Valuation of Startups Focused on Circular Economy: The Therpol Case

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Abstract

This study aims to valuate Therpol company which consists in a natural additive that makes it possible to transform rubber and plastic into renewable materials by using raw material of vegetable origin, the rubber tree. Therpol has local production capacity, or in other countries, in large scale. Up to the conclusion of this study, it was not known all Therpol application possibilities in the industry. The uncertainties contained in the valuation of the proposed scenarios are the greatest challenge of this work which presents three valuation methods of the company value, as discounted cash flow, multiples of variables and real options. Considering that the valuated company is of high intangible value, the analyses assess uncertain opportunities of future growth, this factor was not considered in the valuation of the company in this study. The strengthening of the brand Therpol is a fundamental factor for the company value increase.

Keywords: Valuation of Companies; Recycling; Natural Plastic.

1 . Introduction

This study aims to assess the value of the company Therpol, which developed a natural additive to produce renewable plastic, offering greater resistance, lightness and lesser cost than other raw materials. Therpol makes it possible to transform rubber and plastic into renewable materials, in a circular economy context of high quality, durability and applicable to numerous market segments. It is not known, up to the conclusion of this work, all application possibilities of Therpol in industry, although operational and market tests already conducted up to this moment, denote its application in plastic, textile and heavy chemicals industry. In the literature on valuation of companies, it is considered the three most used methods of company valuation: discounted cash flow, multiples of variables and real options. Each method has its peculiarity according to the context, market, company stage, as well as the available information.[8] states that assessing the values of a company goes beyond the investment and portfolio management analysis, it is a matter of understanding the stage of the life cycle in which the company is.

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This study has the opportunity of bringing up its contribution of the application in a real case to answer the following question: How to determine the value of a Brazilian company, in the beginning of operation, with great potential of development and uncertainty, facing the strategic alternatives and different scale of growth throughout time? To answer this question, three proposed future scenarios were outlined by the authors and validated by the founder of the startup. These scenarios consider the premises adopted without foundation in the past focusing on alternatives which will support decision making on Therpol's destiny in Brazil and the possibilities of expansion to other countries.[8] highlights that the inputs used in the valuation reflect the evaluator's optimistic or pessimistic disposition, which can cause biases in the analyses. In order to avoid such distortions, it is recommended to list the biases which can impact on the company valuation before initiating its valuation. The considered analyses do not exhaust all possibilities of application of Therpol, given that it is a relatively new product and in industrial testing.

Relating to this outlook, there is a level of uncertainty in the assessments, specially to companies of intangible value, when there is not a background, or it is not sufficiently relevant to support analysis. For these cases, it is necessary to establish future scenarios which become benchmarks for the valuation of these companies. [12] highlight that the valuation of intangible value companies is particularly difficult, for a small portion of their value lie in assets whilst a great part of the opportunities derives from uncertain opportunities of future growth.

2. Theoretical Framework

2.1 Methods of Valuation of Business Value

Although the valuation methods may involve several details, any business value relies on certain basic vectors, which vary among different businesses and situations [8]. At searching for these value vectors, it must be considered not only the life cycle, from young to mature businesses, but also several activity sectors, from commodities companies to financial institutions and pharmaceutical laboratories. According to [8], there are dozens of valuation models, but just two approaches: intrinsic and relative. In the intrinsic valuation, the values of an asset are determined by the expected cash flows generated by the asset itself during its lifespan and by the uncertainty degree related to it. Assets with high and stable cash flows must be worth more than assets with low and volatile cash flows.

Although the focus, primarily, must be concentrated on the intrinsic valuation, based on the discounted cash flow (DCF) throughout the life of the enterprise, most assets is assessed on relative bases. The DCF method is the favorite among scholars and professionals for it relies exclusively on how the cash comes in and goes out of the company [10]. In the relative valuation, the asset value is estimated based on similar market prices [8]. Thus, at determining how much to pay for a house, it is verified how much similar houses in the neighborhood are sold for. When it comes to stock, its price is compared to similar shares, generally in their peer group. Thus, Petrobras' shares that will be considered shares to be purchased if they are being traded for a price corresponding to, shall they say, eight times the profit per share, whilst shares of other oil companies are being traded at 12 times the profit per share.

The intrinsic valuation offers a broad view of determining factors of the value of a company or stock, however there are occasions in which the relative valuation shall provide a more realistic estimate of the market value [8]. In general, there is no reason to choose one or another, for nothing prevents from adopting both approaches in the assessment of the same investment.

A deficiency of business DFC, nevertheless, is that the cash flow of each year provides little information on the competitive position and economic development of the company [10] The decline of free cash flow may signal a poor performance or investment for the future. The economic profit model stands out as the company creates value, but properly implemented, leads to an identical DFC business valuation

To [7] businesses do not have finite lives. The study cannot estimate cash flows permanently. Therefore, it generally imposes the closing in valuation models interrupting our cash flow estimate at a certain moment in the future and, next, calculating a terminal value that reflects the cash flows beyond this point.

2.2 Monte Carlo Simulation

According [9], risk is the quantification of uncertainty. Yet, [6] states that the value found for a business is an estimate and as such, it is necessary to quantify an interval on the estimate. Some analysts use simulations while others base on numbers of best or worst case to reach such interval. "The output they provide, therefore, produces both their estimates and their uncertainty on such value" [6]and continues "... the probabilities that follow the statements provide information on the uncertainty which the analyst perceives on the valuation.". The quantification of uncertainty which Frank Knight discusses can be carried out through the Monte Carlo simulation to generate the ranges and probabilities cited Damodaran.

"The term Monte Carlo is typically associated to the process of modeling and simulating of a system affected by randomness"[5], that is, great quantities of random scenarios are generated through an algorithm and then statistics are collected to assess what is to be measured, for instance, the performance of a decision policy or the value of an asset [5]. Stochastic methods (based on randomness) are appropriate for this purpose, because variables and market factors are random in nature. This behavior can be simulated, and its influence can be better understood step by step using Monte Carlo Simulation [17]. By random numbers, it is understood the numbers obtained through a machine (algorithm). Being the result of the discounted cash flow merely the result of estimation of single point, in several cases there is low confidence on its accuracy, since future events which affect the expected cash flow are highly uncertain. Several problems in science, engineering, finances, that is, through random experiments on a computer. The execution of correlated simulations provides a much closer approach of real-life behavior of the variables. As output of the simulation, a sensibility analysis is conducted from the resulting variable, in our case it will be a tornado diagram from NPV. The aim of this analysis is to provide the dimension of the impact on each variable composing the result found. The preceding variables include revenues, costs, tax rates, discount rates, capital expenditure, depreciation and so forth, that, ultimately, flow through the model to affect the net present value (NPV) [13]. "At tracking all these preceding variables, we can alter each one by a predefined value and see the effect on the resulting net present value"[13].

2.3 Brief history of the development of the Monte Carlo methods

According to [21], a random sample of numbers was used in the past, previously to the development of current computers, by several scientists. The first example registered of what today is called method of Monte Carlo came up with the French naturalist Comte de Buffon (1707-88), later, Pierre-Simon, Marquis of Laplace (1749 - 1827) observed and improved Buffon's experiment. In later Years, the techniques of Monte Carlo were used by William Thomson, 1st Baron Kelvin (also knowns as Lord Kelvin, 1824-1907) to solve integrals within the theory of kinetic gases. Several other scientists approached probability problems through techniques based on random sampling. Among them, William Sealy Gusset (also knowns as Student, 1876 -1937), who in 1908 used the method to estimate the correlation coefficient in his famous t distribution. The first computer record of the method can be attributed to Fermi, von Neumann, and Ulam during the Project Manhattan during World War II. In this project, the use of the method of Monte Carlo was to solve whole equations in six dimensions employed in the shielding project for nuclear devices. "It was probably the first case in the history of humanity in which solutions based on trial and error were clearly highly risky." [13].

3. Investigated Context

3.1 About the Recycled Plastic Market

According to the publishing "Atlas do Plástico" by the Heinrich Böll Foundation, the planet may reach, yet in 2025, over 600 million of tons of plastic produced annually – a 50% increase in relation to the current production [20]. Only 1.28% of this material is recycled, according to WWF data cited in the Atlas of Plastic.

[15], which is a Loga and Eco Urbis initiate, household and health waste collection utilities of the city of São Paulo, Brazil, supported by the municipality, mencioned that ~9% of all plastic produced in the world was recycled in 2019, the same information EESP FVG disclosed based on OCDE data [19]. Given that close to 50% were destinated to controlled landfills. Other 22% were taken to illegal landfills.

Besides the garbage generating pollution in the oceans, rivers and soil, it must consume, up to 2050, from 10% to 13% of the limit of carbon emission so that global warming remains below 1.5 °C, as the target laid down in the Paris Agreement [20].

If there is just 10% of the global market available for the use of Therpol and the usage of Therpol is 3% in all this plastic, we would have then, a volume of 1.8 Mt in 2050. Considering just Brazil, we have about 838.5 kt/year of production (only internal production, not considering importation), according to the numbers of Abiplast's report, 2020. 10% of the market at 3% of use of Therpol would provide us with a volume of 2.5 kt/year, which is an initial estimate of volume for the project in 2023, referring solely to 10% of all the plastic produced in Brazil. Considering not only CO_2 emission problem, but also the workforce the recycling industry disposes, reinforces that 10% is quite conservative. Just Brazil: "... This makes the country (Brazil) one of the great champions when it comes to Polymer: the country is the fourth greatest producer of plastic garbage in the world with 11.3 million tons of plastic per year, indicating that every year, it becomes more difficult to reverse such situation" [20].

[1] is a great source to understand the overview of recycling in terms of volume and rentability. It is a billionaire business which handled R$ 90.8 billion on plastic production and R$ 2.5 billion on recycling in 2020.

[1], also mentioned that in two decades, the increase of plastic volume exceeded the economic growth in almost 40%, coming out from an annual plastic production of 234 million tons in 2000 to 460 million tons in 2019. The plastic industry in Brazil has extreme relevance in this context, ranking the 4th greatest employer among the processing industries in our country.

According to [1] of the 11.3 million tons of plastic residue produced per year in Brazil, just 1.28% (equivalent to 145 thousand tons) are in fact recycled and reinserted in the productive chain, pointed out by WWF as source of this statistic, based on a study carried out for the World Bank. Opportunity: the global average of plastic recycling is at least 9%. The USA have a recycling rate of 34.60%. Considering this number for estimating the production volume of Therpol, and, thus, there is space for application of 3% - average consumption provided by the owner of the technology. The type of plastic may vary – of this additive in volume over 10% of the plastic residue produced in Brazil (and which is constant growth and that, compared to the USA, 34.6% is quite low), which we consider extremely conservative.

3.2 About Therpol, the product, the brand, the company

Due to the characteristics described below, the product and the business, this is a private company, located in São Paulo, Brazil, presenting extremely high potential of national and international growth, ready to start producing, with great possibilities of an exponential traction. Such perspectives of growth and uncertainties, refer to a great difficulty in the calculation of the value of the company, which is of fundamental relevance, since the defined model foresees the entry of one or more partners in the business and investments need to be defined.

The product in question is Therpol, which emerged in 2018, as an opportunity of reducing costs on the production of rubber artifacts, through the injection system used in the production of injected plastic parts. For it is a sustainable innovation, a thermoplastic based on a bio renewable source of raw material, natural rubber from rubber trees, 100% recyclable, is considered as part of the 5th Industrial Revolution, due to its reuse and, therefore, circularity. The applicability is broad, since there is the possibility of substituting all the products which use plastic and rubber as raw material. Its initial usage, already tested, is in shoes (sandal straps, soles, boots and beach sandals) according to [3], in the automobilist sector (suspension bushings, door trims, anti-noise plates) [2], in agricultural parts, grip (rubberizing) of pens, shaving razors, pallets, boxes, vases, tools and rubber artifacts in general, plastic film for packaging, among others. The only plastic which Therpol cannot substitute is the one which needs full transparency. One of the main features of Therpol is the possibility of being added to PCR (post consume resin), post-consumer plastic, returning properties and reinserting this plastic into the production chain, fomenting recycling, and circular economy. The [14] mentioned that for it be 100% recyclable, it can be reintroduced into production for countless times, besides contributing to the ecosystem, since the raw material is originated from a 100% renewable source, the rubber tree, substituting another fossil origin raw material, non-renewable, and non-recyclable.

Another characteristic of Therpol is related to the manufacturing process, since it is injected as plastic, it has a short injection cycle, therefore it generates a decreased consumption of energy, besides decreased expenses on discarding, for all refuse material can be reused. Furthermore, the final product is lighter than conventional thermoplastics.

The benefits of Therpol extend to all the chain beyond its production process. Therpol presents on their commercial brochure that in the beginning it have the production of the raw material, natural rubber, or latex, in which each tree produces just 5 to 6 kilograms per year and absorbs 150 kg/CO_2 within the same period, presenting a highly positive environmental balance. The management of rubber tree is quite simple, it needs basically water, and its lifespan is of 35 years, a culture which keeps the worker in the field, therefore. At the other end of the chain are all the businesses and jobs created from the reverse logistic, for the product reuse.

There also must be considered on the company valuation the intangible asset "brand", since there is potential for Therpol to become a label for sustainable products, such as "Lycra" for synthetic fabrics, "Teflon" for anti-stick pots, etc. In a valuation perspective, according to [16], "much of the uncertainty associated with brands is regarding the relationship with goodwill and other intangible assets.

This is real confusion about the distinction between brands and other assets such as goodwill or trademark. This difficult leads to further problems when deciding how to measure and report them in financial statements".

The brand Therpol is an asset to be explored in several opportunities, as a symbol of the category of plastic reuse, related to circular economy and becoming an important link of all production chain, trade and consumer. For being a new brand and not a renowned one, it is estimated a period of five years to become renowned in the market. As the concept of circular economy and brand are widespread in the relation among companies, the Therpol seal must become a reference to the category. Its brand attributes must be quality, durability, and longevity, given the infinite times the raw material can be reused.

Such product has already aroused the interest of national and international investors, in addition to many commercial contracts are in the closing phase with large-scale companies in Brazil, Europe and Asia. Therpol has registered trademarks and patents in Brazil, China, the USA, Taiwan, and India and in several European countries aiming to preserve the integrity of the innovation effect for the product.

Considering the previous contextualization and the expectations of the owner of the company, three strategic alternatives that will be valuated and assessed in this work were defined:

1- Initial production with own resources and when production scales up, consider a minority share (up to 49%) of an investor partner or Initial Public Offering (IPO);
2- Initial production with own resources, as well as the company's organically growth to a national level. International expansion through licensing of production and payment of royalties.
3- Initial production with own resources and national and international growth through licensing of production and payment of royalties.

4. Diagnosis of the Problem-Situation

Once listed the strategic alternatives, all contemplating a high level of uncertainty and possibilities, another variable emerges with great impact on the business valuation which is "time", since for each stage of the business there can be different growth coefficients.

Three growth stages (see Table 2) were estimated for each strategic alternative:

i.   Initial stage, with the duration of 3 years, which is the time-length for the company to be established, balance its production and the market know the product.

ii. Intermediate stage, with duration from 3 to 5 years, time-length to consolidate the brand Therpol, and gain market and traction on production.

iii. Consolidated stage, from 5 years, which foresees an exponential growth, providing the entry of investors and internationalization of the brand.

The ambition of this work is one or more consistent conclusions, referring to the business valuation, facing the context relative to the growth potential and uncertainty level of the business.

Therefore, the problem which is presented in this case and object of this investigation is: How to determine the value of a Brazilian company, in the beginning of operation, with great potential of development and uncertainty, facing the strategic alternatives and different scale of growth throughout time?

Table 1: Assumptions for the Preparation of production plan – in thousands of tons.

Assumptions of Production Volume											
Scenarios		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Best Case	40%	3.500	5.600	7.700	11.900	16.100	22.400	28.700	37.100	45.500	53.900
Most Likely		2.500	4.000	5.500	8.500	11.500	16.000	20.500	26.500	32.500	38.500
Worst Case	20%	2.000	3.200	4.400	6.800	9.200	12.800	16.400	21.200	26.000	30.800
Volume (average)		2.583	4.133	5.683	8.783	11.883	16.533	21.183	27.383	33.583	39.783

Table 2: Assumptions used on the mathematical model.

Premises for modeling
• Total net revenue = production volume [t] × 38 BRL/kg × 0.7275 (deterministic)
• Costs of goods and services provided = total net revenue × 0.85 (deterministic)
• Operating expenses = total net revenue × 0.05 to 0.1 (stochastic, continuous distribution)
• CapEx = for each increment of 1.5 kt/year, WCS 2.0 MBRL was considered; MLS 1.5 MBRL and BCS 1.0 MBRL (stochastic, triangular distribution) + 5% for Sustain Business' CapEx
• Depreciation = 10% of CapEx
• We do not consider the effect of working capital in the model

Consolidated stage (from 5 years)	Intermediate stage (3 to 5 years)	Initial stage (3 years)
Expansion of national production and international partners with participation via royalties	Consolidated Therpol brand, production has already gained traction (3 times initial phase) and expansion of production (national)	The creation of the startup OK, Launch of the Therpol brand and local production
Physical Modifier / Petrochemicals / Footwear / Automotive	Plastic Modifier (PP, PS, PET, ABS, Nylon, PLA, PE) / Footwear	Plastic Modifier (PP, PS, PET, ABS, Nylon, PLA, PE) / Footwear
Exponentially expanding the portfolio and market	Portfolio and market expansion (organically)	Adidas, Arezzo, Leroy, Magalu, sandals, others
10,000 t/year × number of licensed countries	6,000 t/year × number of licensed countries	2,500 t/year × number of licensed countries

5. Methods used for Business Valuation

5.1 Market Multiples

From the *EBITDA* calculation for the year of 2023, it was applied a market multiple, for chemicals industry in emerging markets aiming to find the Equity Value. In addition to *EBITDA* and the market multiple, it was also considered an average growth rate of 30% in a constant way. For the growth rate, it was made the risk adjustment which was given by a *PERT* distribution of probabilities considering worst case 25%, most likely case of 30% and optimistic case 35%.

Table 3: Market Multiples.

Reference Year	2023
EBITDA (MBRL)	7,14
(×) EBITDA Multiple (Emerging markets)	9,83
(=) Enterprise Value	70,20
(-) Net Debt	-
Estimated growth	30%
(=) Equity Value	91,26

5.2 Discounted Cash Flow

Table 4: Discounted Cash Flow.

Projection Volume t/year											
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Best Case	40%	3.500	5.600	7.700	11.900	16.100	22.400	28.700	37.100	45.500	53.900
Most Likely		2.500	4.000	5.500	8.500	11.500	16.000	20.500	26.500	32.500	38.500
Worst Case	20%	2.000	3.200	4.400	6.800	9.200	12.800	16.400	21.200	26.000	30.800
Volume		2.583	4.133	5.683	8.783	11.883	16.533	21.183	27.383	33.583	39.783

Values in million Reais (MBRL)											
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total net revenue – Most Likely		96,76	154,81	212,87	328,98	445,08	619,25	793,41	1.025,63	1.257,85	1.490,07
Total net revenue – Best Case	-	69,11	110,58	152,05	234,98	317,92	442,32	566,72	732,59	898,46	1.064,33
Total net revenue – Worst Case		55,29	88,46	121,64	187,99	254,33	353,86	453,38	586,07	718,77	851,47
Total net revenue – Monte Carlo outcomes		71,42	114,27	157,12	242,82	328,51	457,06	585,61	757,01	928,41	1.099,81
(-) Costs of goods and services provided	-	60,70	97,13	133,55	206,39	279,24	388,50	497,77	643,46	789,15	934,84

(=) Gross profit	-	10,71	17,14	23,57	36,42	49,28	68,56	87,84	113,55	139,26	164,97
(%) Revenue growth			0,60	0,38	0,55	0,35	0,39	0,28	0,29	0,23	0,18
(%) Gross margin		0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15

(-) Operating expenses (freight, commissions)	-	3,57	5,71	7,86	12,14	16,43	22,85	29,28	37,85	46,42	54,99
Operating expenses index (upper limit)	10%	-	-	-	-	-	-	-	-	-	-
Operating expenses index (lower limit)	5%	-	-	-	-	-	-	-	-	-	-
(=) EBITDA	-	7,14	11,43	15,71	24,28	32,85	45,71	58,56	75,70	92,84	109,98
(%) EBITIDA margin over net revenue		0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10

Real estate assets + DU intangible beginning of the year	-	-	-	-	-	-	-	-	-	-	1,00
(+) Capex	-	-	1,50	1,50	3,00	3,00	4,50	4,50	6,00	6,00	6,00
Most Likely			1,50	1,50	3,00	3,00	4,50	4,50	6,00	6,00	6,00
Best Case			2,10	2,10	4,20	4,20	6,30	6,30	8,40	8,40	8,40

Worst Case			1,20	1,20	2,40	2,40	3,60	3,60	4,80	4,80	4,80
(-) Depreciation	-	-	-	0,15	0,45	0,75	1,20	1,65	2,25	2,85	3,45
(+/-) Others	-	-	-	-	-	-	-	-	-	-	1,00
(=) Real estate assets + DU intangible end of the year	**-**	**-**	**1,50**	**1,35**	**2,55**	**2,25**	**3,30**	**2,85**	**3,75**	**3,15**	**3,55**
(%) Capex over net revenue		-	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
(%) Depreciation over real estate asset											- 3,45

EBITDA	**-**	**7,14**	**11,43**	**15,71**	**24,28**	**32,85**	**45,71**	**58,56**	**75,70**	**92,84**	**109,98**
(-) Depreciation	-	-	-	0,15	0,45	0,75	1,20	1,65	2,25	2,85	3,45
(=) EBIT	**-**	**7,14**	**11,43**	**15,56**	**23,83**	**32,10**	**44,51**	**56,91**	**73,45**	**89,99**	**106,53**
(-) Financial expenditures	-	-	-	-	-	-	-	-	-	-	1,00
(=) Profit before income tax	**-**	**7,14**	**11,43**	**15,56**	**23,83**	**32,10**	**44,51**	**56,91**	**3,45**	**89,99**	**105,53**
(-) Income tax	-	2,43	3,89	5,29	8,10	10,91	15,13	19,35	24,97	30,60	35,88
(=) Net profit	**-**	**4,71**	**7,54**	**10,27**	**15,73**	**21,19**	**29,37**	**37,56**	**48,48**	**59,39**	**69,65**
(%) Financial expenditures over net revenue		-	-	-	-	-	-	-	-	-	0,00
(%) Effective rate of income tax		-0,34	-0,34	-0,34	-0,34	-0,34	-0,34	-0,34	-0,34	-0,34	-0,34

Free cash flow of the firm (FCFF)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
EBIT	**-**	**7,14**	**11,43**	**15,56**	**23,83**	**32,10**	**44,51**	**56,91**	**73,45**	**89,99**	**106,53**
(-) Income tax	-	2,43	3,89	5,29	8,10	10,91	15,13	19,35	24,97	30,60	35,88
(=) NOPAT	**-**	**4,71**	**7,54**	**10,27**	**15,73**	**21,19**	**29,37**	**37,56**	**48,48**	**59,39**	**70,65**
(+) Depreciation	-	-	-	0,15	0,45	0,75	1,20	1,65	2,25	2,85	3,45
(-) Capex	-	-	1,50	1,50	3,00	3,00	4,50	4,50	6,00	6,00	6,00
(+/-) Variation working capital	-	-	-	-	-	-	-	-	-	-	1,00
(=) FCFF	**-**	**4,71**	**6,04**	**8,92**	**13,18**	**18,94**	**26,07**	**34,71**	**44,73**	**56,24**	**68,10**
(%) Variation in working capital over net revenues		-	-	-	-	-	-	-	-	-	0,00

548,0	684,15	637,10	666,47	627,52	634,09	610,27	612,22	597,10	584,19

5.3 Intangible value

In addition to the valuation methods of tangible value, Therpol presents a broad potential of increment on its intangible value through the building-up and strengthening of its brand. An ecosystem is formed focused on the circular economy encompassing all the stakeholders of the chain:

    i.   Rural producer and rubber extraction

ii.   Therpol production

iii.   Industries involved in the use of the additive as raw material

iv.   Sale of the final product and returning of post-consumer product for reusing and recycling

It is believed that the brand Therpol must be positioned as green, carbon-free plastic and synonym of green plastic circular economy. For this purpose, it is necessary the development of these attributes on the brand Therpol as connected with its ecosystem through actions which increase the intangible value, including the possibility of this becoming superior to the tangible value previously measured. [12] mention that high-technology companies, research, and activities under development, as well as the majority of the dot.com, cannot be evaluated by its present asset value, for being less representative. A great part of its value derives from uncertain opportunities of future growth. Thus, it becomes more challenging to propose empiric results of analysis of high intangible value companies, as it is the case of Therpol. [12] complements the view that analysis estimates are generally worse for companies with high intangible assets. The reason is that the estimates do not totally capture the opportunities of growth and other intangibles associated to these companies. The challenge is creating and maintaining the value of the brand to Therpol, making it renowned and increasing its generation empiric value. To [16], the investment in brand actions create the true value for the brand, the real value exists when the consumer knows the brand, is loyal to it and has the perception of value. [16] adds stating that the knowledge of the brand, faithfulness and perception of quality are the three components for the success of a brand.

6. Result Obtained

From the methods and premises previously explained, it was possible to estimate the value of a business as well as quantify the related risk, presented here in the form of statistical data being the risk represented by the dispersion surrounding the central value, that is, the standard deviation and the chance/probability of a certain event occur as it can be verified further ahead in the scatter plot.
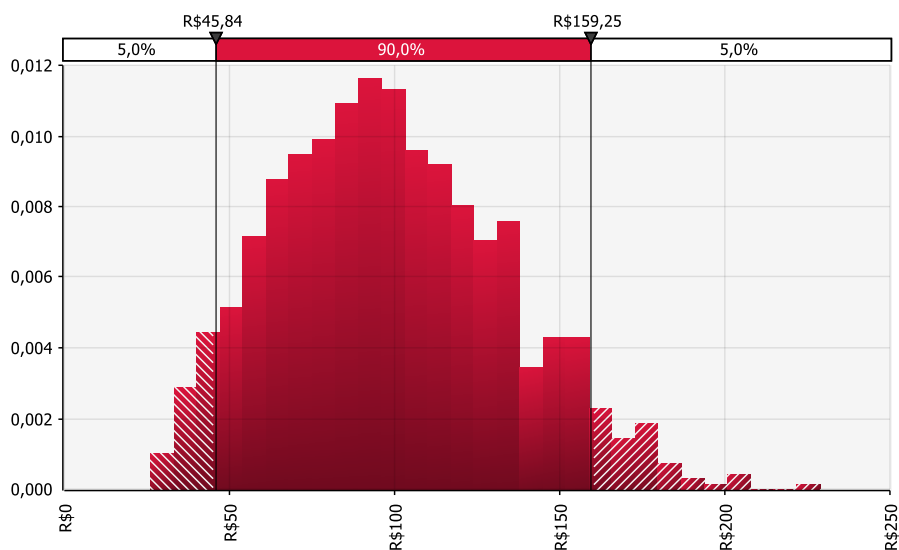

Figure 1: Histogram for relative valuation through market multiples.

In Figure 1, as a first result for the business value, by using the Monte Carlo simulation, the Equity Value histogram is presented. As results we have for a confidence interval of 90%, the expected value is between 45.84 MBRL and 159.25 MBRL representing the range of possible values for this company, being the central value of 98.92 MBRL with standard deviation of 34.7 MBRL.
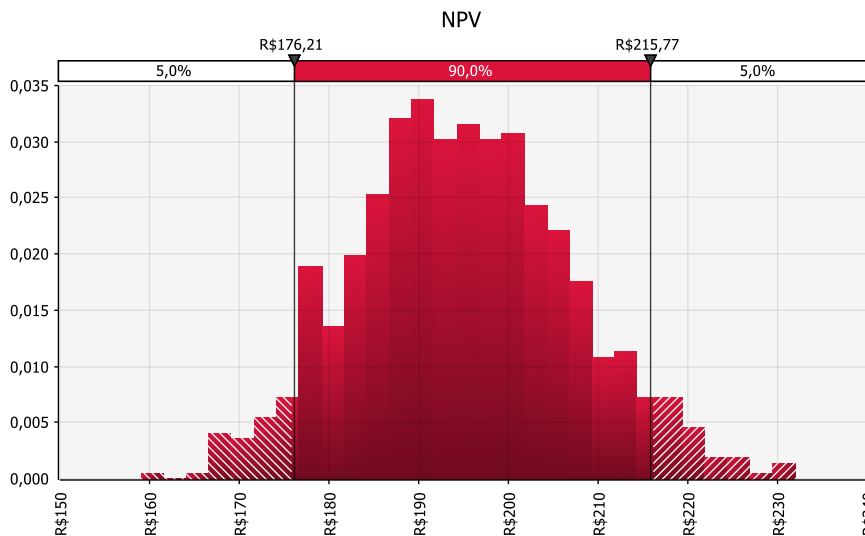

Figure 2: Histogram of Net Present Value (NPV).

In Figure 2, as an output of the Monte Carlo simulation, the Net Present Value (NPV) histogram representing the company value. For a confidence interval of 90%, it is expected values between 176.2 and 215.7 MBRL as possible company values, being the central value of 194.9 MBRL with standard deviation of 12 MBRL. A result superior to the one found through the application of the *EBITDA* multiple. In addition to the cash flow values themselves, dependent on volumes, prices and subsequently revenues, the factor that most returned us risks was the discount rate applied to the Discounted Cash Flow, in which we used the Weighted Average Cost of Capital (WACC).
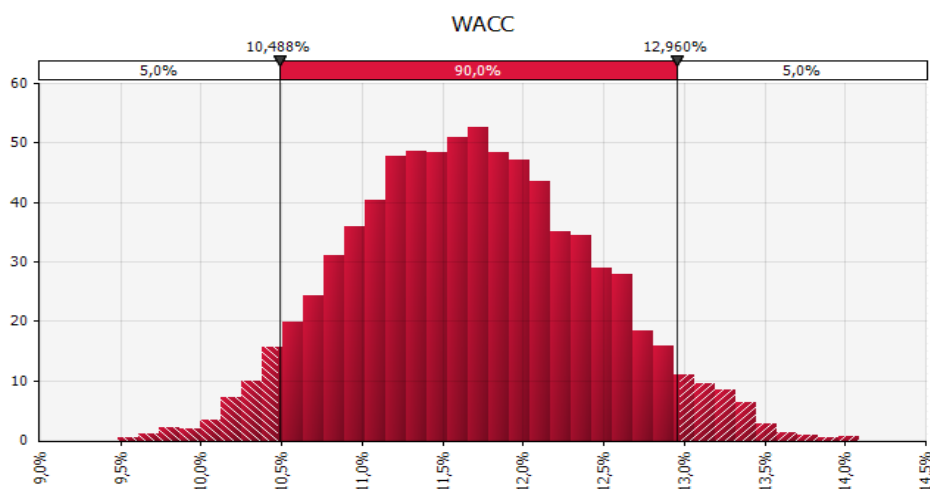

Figure 3: WACC Histogram.

When estimating the WACC, as a result we had, for a confidence interval of 90%, the expected value is in a range between 10.49% and 12.96% being its central value, 11.68% and standard deviation of 0.75%, as it can be verified above in Figure 3.
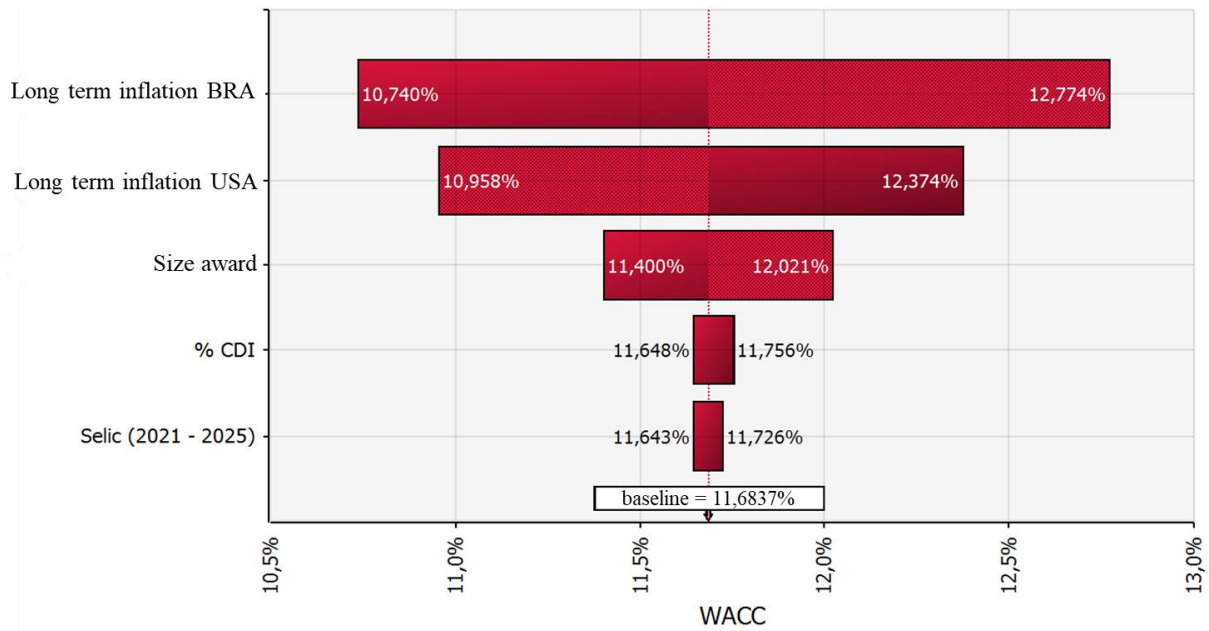

Figure 4: Tornado diagram with factors of influence of WACC value.

In Figure 4, the Tornado Diagram aims to represent the factors that most influence the result of WACC. The three main factors of influence for the variation of the WACC for the estimate were: Brazilian long-term influation which can vary WACC from 10.74% to 12.77%, USA long-term influation which can vary the WACC from 10.96% to 12.34% and the Business Size Award which can vary the WACC from 11.4% to 12.02%.
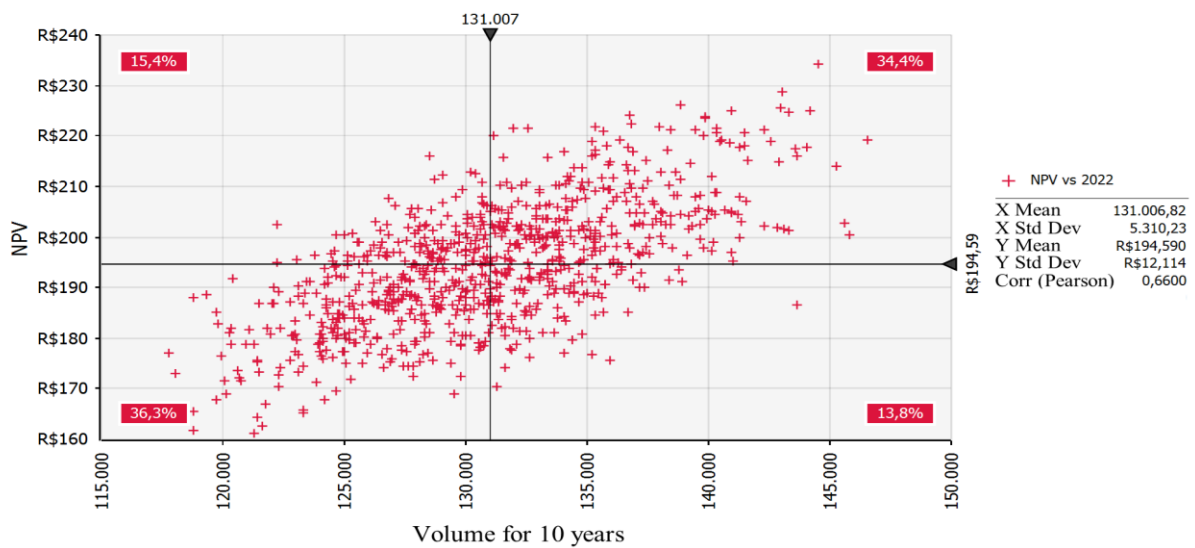

Figure 5: Scatter Plot for 5000 simulated scenarios – central values.
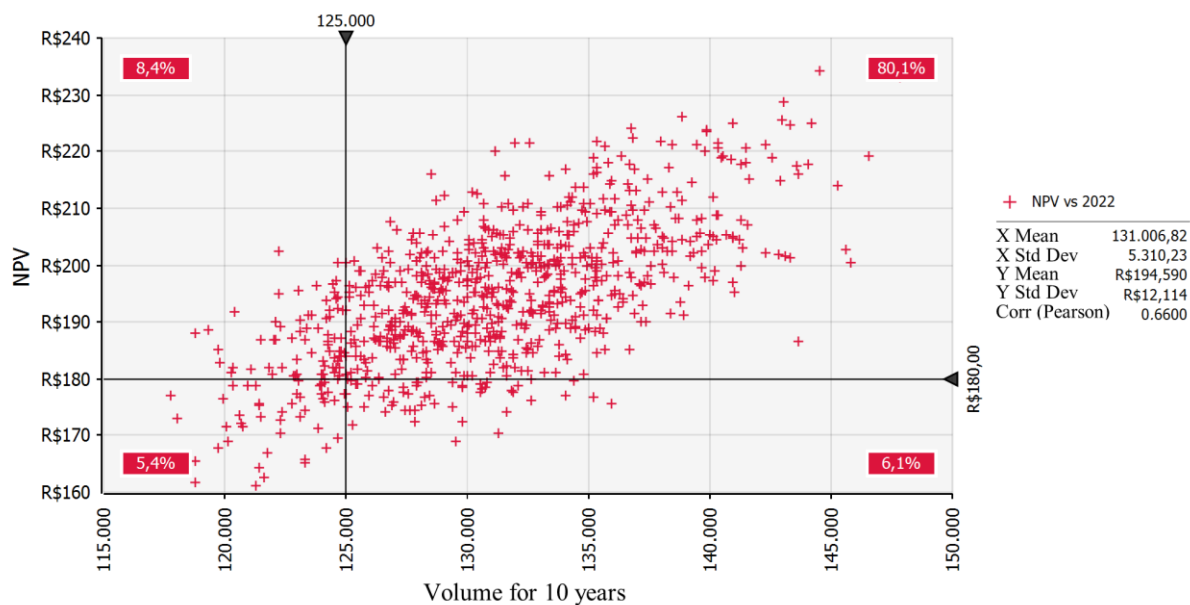
Figure 6: Scatter Plot for 5000 simulated scenarios – minimum values.

Subsequent to the simulantion and the generation of 5,000 scenarios, it was possible to verify the certainity level through the frequency of which these values appeared in the simulation. In Fig. 5 it is verified that there is a concentration of 34.4% of the data (each dot – red cross – represents a simulated scenario) as possible results and superior to the limits established on the axes that intersect being NPV = 194.59 MBRL and total volume total for 10 years = 131 kt. The interpretation is that the chance of success is to obtain equal or higher values to this result specifically is of 34.4%. The total chance of obtaining values superior to NPV of 194.59 MBRL is of 49.8%. The lesser the volume to be produced – function of the price to be sold – the greater will be the chance of overcoming the NPV of 194.59 MBRL. This will depend on other factors as cost and perception of value of the brand or product. The intangible value of the brand was not considered in the simulation, however, it is understood that this is a fundamental part to be assessed to increase the company value as well as the revenue and place Therpol as a premium offer.

In Figure 6, the same 5,000 scenarios, it was adopted the possible minimum limit values to make a comparison and the result is that for a NPV target of 180 MBRL and total volume for 10 years of 125 kt combined, we have over 80% chance of success being that the total chance of having a NPV above 180 MBRL is of 88.5%, being it considered as very high.

7. Limitations on this study

i. The approach to risk modeling was extremely conservative due to the time constraint imposed by the project owner, which is normal in this initial project phase, therefore, it is necessary to deepen the risk variables;

ii. One of the biggest challenges in dealing with quantitative risk analysis is determining the probability distribution shapes. As this is a preliminary study for a business case, we used distributions that are simpler to understand, such as triangular and normal distribution;

iii.   The risk quantification process through stochastic simulations is more reliable when the risk events consider the sources or causes as well as the impacts if they materialize. In this work, only the expected variability for the elements of the Valuation model were considered as risks;

iv.   It is necessary to carry out risk assessment workshops in order to understand the cause-and-effect relationship for the several risk events as well as how these can be correlated with each other. It is important to determine the eventual use of copulas, which is a way, using statistical correlation and linear regression, to predict the behavior of certain variables using variables of known behavior.

8. Contributions of the study

This study was carried out based on real information from Therpol and the market with the objective of supporting corporate decision-making and growth, based on the evaluation of the alternatives and their respective scenarios of company value in the short, medium and long term. The results of these analyzes make tangible the value and risk regarding the various possible strategic paths for Therpol, which are already being applied by the company on a global scale, proving to be a profitable business. Additionally, there is a direct benefit to society through the circular economy and sustainability.

Providing clearness to the quantity of uncertainty becoming risk expressed as volatility of the company value, where the factors can contribute to such risk and with this having a set of actions that would guarantee the success of the enterprise.

The recommendations for building a strong brand value creation and generation of high intangible value strengthening are:

i.   Therpol seal applied on all products which use this raw material in order to become renowned worldwide.

ii.   Therpol take ownership of the concept of circular economy of renewable plastic through the governance of the entire production and returning of post-consumer product chain:

iii.   Associate emotion and bound to the brand, aiming the balance and protection of the environment, inclusion of a great number of people in the production chain and zero carbon emission cycle in the production chain.

iv.   Develop the concept and the strategic link with brands and companies that are socially correct and previously certified according to the market segment.

v.   Association with opinion leaders, partnerships with universities and creation of content aiming to publish its accomplishments and increase the engagement with its brand.

Additionally, it is recommended that the enterprise destinates between 0.5% to 1% of its net revenue to initiates for the building-up and strengthening of the brand, to increase gradually, as the company develops, its high representativeness as intangible value.

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