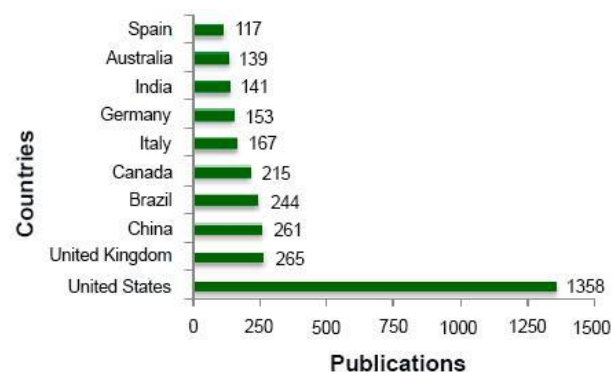

Figure 11: Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

The United States remains the leading among the other countries, common publication number well above all others, with 1,358 publications, while the second place (United Kingdom) has only 265 publications.

IV.2.6 Publication Number by Areas

The data contained in Figure 12, illustrated below, show the areas of knowledge with the highest frequency of publication through the graphic.
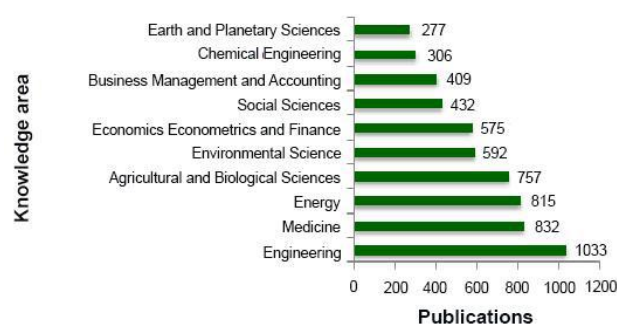

Figure 12: Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

The publications were grouped in 10 knowledge areas, as shown in Figure 12. The Engineering stands out with 1,038 published articles, followed by Medicine, with 832 publications and Energy with 815.

4.2.7 Analysis of articles

In Table 3 we present the articles selected as most relevant by the author provided by the database.

Table.3: Selected Articles for the Internal Rate of Return (IRR) Method

Title	Author	Year	Citatio

			ns
Combustion in swirling flows: A review	SYRED, N. et al.	1974	350
School subsidies for the poor: Evaluating the Mexican Progresa poverty program	SCHULTZ, T. P.	2004	316
Economic considerations and class size	KRUEGER, A. B.	2003	247
Migration incentives, migration types: the role of relative deprivation	STARK, O. et al.	1991	246
Some formal connections between economic values and yields and accounting numbers	PEASNELL, K. V.	1982	203

Source :*Scopus* (2018)

Schultz (2004) sought to evaluate how the Progress program, which offers low-income students in rural areas of Mexico, affected the number of enrolments made. Poor children residing in communities randomly selected to participate in the early phase of Progression compared to those residing in other (control) communities. The pre-program comparisons verify the design and the difference estimators of the double effect program effect on the treatment are calculated by grade and sex. Probity models are also estimated as to the probability of enrolment of a child, controlling the additional characteristics of the child, their parents, local schools and community, and the friction of the sample to assess the sensitivity of program estimates.

These estimates of the short-term effects of the program on enrolment are extrapolated to lifelong schooling and the gains of adults to approximate the internal rate of return on public school subsidies are likely to increase expected private salaries. A recent study found empirical evidence that the initial relative deprivation of families in their referenced village group plays a significant role in migration from Mexico to the US. Controlling the initial absolute income and expected income gains from migration, appropriation of households to participate of international migration was directly related to the relative deprivation of families. The rationale for the analysis is threefold. First, there is reason to expect that papal of relative deprivation is different between international migration and migration within a country, as explained below. Second, the sharp discontinuities in human capital returns between work of the country of origin and the host country may affect the

ability of families that differ in their human capital endowments to achieve income earning gains through international migration. Third, a relative deprivation approach to migration has important implications for developmental politics. In section I of the paper, they described the model of relative deprivation of migration and presented an illustration of the divergent political implications of a model of relative deprivation versus an absolute income model. In section II, a migration decision model is estimated and used to explore open and relative income motives for internal and international migration in a sample of rural Mexican households, as well as to test to what extent the labour market discontinuity shapes the choice of migrant destination. In Section III the conclusions were presented (STARK et al., 1991).

Peasnell (1982) presented a series of results concerning the relation between accounting and accounting values and income and economic values. Some of the results have appeared before in the literature and some are new. These were gathered together in a common analytical framework to demonstrate their formal and mathematical character. It is shown that the present value can be obtained by discounting almost all profit numbers; that the accounting rates of return define a discount function directly analogous to the structure of the term and the internal rate of return; and that the internal rate of return can be expressed as a linear sum weighted return rates.

4.3 Profitability Index – IL

Con the keywords "Profitability" AND "Index", the search returned 2,797 newspapers. These data will be used for the analyzes shown below.

4.3.1 Year of publications

The data contained in Figure 13, shown below, demonstrate through the graphic the frequency of publications in the period 2000-2018.
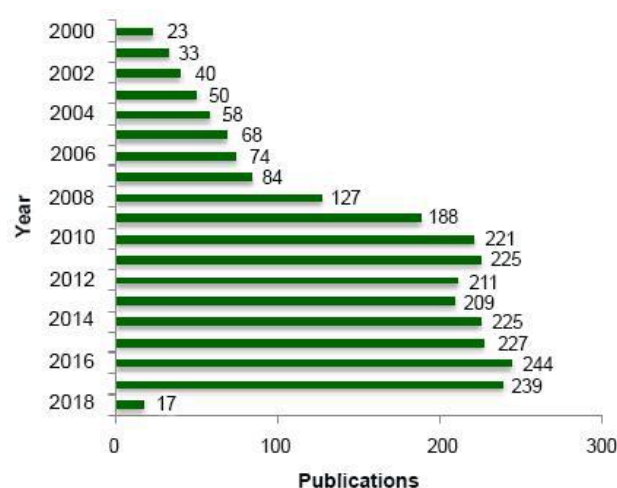
Figure 13. Graph of frequency of publications per year in the period 2000-2018
Source: Adapted from Scopus (2018)

It can be verified that from the year 2000 there was a gradual increase in the number of publications. However, the year 2016 presented a number of published articles greater than the year 2017, 244 and 239, respectively.

4.3.2 Authors who published on the subject

The data contained in Figure 14, illustrated below, demonstrate through the graphic the authors with the highest frequency of publication.

Figure 14. Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018)

According to the data presented in Figure 14, the most influential periodic in this theme is the Indian Journal of Agronomy with 31 publications, followed by the Expert Systems with Application, with 27, and Journal of Dairy Science, with 24

4.3.3 Membership

The data contained in Figure 15, illustrated below, demonstrate through the graph the most frequently published affiliations.
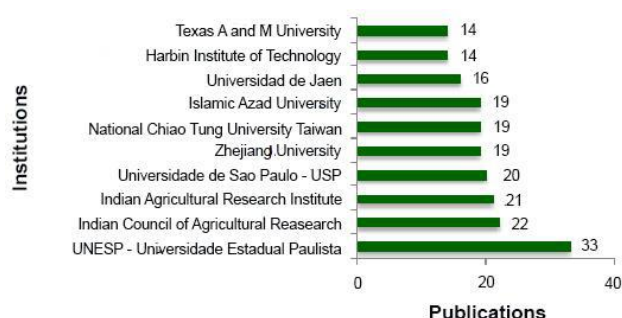

Figure 15: Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

A significant point of the data presented in Figure 15 is that the State University of São Paulo (UNESP) is the highlight among the institutions that study and publish on the Profitability Index (IL) method, after which two Indian institutions, the Indian Council of Agricultural Research an Indian Agricultural Research Institute.

4.3.4 Number of publication by country

The data contained in Figure 16, illustrated below, demonstrate through the graphic the countries with the highest frequency of publication.
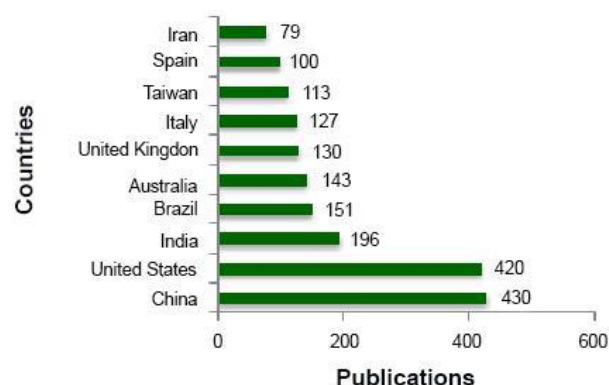

Figure 16. Chart of the most frequently published countries
Source: Adapted from Scopus (2018)

The data show that Brazil is once again among the leading countries provided by the database, fourth place after China (430), the United States (420), and China (430). India (196).

4.3.5 Publication Number by Areas

The data contained in Figure 17, illustrated below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication
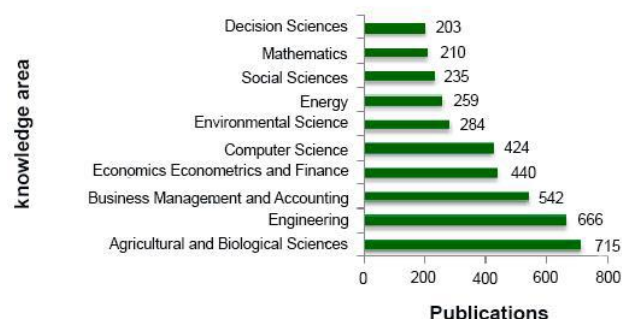

Figure 17. Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

As can be analysed, the areas of knowledge that published the most were: Agriculture and Biological

Sciences with 715 publications, Engineering with 666 and Management and Accounting with 542.

4.3.6 Analysis of articles

In Table 4 are presented the articles selected as most relevant by the author provided by the database in the Lucratively - IL method.

Table.4: Selected Articles for the Profitability - IL Method

Title	Author	Year	Citations
Customer satisfaction, productivity, and profitability: Differences between goods and services	ANDERSON, E. W. et al.	1997	558
The impact of culture and governance on corporate social reporting	HANIFFA, R. M. et al.	2005	348
Annual report readability, current earnings, and earnings persistence	LI, F.	2008	294
Associations between corporate characteristics and disclosure levels in annual reports: A meta-analysis	AHMED, K. et al.	1999	264
The determinants of voluntary financial disclosure by swiss listed companies	RAFFOURNIER, B.	1995	237

Source: Adapted from Scopus (2018)

In order to investigate whether there are conditions of exchange between customer satisfaction and productivity, a school of thought is analysed that argues that customer satisfaction and productivity are compatible, since improvements in customer satisfaction can reduce time and effort to commit returns, rework, guarantees, and complaint management, while reducing the cost of making future transactions. Importantly, increasing customer satisfaction can increase costs as it often requires efforts to improve product attributes or product

design. A useful conceptual framework is developed to address these contradictory points of view. (Anderson, EW et al.) The model predicts that customer satisfaction and productivity are less likely to be compatible when: 1) customer satisfaction is relatively more dependent on personalization, the degree to which the company's supply is reliable, standardized and free from disabilities; and 2) when it is expensive to provide high levels of customization and standardization simultaneously. The central feature of this database is the set of customer satisfaction indexes provided by the Swedish Customer Satisfaction Barometer (SCSB). The SCSB provides a uniform set of comparable company performance measures based on the customer and provides a unique opportunity to test the hypotheses of the study. The findings indicate that the association between changes in customer satisfaction and changes in productivity is positive for goods but negative for services. In addition, while customer satisfaction and productivity are positively associated with ROI for goods and services, the interaction between the two is positive for goods but significantly less for services. Taken together, the results suggest support for the contention that compensation is most provable for services. Thus, concurrent attempts to increase customer satisfaction and productivity are likely to be more challenging in these industries. The findings should provide motivation for future research on the nature of customer satisfaction and productivity, as well as appropriate ethical strategies for each. (HANIFFA, R. M. ET AL.) It is worth noting that this is a problem that is not only important today but will certainly become even more important in the future. As service growth continues and global markets become increasingly competitive, the importance of customer satisfaction will also increase. In order to compete in such a world, companies must find the right balance between their efforts to compete efficiently and their efforts to compete competitively (Anderson et al., 1997) Since 1961, accounting researchers have investigated associations between corporate characteristics and disclosures in annual corporate reports. It was observed that the results consistently showed that company size and listing status were significantly associated with disclosure levels, while mixed results were found for leverage, profitability and size of the audit firm. The authors aimed to integrate previous disclosure studies and to identify the underlying factors that caused the apparent variation in results. (Anderson et al., 1997). The method used was the meta-analysis of 29 studies, so it was possible to confirm significant and positive relationships between levels of disclosure and corporate size, listing status and leverage. However, no significant associations were found between the corporate profitability or the size of the audit firm, with aggregate levels of disclosure. As a conclusion, this

study also found that, in addition to the sampling error, the results are driven by differences in the construction of the dissemination index, differences in the definition of the explanatory variables, and differences in search configurations (AHMED ET AL, 1999).

Raffournier (1995) aimed to relate the extent of disclosure in the annual reports of Swiss companies, in order to list the possible determinants that represent the political and agency costs. The object of the study was chosen because, prior to the implementation of the new company law on 1 July 1992, Switzerland's disclosure requirements were very low, so that most of the content of the annual report could be considered as voluntary disclosure. The sample included the 1991 annual report of 161 industrial and commercial companies. Where the extent of disclosure is measured by an index based on information the disclosure of which is required by the four and seventh directives of the European Union. Independent variables are measures of firm size, leverage, profitability, ownership structure, internationality, auditor size, percentage of fixed assets and type of industry. Relationships are evaluated using univariate analyses and multiple regressions. The main result is that size and internationality play an important role in the dissemination of companies, large and internationally diversified companies that tend to disclose more information than purely domestic companies. (RAFFOURNIER, 1995).

4.4 Simple Payback

For this method, periodic searches were performed using key words "Simple" AND "Payback", which ended up returning 769 results. With this information, different perspectives, such as the year of publications, most published authors, origin of publications, among others, will be analysed from this topic.

4.4.1 Year of publications

The data contained in Figure 18, illustrated below, demonstrate through the graphic the frequency of publications per year in the period 2000-2018
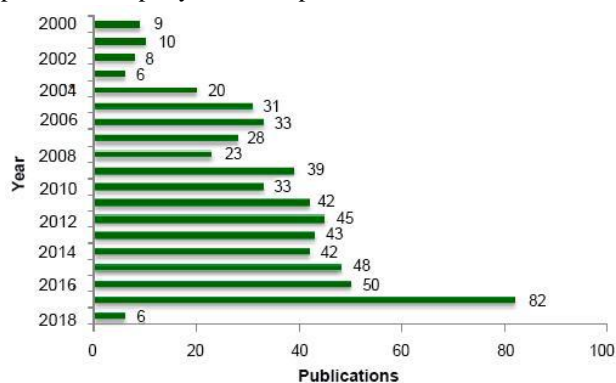

Figure 18. Graph of frequency of publications per year in the period 2000-2018

It should be noted that there is a growing trend in publications. The largest anode publication was 2017, with 82 publications, and the year 2018 is already with 6 scientific works until the moment of the realization of this research

4.4.2 Authors who published on the subject

The data contained in Figure 19, illustrated below, demonstrate through the graphic the authors with the highest frequency of publication.
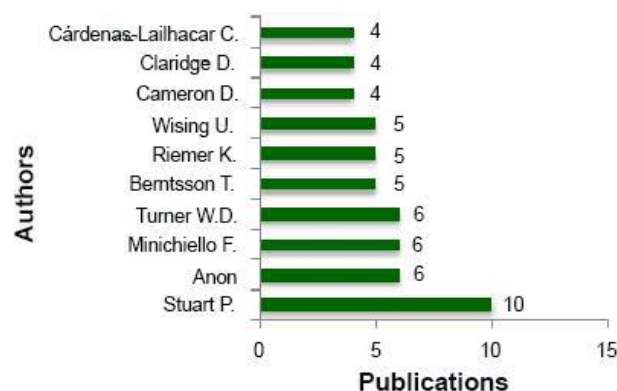

Figure 19: Graph of authors with higher frequency of publication

It is already a great highlight for the writer Stuart P., who has 10 articles published, still 40% ahead of the second, third and fourth post that have only 6 publications each.

4.4.3 Source of publication

The data contained in Figure 20, illustrated below, demonstrate through the graphic the periodicals with the highest frequency of publication.
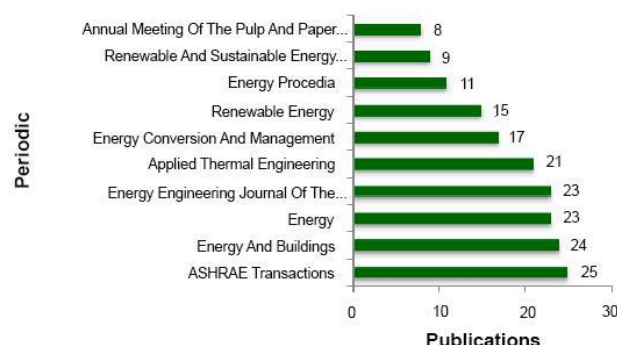

Figure 20. Graph of periodicals with higher frequency of publication

The 10 most relevant journals provided by the database are shown in Figure 29. Most published was

ASHRAE Transaction (25), followed by Energy and Buildings (24).

4.4.4 Affiliation

The data contained in Figure 21, shown below, demonstrate through the graphic the affiliations with the highest frequency of publication.
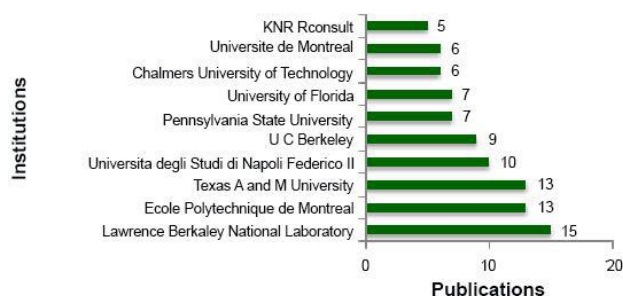

Figure 21. Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

The institution that most republished on this financial method was Lawrence Berkeley National Laboratory, with 15 scientific papers, followed by EcolePolytechnique de Montreal, with 13 and Texas A and M University with the same number.

4.4.5 Number of publication by country

The data contained in Figure 22, illustrated below, demonstrate through the graphic the countries with the highest frequency of publication.
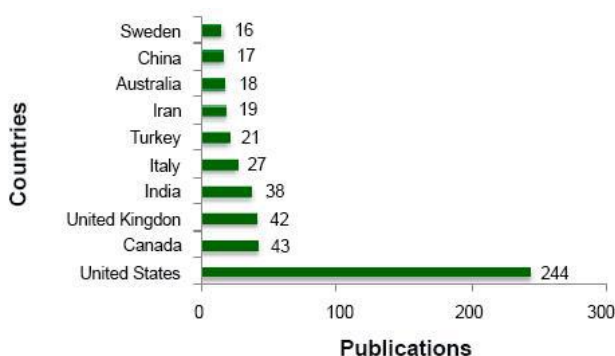

Figure 22. Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

The United States appears as absolute leader in the publications, responsible for 244 of them. In second place is Canada with 43 publications and third with 42.

4.4.6 Number of publications per area

The data contained in Figure 23, illustrated below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication
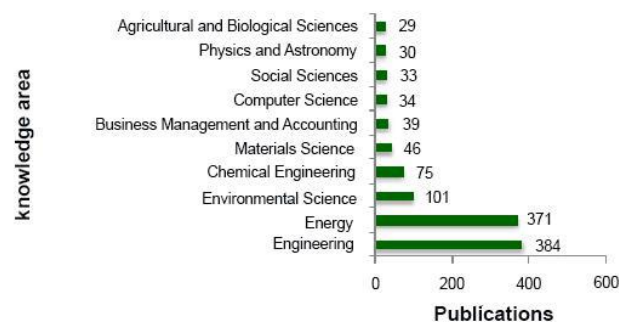

Figure 23. Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

It can be noted, Figure 23, that the most published areas of knowledge were Engineering, with 384 publications and Energy with 371, well in front of the third place, Environmental Sciences, which had only 101 publications.

4.4.7 Analysis of articles

In Table 5 we present the articles selected as most relevant by the author provided by the database.

Table.5: Selected Articles for the Simple Payback Method

Title	Author	Year	Citations
Improved performance and stability in quantum dot solar cells through band alignment engineering	CHUANG et al.	2014	588
Simulink model for economic analysis and environmental impacts of a PV with diesel-battery system for remote villages	WIES et al.	2005	125
Cost of solar energy generated using PV panels	REHMAN et al.	2007	119
Dewatering of microalgal culture for biodiesel production: Exploring polymer flocculation and tangential flow filtration	DANQUAH et al.	2009	114
Intelligent speed adaptation: Accident savings and cost-benefit analysis	CARSTEN et al.	2005	109

Source: *Scopus* (2018)

Chuang et al. (2014) observed that the processing of solutions is promising for the realization of low cost, large areas, flexible and light photovoltaic devices with short and high power return time specific. But in contrast, solar cells based on generally reported organic, inorganic and hybrid materials suffered from low air stability, requiring an inert atmosphere processing environment or high temperature processing, which increases the complexities and manufacturing costs. According to Rehman et al. (2007), the manufacturing conditions low temperature and good atmospheric stability remains a great technical challenge, which can be approached, as demonstrated by the authors, with the development of ZnO / PbS quantum solar cells processed in ambient temperature solution. It was observed that by including the alignment of the quantum dots layers through the use of different ligand treatments, a certified efficiency of 8.55% was obtained. In addition, the performance of encapsulated devices remains unchanged for over 150 days of airborne storage. This material system introduces a new approach to the goal of stable high performance solar cells, compatible with simple solution and deposition processes on flexible substrates. Wies et al. (2005) sought to discuss the economic analysis and the environmental impacts of the integration of a Photovoltaic Matrix (PV) in energy systems diesel-electric to remote villages. Thus, MATLAB Simulink was used to combine the load with the demand and to distribute the electrical production between the PV and the diesel-electric generator. Since the economical part of the model calculates the fuel consumed, the kilowatt hour obtained per gallon of fuel supplied and the total cost of the fuel. The simulations were based on a real system in the Alaskan remote community of Lime Village were performed for three cases: 1) diesel only; 2) diesel battery; and 3) PV with diesel battery using a period of one year.The simulation results were used to calculate the energy return, the simple return time for the PV module and the avoided CO2, NOx and PM costs. The post-simulation analysis includes the comparison of the results with those expected by the Hybrid Optimization Model for Electric Renewable Energies (HOMER). The life cycle cost (LCC) and the air emissions results from the Simulink model were comparable to those predicted by HOMER. (WIES et al., 2005) Rehman et al. (2007) used the daily mean of solar radiation and data from the sun to study the distribution and solar duration over Saudi Arabia. The analysis also included the production of renewable energy and the economic evaluation of a power plant connected to the photovoltaic network of 5 MW installed for electricity generation. The study used the RetScreen software for energy production and economic evaluation. In their results, it was verified that global solar radiation varies between a minimum of 1.63 MWh /

m2 year-1 in Tabuk and a maximum of 2.56 MWh / m2 year-1 in Bisha, while the average remained as 2.06MWh / m2 year-1. The duration of sunlight ranged from 7.4 to 9.4 h with a mean of 8.89 h. It has also been found that the specific yield varies from 211.5 to 319.0 kWh / m 2, with a mean of 260.83 kWh / m 2. The renewable energy produced each year from the 5 MWp installed capacity plant ranged from 8196 to 12,360MWh while the average remained at 10,077 MWh / year-1. Economic indicators, such as the internal rate of return, the simple recovery period, the positive cash flows, the net present value, the annual economy of the life cycle, the profitability index and the cost of producing renewable energy showed that Bishah was the best site for Power Plant Development based on PV and Tabuk the worst. From an environmental point of view, it has been found that approximately 8182 tonnes of greenhouse gases are prevented from entering the local atmosphere every year. (REHMAN et al., 2007)

4.5 Discounted Payback

For the performance of the searches related to the PaybackDescontado method, the keywords "Discounted" AND "Payback", return as data were used 304 results.

4.5.1 Year of publications

The data contained in Figure 24, illustrated below, demonstrate through the graphic the frequency of publications per year in the period 2000-2018.
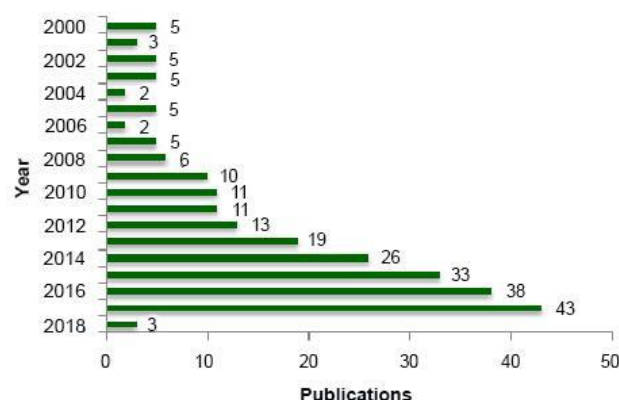

Figure 24. Graph of frequency of publications per year in the period from 200-2018
Source: Adapted from Scopus (2018).

Following the trend presented in the other methods already analyzed, the anode 2017 was the year that obtained the largest publication in the temporal cut, with 43 publications, followed by the year 2016 with 38. The year 2018 already presents published works (3) as can be seen in Figure 24.

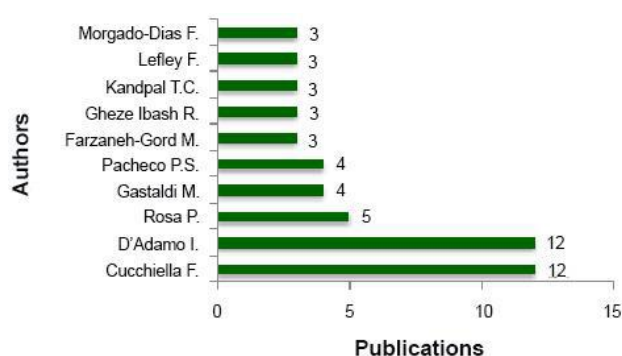### 4.5.2 Authors with higher frequency of publication.

Figure 25: Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018))

Analyzing the main authors represented in Figure 25, it can be seen that Cucchiella, F. and D'Adamo, I. stand out among the others because they have more than two thirds of the list, Rosa, P., which presents only 5 published works on 12.

4.5.3 Source of publication

The data contained in Figure 26, illustrated below, demonstrate through the graphic the most frequently published periodicals.
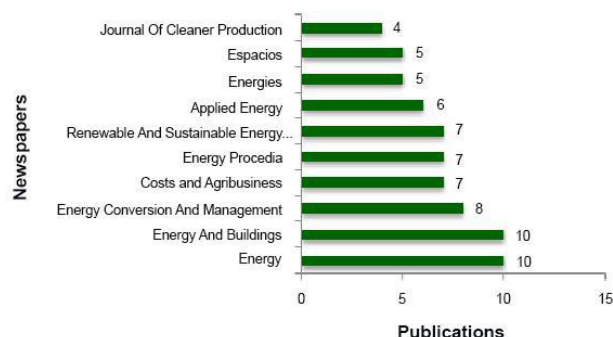

Figure 26: Graph of journals with higher frequency of publication

The main journals presented as a result of the energy-related research data are Energy, Energy and Buildings and Energy Conversation and Management.

4.5.4 Affiliation

The data contained in Figure 27, illustrated below, demonstrate through the graphic the affiliations with the highest frequency of publication

Figure 27: Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

Figure 27 shows the institutions most engaged in the publications, being first, with 13 publications, the University of Gli Studi dell'Aquila. An interesting fact is that the University of São Paulo (USP) is among the 10 most relevant with 5 published articles.

4.5.5 Number of publication by country

The data contained in Figure 28, shown below, demonstrate through the graphic to the countries with the highest frequency of publication.
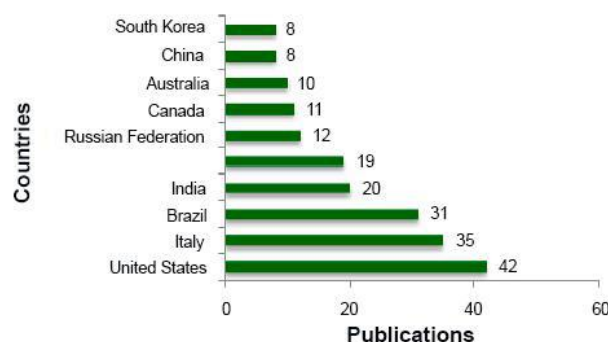

Figure 28: Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

Different from the pattern of most of the other methods investigated, in the discounted Payback method Brazil is in the list of the most influential countries, with 31 publications, being third only behind the United States, with 42 publications, and Italy with 31 publications.

4.5.6 Publication Number by Areas

The data contained in Figure 29, illustrated below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication.
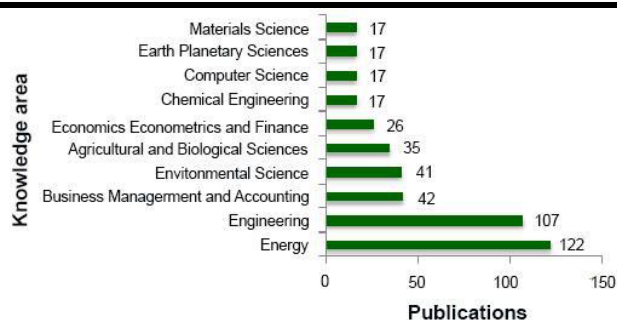
Figure 29: Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

As in the previous method, in the analysis of the method of Payback Descanted the areas of knowledge that lead the list of the most relevant is the Energy with 122 and Engineering with 107 publications.

4.5.7 Analysis of the articles
In Table 6 are presented the articles selected as most relevant by the author supplied by the base.

Table.6: Articles selected for the Discounted Payback Method

Title	Author	Year	Citations
Methodology for the design optimisation and the economic analysis of grid-connected photovoltaic systems	KORNELAKIS et al.	2009	54
Algal biofuel production for fuels and feed in a 100-ha facility: A comprehensive techno-economic analysis and life cycle assessment	BEAL et al.	2015	49
Environmental and economic analysis of building integrated photovoltaic systems in Italian regions	CUCCHIELLA et al.	2015	38
Hybrid PV and solar-thermal systems for domestic heat	HERRANDO et al.	2016	36

and power provision in the UK: Techno-economic considerations			
Techno-economic analysis of solar photovoltaic power plant for garment zone of Jaipur city	CHANDEL et al.	2014	35

Source: *Scopus* (2018)

Kornelakis et al. (2009) presented a methodology for the optimization of the project and the economic analysis of systems connected to the photovoltaic network (PVGCSs). The purpose of this study was to suggest, from a list of commercially available system devices, the number and type of optimized system devices and optimum details of PV module installation details, so that the total net economic benefit achieved during the period operating system is maximized. The decision variables included in the optimization process were the ideal number and type of photovoltaic modules and DC / AC converters, the optimum angle of inclination of the photovoltaic modules, the ideal arrangement of the photovoltaic modules within the available installation area and the ideal distribution of the PV Modules between DC / AC converters. The economic viability of the resulting PVGCS configuration was exploited by the net present value, the return period of counted, and the internal rate of return methods. The proposed method was applied to the ideal design of a PVGCS interconnected to the electrical grid of an island with significant potential of solar irradiation. (KORNELAKIS ET AL. (2009) There are many factors that contribute to the definition of the economic and environmental performance of investments in solar energy, such as annual irradiation, consumer consumption, tariff incentive system, energy portfolio, emissions produced by photovoltaic system, nominal power of the modules modules, available income of the investor, availability of surface for the installation of photovoltaic panels and mission, which characterize the project (environmental maximization, economic maximization or self-sufficiency of the system during the first year) (KORNELAKIS ET AL Cucchiella et al. (2015) developed a study in Italy, taking into consideration and estimating the economic profitability and the environmental impact of these systems, first at the provincial scale and then at the regional scale, to delineate the general characteristics that were not caused by a single c Indicators used include the following: net present value (NPV), internal rate of return(IRR), discounted payback period (DPbP), aggregate cost-benefit ratio

(BCr), and carbon dioxide emission reduction (ERcd). The final objective of the work was to define the number of photovoltaic (PV) systems needed to achieve the objective of producing renewable energy in the above configurations. Where an appropriate overall scenario was examined to achieve the objective, as well as the implementation of the total wealth generated by this framework and the reduction of CO2 emissions resulting from the implementation of this plan. The indicators used were the net present value per capita and the reduction of per capita carbon dioxide emissions. (CUCCHIELLA ET AL., 2015) Herrando et al. (2016) analyzed the potential and cost-effectiveness of a photovoltaic solar power plant to meet the demand for energy from clothing in Jaipur, India. In addition to estimating the energy demand of garment zoning for 2011 (2.21 MW), and the 2.5 MW solar photovoltaic power plant project was proposed, which requires about 13.14 aces of area of land. Noting the shortage and the cost of land near the city, a proposal for the plant outside Jaipur was also considered and compared to the option in place. For the internal rate of return of the photovoltaic solar on-site network (IRR) was 11.88%, the discount rate of NPV 10% was INR 119.52 million, single return operation was 7.73 years and the discounted payback period 10% was 15.53 years, while the IRR of the off-site energy system was 15.10%, the NPV was 249.78 million INR, the simple payback period was 6, And the discounted payback period was 10.14 years. The energy cost is Rs. 14.94 and Rs. 11.40 per kW / h for solar photovoltaic plants in the off-site locale, respectively, discount rate of 10%, which is quite attractive. (HERRANDO ET AL., 2016).

4.6 Minimum Attractiveness Rate

The keywords "minimum" AND "attractiveness" AND "rate" are used in the search for this method, returning 55 results.

4.6.1 Year of publications

The data contained in Figure 30, illustrated below, demonstrate through the graphic the frequency of publications per year in the period 2004-2018.
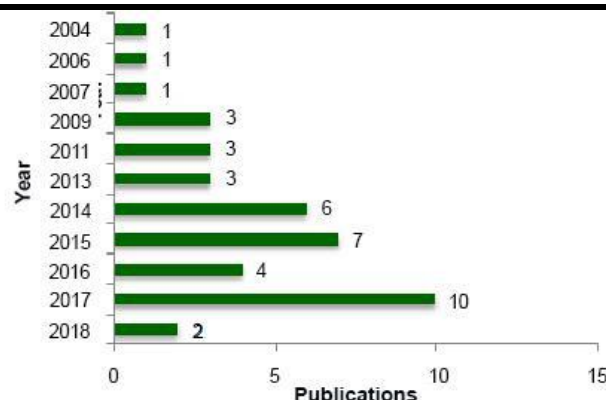

Figure 30: Graph of frequency of publications per year for the period 2004-2018
Source: Adapted from Scopus (2018)

As can be observed, the year of greatest publication, as expected, was 2017 with 10 articles, followed by 2015 with 7 publications.

4.6.2 Authors who published on the subject

The data contained in Figure 31, shown below, demonstrate through most frequently published authors.

Figure 31: Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018))

Pacheco, P., with 5 articles, followed by Vaz, F. N., with 4 publications, Pacoal, L. L. with 3 papers and Restle, J, also with 3 papers.

4.6.3 Source of publication

The data contained in Figure 32, illustrated below, demonstrate through the graphic the periodicals with the highest frequency of publication.
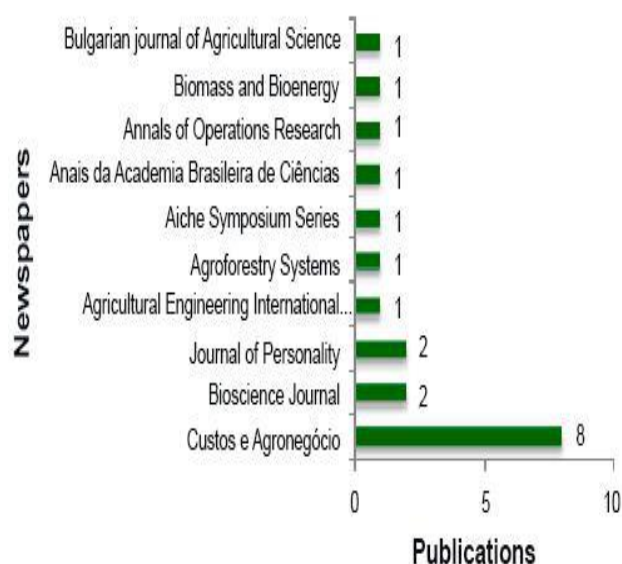
Figure 32: Graph of journals with higher frequency of publication
Source: Adapted from Scopus (2018)

Among the journals presented in Figure 32, two Brazilians stand out: Costs and Agribusiness, leading the list with 8 publications, and Annals of the Brazilian Academy with only 1.

4.6.4 Affiliation

The data contained in Figure 33, shown below, demonstrate through the graphic the affiliations most frequently published

Figure 33: Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

In terms of affiliation, Brazil again represents the majority of institutions that seek to study and publish on the topic, as can be seen in Figure 33.

4.6.5 Number of publication by country

The data contained in Figure 34, illustrated below, demonstrate through the countries with the highest frequency of publication.
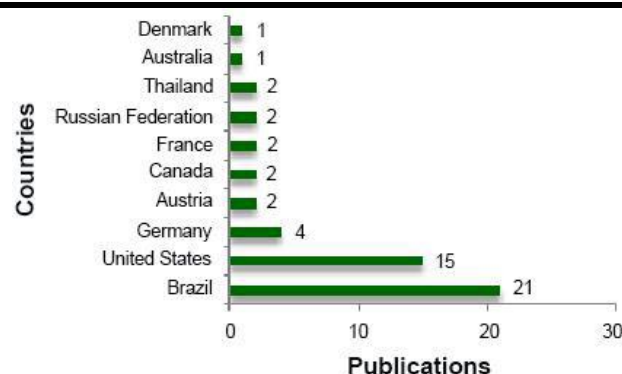

Figure 34: Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

Analyzing Figure 34, it is possible to identify that the United States ranks second, with 15 publications, followed by Germany with only.

4.6.6 Number of publication by areas

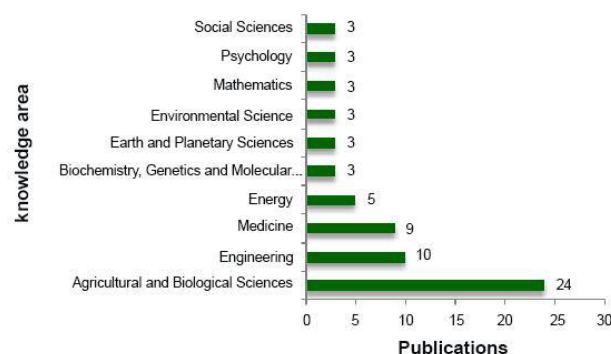The data contained in Figure 35, shown below, the areas of knowledge with the highest frequency of publication.

Figure 35: Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

It should be noted that the main knowledge area returned by the research data was Agriculture and Social Sciences, with 24 publications, followed by Engineering with 10 and Medicine with.

4.6.7 Analysis of the articles

In Table 7 the selected articles are presented more pertinent to the theme of the Minimum Attractiveness Rate method, returning works from the authors provided by the base research.

Table.7: Selected Articles for the Minimum Attraction Rate Method

Title	Author	Year	Citations
Electric energy production from swine deject: Analysis of financial feasibility with the use of monte carlo simulation for the implantation of bio-digester in Brazil	CATAPAN et al.	2015	4
Techno-economic assessment of a heat-integrated process for hydrogenated renewable diesel production from palm fatty acid distillate	KANTAMA et al.	2015	3
Methodology for the determination of optimum power of a Thermal Power Plant (TPP) by biogas from sanitary landfill	SILVA et al.	2017	2
Technical and economic study of a mobile system for extraction of eucalyptus essential oil	VIVAN et al.	2011	2
Stochastic processes and copula model applied in the economic evaluation for Brazilian oil fields projects	MARQUES et al.	2014	1

Source: *Scopus* (2018)

Catapan et al. (2015) aimed to use the technical analysis of investments, to determine the break-even point, in number of animals, to allow the implantation of bio-digesters for the generation of electric energy with the use of swine projects. As methods, interviews were carried out with final owners, analysis of cost sheets and budget control with suppliers for the cash flow project. Then, the deviation indicators were calculated and the Monte Carlo simulation was done to measure the sensitivity of the input parameters. The results of the research pointed out that the balance point is 1009 pigs. Considering the premises of the Monte Carlo Simulation considering that p (Net Present Value <0) = p (Internal Rate of Return <Minimum Attractiveness Tax) should be

a maximum of 0.20, it is suggested to implant bio-digester in properties with in at least 1075 pigs. Hydrogenated Diesel (HRD), which is defined as paraffinic hydrocarbon vegetable oil and animal fat, has received worldwide consideration with alternative diesel fuel. In this work, the production of DRH from palm oil fatty acid distillate (PFAD) was elaborated and a techno-economical evaluation of a heat integrated HRD production plantRD was attractive for investment with a VPN of 61.89 M $ (KANTAMA et al., 2015) .Silva et al. (2017) aimed at theoretically determining the electric power of LFG using the Maximum Net Benefit (MNB) methodology, taking into account the economic, demographic and regional aspects of the Inter-municipal Consortium of the Micro-region of Alto Sapucaí for Landfill (CIMASAS, as an acronym in Portuguese), located in the southern part of the state of Minas Gerais, Brazil. To this end, the prognosis for a 20-year period of household solid waste generation in this region has been estimated and quantified on the basis of population data in order to estimate LFG production and energy that can be generated. From this point, the ideal power for the power plant (TPP) by LFG was determined. The results indicated that the landfill in this region could produce 66,293,282 m3 of CH4 (with a maximum power of 997 kW in 2036) in twenty years and that there would be no economic viability to generate energy from the LFG, since the Net Present Value (NPV) it would not be positive. The population for this can achieve a minimum attractiveness rate (MAR) of 15% of 3,700,000 inhabitants under the conditions studied. Considering the Resolutions of the National Electric Energy Agency (ANEEL), it would be 339,000 inhabitants installed 440 kW capacity. In addition, the result of the CIMASAS case study demonstrated the applicability of the MNB methodology for determining the potency of TPP

4.7 Cash Flow

For the researches carried out on this method, the key words "Cash" AND "Flow" were used, which returned which formed the basis of data for the analyzes on this topic.

4.7.1 Year of the publications.

The data contained in Figure 36, illustrated below, demonstrate through graphic the frequency of publications per year in the 2000-2018.
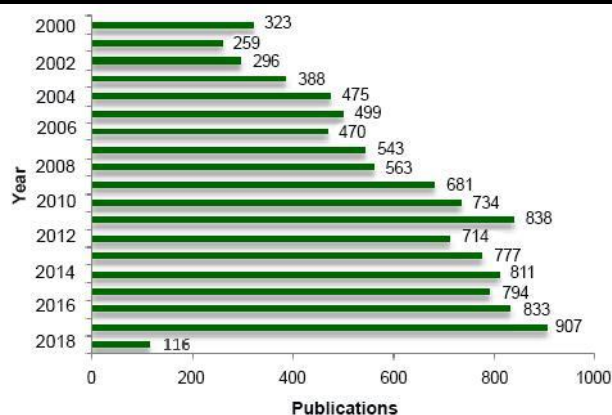
Figure 36: Graph of frequency of publications per year in the period 2000-2018
Source: Adapted from Scopus (2018)

Again, as can be seen in Figure 36, the year 2017 follows as the highest number of publications made, 907, followed by the year 211 with 838 publications. Although between the years 2001 and 2011 there has been an exponential decline of publications in this area, there was some stability from 2012, with reduced growth.

4.7.2 Authors who published on the subject

The data contained in Figure 37, illustrated below, demonstrate through the graphic the authors with the highest frequency of publication.
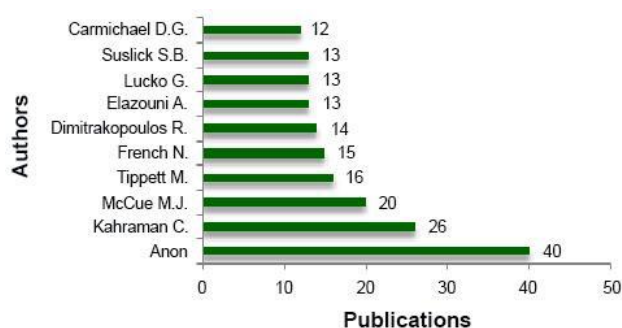

Figure 37: Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018)

In this methods the data returned a large number of works published the identification of the author, that is, anonymous publications. These represent a major part of the results, followed by Kahraman C. and McCue M.J., with 26 and 20 publications, respectively.

4.7.3 Source of Publication

The data contained in Figure 38, shown below, demonstrate through the graphic the most frequently published.
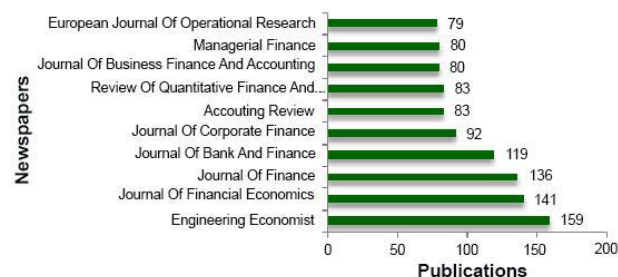

Figure 38: Graph of periodicals with higher frequency of publication
Source: Adapted from Scopus (2018)

Among the journals presented in Figure 38, the following stand out: Engineering Economist, Journal of Financial Ecnomics and Journal of Finance, with 159, 141 and 136 published works, respectively.

4.7.4 Affiliation

The data contained in Figure 39, illustrated below, demonstrate through the graphic the affiliations with greater frequency of publication.

New York University was the institution that most published about the method, resulting in 108 articles published.
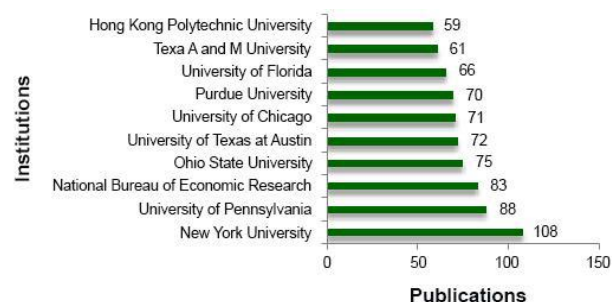

Figure 39: Graph of affiliations with higher frequency of publication
Source: Adapted from Scopus (2018)

4.7.5 Number of publication by country

The data contained in Figure 40, illustrated below, demonstrate through the graphic the countries with the highest frequency of publication.
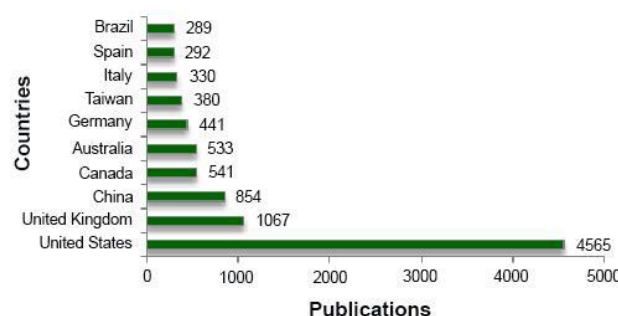
Figure 40: Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

The United States has more publication than the sum of the other Dalista countries, with 4,565. Brazil ranks tenth in the list of the most relevant countries, with 289 publications.

4.7.6 Publication Number by Areas

The data contained in Figure 41, shown below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication.
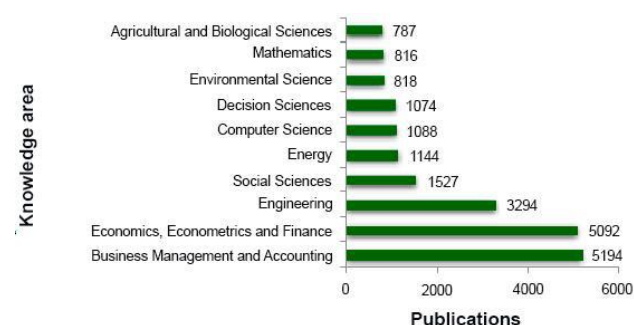

Figure 41: Graph of knowledge areas with the highest frequency of publication
Source: Adapted from Scopus (2018)

As can be seen in Figure 41, the most relevant publications related to the areas of Business, Management and Accounting, with 5,194 publications, and Economics Econometrics and Finance, with 5,092 published works.

4.7.7 Analysis of articles

The selected articles are presented in Table 8 as more relevant by the author provided by the basis for the Cash Flow method.

Table.8: Selected Articles for the Cash Flow Method

Title	Author	Year	Citations
Economic analysis of different supporting policies for the production of electrical energy by solar photovoltaics in western European Union countries	DUSONCHET et al.	2010	93
Techno-economic analysis of a wind-solar hybrid renewable energy	CHONG et al.	2011	91
system with rainwater collection feature for urban high-rise application			
Economic analysis of power generation from parabolic trough solar thermal plants for the Mediterranean region-A case study for the island of Cyprus	PULLIKKAS, A.	2009	83
Technical feasibility and financial analysis of hybrid wind-photovoltaic system with hydrogen storage for Cooma	SHAKYA et al.	2005	77
Optimization of photovoltaic penetration in distribution systems considering annual duration curve of solar irradiation	LIN et al.	2012	57

Source: Adapted from Scopus (2018)

Within several renewable energy technologies, photovoltaic (PV) energy today attracts considerable attention because of its potential to contribute a large share of renewable energy in the future. However, photovoltaic market development is undoubtedly dependent on the political support of any country. Dusonchet et al. (2010), after a brief analysis of the national PV support policies in the countries of the Western European Union (EU), carry out an economic analysis of the main support mechanisms implemented in the same countries, based on the calculation of the cash flow, (NPV) and the Internal Rate of Return (IRR). The analysis showed that in some situations support policies may be inconvenient for the owner of the PV-based generation system and that in many cases the differences between the implementation of the same policy in different countries can give rise to significantly different results . The analysis performed in this work could help in assessing the impact of photovoltaic energy policies in different member states of Western Europe, renewable

energy companies to identify potential photovoltaic markets and investigate the political landscape in Western EU countries. In the work of Pullikkas (2009), a study feasibility study was carried out to investigate whether the installation of parabolic solar thermal energy generation technology in the Mediterranean region is economically viable. The case study took into account the available solar potential for Cyprus, as well as all available data on the current Cyprus renewable energy policy, including the relevant feed-in tariff. In order to identify the least cost feasible option for the parabolic solar thermal plant, a parametric cost-benefit analysis was carried out through variable parameters, such as parabolic capacity through solar thermal energy, parabolic investment through solar thermal energy, hour operation, system price of carbon dioxide emissions trading, etc. For all of the above cases, the cost of the unit of electricity was estimated before taxes, as well as the cash flow, net present value, internal return rate and return period. The results indicated that, under certain conditions, these projects may be profitable

The penetration level of a photovoltaic (PV) system is often limited due to the violation of the voltage variation introduced by the large generation of intermittent power. Lin et al. (2012) discussed the use of an active energy reduction strategy to reduce the injection of photovoltaic energy during peak solar irradiation to avoid strain violation so that the PV penetration level of a distribution feeder can be increased to use fully to solar energy. The generation of photovoltaic energy was simulated according to the hourly data of solar irradiation and temperature provided by the meteorological agency.

By using the voltage control scheme proposed to limit the injection of photovoltaic energy into the study distribution feeder during periods of high solar irradiation, the total energy generation and the total energy delivered by the photovoltaic system over a period of one year are determined according to the annual solar radiation. The annual cash flow from sales of photovoltaic energy, the O & Mao cost over the life cycle of the system and the capital investment in the photovoltaic system were used to calculate the PV project's amortization years and net present value (NPV). With the voltage control proposed to execute partial generation of photovoltaic systems, the ideal installation capacity of photovoltaic systems could be determined by maximizing the net present value of the system so that a better cost-effectiveness of the PV project and a better energy utilization could be obtained

4.8 Return on the Investment – ROI

A research on the periodicals related to the Return on Investment method - ROI, used the set of keywords or key terms "Return" AND "on" AND "Investment", reaching 35,152 results.

4.8.1 Year of publications

The data contained in Figure 42, illustrated below, demonstrate through the graphic the frequency of publications per year in the period 2000-2018.
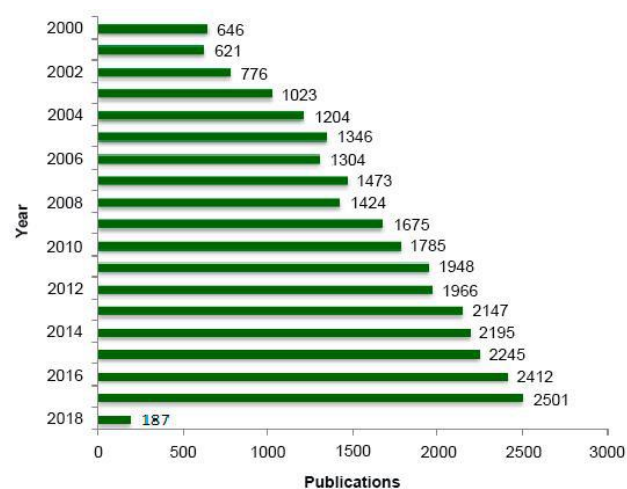

Figure 42: Graph of frequency of publications per year in the period 2000-2018
Source: Adapted from Scopus (2018)

As in the previous method, there is a gradual increase in the volume of publications over the years 2000 to 2018. The year that had less publications was 2001, and the one that had the most publications was 2017, 2018 presented 187 articles published until the current date of this search.

4.8.2 Authors who published on the topic

The data contained in Figure 43, illustrated below, demonstrate through the graphic the authors with the highest frequency of publication.
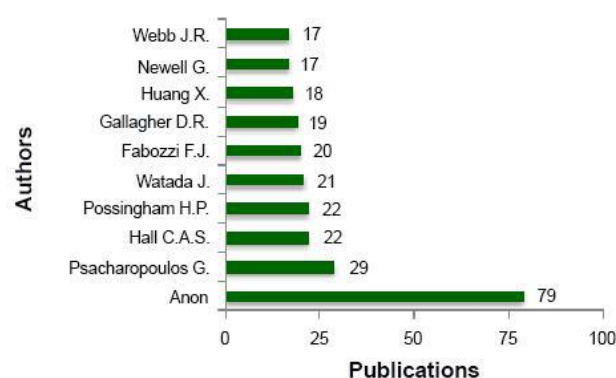

Figure 43: Graph of authors with higher frequency of publication
Source: Adapted from Scopus (2018)

In Figure 43 the most relevant authors given by the Scopus database are not found, of which 79 publications are by anonymous authors.

The identified author who most publishes is Psacharoulos G., with 29 publications, followed by Hall C. A. S.com 22.

4.8.3 Source of publication

The data contained in Figure 44, illustrated below, demonstrate through the graphic the periodicals with the highest frequency of publication

Figure 44: Graph of journals with higher frequency of publication
Source: Adapted from Scopus (2018)

The most relevant journals in the publication of this method in question, as can be seen in Figure 44, are the Journal of Banking and Finance and the Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics.

4.8.4 Affiliation

The data contained in Figure 45, illustrated below, demonstrate through the graphic the affiliations with the highest frequency of publication.
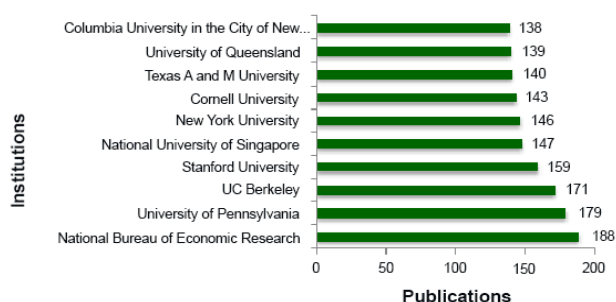

Figure 45: *Graph of affiliations with higher frequency of publication*
Source: Adapted from Scopus (2018)

Result, it can be seen in Figure 45 that the National Bureau of Economic Research has 188 publications, the University of Pennsylvania has 179 and UC Berkeley has 171 articles published.

4.8.5 Country publication number

The data contained in Figure 46, illustrated below, demonstrate through graphic the countries with the highest frequency of publication.
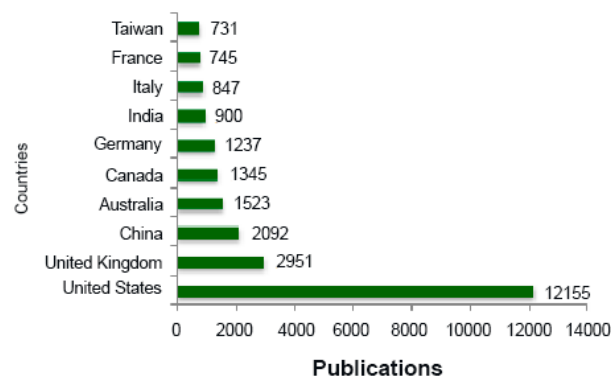

Figure 46: Graph of the countries with the highest frequency of publication
Source: Adapted from Scopus (2018)

As can be seen, the United States leads the list of countries with 12,155 published articles, followed by the United Kingdom (2,951), China (2,092), Australia (1,523) and Canada (1,345).

4.8.6 Number of publication by areas

The data contained in Figure 47, illustrated below, demonstrate through the graphic the areas of knowledge with the highest frequency of publication.

It is possible to analyze, through Figure 47, that the Economy, Econometrics and Finance area has the largest number of publications, with 9,468. In second place, we have Administration and Accounting, with 8,267 published in Engineering, with 7,645 publications.

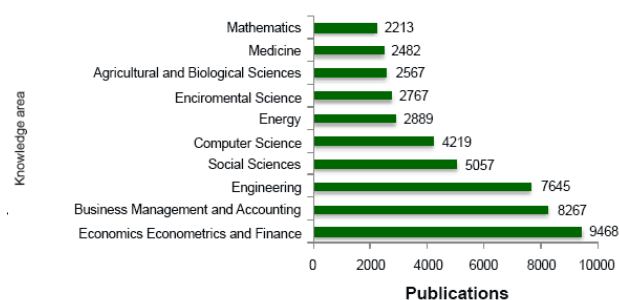*Figure 47: Graph of knowledge areas with the highest frequency of publication*
Source: Adapted from Scopus (2018)

4.8.7 Analysis of articles

The table 9 presents the articles selected as most relevant by the author provided by the database.

Table.9: Selected Articles for the Return on Investment Method - ROI

Title	Author	Year	Citations
On persistence in mutual fund performance	CARHART, M. M.	1997	3677
The worldwide leaf economics spectrum	WRIGHT, I. J. et al.	2004	2815
Investor psychology and security market under and overreactions	DANIEL, K. et al.	1998	1541
On estimating the expected return on the market: An exploratory investigation	MERTON, R. C.	1980	1014
Open source software and the "private-collective" innovation model: Issues for organization science	VON HIPPEL, E. et al.	2003	1012

Source: Adapted from Scopus (2018)

Carhart (1997) using a "bias-free" sample demonstrated that common factors in stock returns and investment expenditures almost completely explain persistence in average equity investment funds risk-adjusted returns. The result was mainly driven by the one-year impulse effect, however, it was noted that individual funds do not earn higher returns by following the momentary stock strategy. Since it indicates significant unexplained persistence, it is concentrated on an underperformance by the worst return investment funds. The results do not support the existence of qualified or informed mutual fund portfolio managers. The authors propose a market theory of exaggerated bonds and reactions based on two well-known psychological defects investor on the accuracy of private information and self-attribution tendentious, which causes asymmetric changes in investor confidence as a result of investment results. In their results, they showed that the excess confidence implies long-term negative correlations, excessive volatility, and when managerial actions are correlated with stock mispricing, return perceptibility based on public events. They concluded that biased self-attribution adds self-correlations to short-term positive short-term drift gains, but a negative correlation between future returns and long-term and stock market performance. In addition, the theory also offers several implications and untested implications for corporate financial policy (DANIEL et al., 1998).

The author believes that the expected return on the market is a number often needed to solve many investment and corporate finance problems, but compared to other financial variables, there has been little research

into estimating this expected return. Thus, current practice to estimate the expected market return adds the historical average of market responses at the current observed interest rate. However, even if this model explicitly reflects the dependence of market returns on interest rates, it does not account for the effect of changes in the level of market risk. With this, the author analyzed three equilibrium models that expected market returns that reflect this dependence. The estimation procedures that incorporate the restriction that the exaggerated equilibrium returns in the market are positive are derived and applied to the return data for the period 1966-1978. The main conclusions of this exploratory investigation are: (1) in estimating expected market returns, the non-negativity constraint of the expected return must be explicitly included as part of the specification: (2) estimators using returns must be adjusted for heteroskedasticity1 MERTON, 1980)

V. CONCLUSIONS

This study was able to achieve the proposed goal by presenting a bibliometric study on eight financial methods that can be applied to economic viability in voltaic plates: IL; ROI, IRR, TMA, NPV, Payback (simple and discounted) and cash flow. Emphasis was given to the authors who study the subject, journals with the largest number of publications, countries and institutions that return their studies on the methods and routes of publications used and the areas of concentration that have a greater focus, which are presented in graphic form in this job.

With the large volume of results offered by the database, it is noted that the study of financial methods is of great interest, both globally and globally. These have a very great applicability, in several areas such as agriculture, education, medicine, biology, economics, among others. Thus, it can be said that it is of the utmost importance to continue the study of these methods applied to economic viability to aggregate the area of renewable energies, since sustainability and the use of renewable energies are of great interest to society. The bibliometric study model used in this work is the one proposed by Costa (2010), since it guides a researcher who does not have contact with the area, since he finds, in a single article, a selection of relevant scientific works on a certain theme. It is worth noting that the values defined for the time cut from year 2000 to year 2018, the 10 most relevant for each topc (authors countries, institution, type of publication, knowledge area) and selection of articles were author's choice and not a rule that must always be followed. A standard observed for all methods was the increase in the number of graduated publications over the years, a trend that demonstrates the increase in interest in

financial methods, which makes us believe that the topic is quite relevant and which has much to explore.

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