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Investment assessment techniques to study the viability of PRESPO diversification initiatives

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1. Objectives

The objective of this study is to analyse and describe investment assessment techniques and to develop a spreadsheet which allows the implementation of these techniques on the diversification initiatives which are selected by the participating partners in the PRESPO project. Using them, the analysis of viability of the case studies which are chosen by the participating partners in the PRESPO project will be done.

2. Material and methods

In order to reach this objective, a search about references on investment assessment techniques has been done. In this regard, it is worth noting the following references: Aguer Hortal et al. (2004), Durbán Oliva (2008), García Martín (2009), Goxens Orensanz and Gay Saludas (2000), Guarnizo and Jiménez (1995), Jiménez Caballero et al. (2009), Pérez Gorostegui (2006), Ruiz Martínez (1990), Ruiz Martínez and Gil Corral (2000), Sapag Chain (2001) and Suárez Suárez (2003). Likewise, the spreadsheet software Microsoft Excel has been used.

3. Results

To study the economic financial viability of the different diversification initiatives in the fishing sector, a set of investment assessment techniques have been analysed and described. These techniques will allow the identification of the most profitable investment initiatives and discard those diversification initiatives which do not reach a minimum level of profitability. All the investment assessment techniques are based on obtaining the highest profitability of the invested money. However, when the investment is carried out in the long run, we have to take into account that the value of money is not the same over time. For this reason, it is necessary to distinguish between static and dynamic techniques.

The static methods do not take into account time, that is, they are based on assuming that the value of money is constant over time. For this reason, cash flows have the same value though they occur at different moments. The use of these techniques can lead to a wrong decision because these methods do not take into account the inflation and the interest rate. Nonetheless, despite their limitations, this type of methods can be useful as approximate criteria. Additionally, they can contribute to obtain a

general overview of the viability of projects and to make an initial selection of investment projects which can be interesting for a firm.

On the other hand, the dynamic methods take into account time, that is, these techniques consider that money has a different value because cash flows occur at different moments. Therefore, these techniques take into consideration the exact moment in which cash-flows occur. For this reason, these dynamic methods are much more realistic than the static ones because they take into account the different value of money by considering the inflation and the interest rate. Regarding the static methods, it is worth mentioning the pay-back, the total net cash-flow per unit of money involved, the average annual cash-flow per unit of money involved, the accounting rate of return (ARR) and the comparison of costs. These methods are complementary and it would be convenient to accompany them with dynamic investment assessment methods because they do not take into account the different value of money over time. Next, these methods are described:

- The payback (P)

The payback determines the length of time that it takes for a project to repay the initial investment cost. In other words, this technique provides the time that it takes for a project to recoup the money used in the initial investment by means of the net cash-flows which are produced by the investment project. Assuming that the length of time of the investment project is equal or higher than the payback and assuming that the net cash-flows, which are obtained by subtracting the cash payments (or outflow) to the cash receipts (or inflow), are constant, the payback would be determined as follows:

$$P = \frac{A}{Q} \quad (1)$$

where A is the initial investment cost and Q represents the constant value of the net cash-flows. If the net cash-flows were not constant, the payback would be obtained by the sum of the subsequent cash-flows until it is equal to the initial investment A.

The advantage of this technique is that it is very useful if the time in which the investment can be developed is not known for sure or there is a high uncertainty. Under these circumstances, this technique provides some information on the minimum length of time which is necessary to recoup the investment.

Also, this technique has some disadvantages. First, it does not take into account the moment in which the different cash-flows are produced by the investment. Second, it does not provide any profitability measure. Finally, it does not consider the positive cash-flows which can be produced once the initial investment cost has been recouped.

In order to select an investment project, the criterion consists of choosing the investment projects which require the lowest payback.

- The total net cash-flow per unit of money involved (FNT)

This technique is a static method of investment project selection which provides a profitability measure which is based on the cash-flows produced by the investment. In order to compute it, it is necessary that the sum of all the cash-flows is divided by the initial investment cost. Therefore, it is obtained as follows:

$$FNT = \frac{\sum Q_i}{A} \quad (2)$$

where $\sum Q_i$ represents the sum of all the cash-flows and A is the initial investment cost.

According to this technique, only the investment projects whose total net cash-flow per unit of money involved is higher than one will be interesting because they will allow the recouping of the initial investment cost. Therefore, only the part which exceeds one is considered profitability and the rest is the recouping of capital. Among the investment projects considered, the one in which the total net cash-flow per unit of money involved is higher will be selected.

This investment selection technique has some disadvantages. First, this technique should be used to make comparisons between investment projects which had the same time length so that the result obtained is conclusive. The total net cash-flow per unit of money involved does not inform about the profitability per year. It informs on the total profitability of the investment. For this reason, when investment projects which have different time lengths are compared, the result of this technique is not conclusive. Second, it does not take into account the value of money over time because it is a static investment selection technique.

- The average annual cash-flow per unit of money involved (FNM)

In this technique, the average annual cash-flow is compared with the initial investment cost. The average annual cash-flow per unit of money involved is obtained as follows:

$$FNM = \frac{\bar{Q}}{A} \quad (3)$$

where \bar{Q} is the annual average cash-flow (i.e., the sum of all the cash-flows divided by the number of periods n), and A represents the initial investment cost.

As opposed to the total net cash-flow per unit of money involved, this technique has the advantage that the result obtained represents the annual investment profitability due to the fact that the sum of all the cash-flows is divided by the number of periods in which the investment project produces cash-flows. Nevertheless, this investment selection technique does not take into consideration the value of money over time because it is a static method.

According to this method, the investment project which has the highest average annual cash-flow per unit of money involved will be selected.

- The accounting rate of return (ARR)

This method consists of comparing the profit with the value of the investment. The accounting rate of return provides information about the percentage which represents the annual profit over the invested capital. This technique is not specifically designed for investment analysis because it is not based on net cash-flows. In contrast, it is based on profits. The result which is obtained is a measure of the average economic profitability of the project.

The accounting rate of return is defined as the ratio between the average annual expected profit of the investment project, in which depreciations are included, and the average investment which is required in assets (i.e., the investment which is made by the firm on average during the years which last the investment project), that is:

$$ARR = \frac{\text{Average profit}}{\text{Average investment}} \quad (4)$$

The main advantage of this technique is its computation because it does not need any information about cash-flows, unlike other methods which do use some information about cash-flows.

This method has several drawbacks. First, it is a static method and, consequently, it does not have into consideration the different value of money over time. Second, it does not take into account the project liquidity. It is an important concept which should be considered. It could jeopardise the project viability because the accounting rate of return is based on the investment project profits and it does not have into consideration the cash-flows produced by the investment project. Finally, the accounting rate of return has not much real meaning due to the fact that the economic return on an investment does not have to be linear over time.

- The comparison of costs

This technique is based on determining the annual costs which are associated with the investment projects considered and choosing the investment project which has the lowest total cost. The main advantage of this investment selection method is its simplicity because the estimate of revenues is not necessary. In contrast, the estimate of costs is only necessary. Regarding costs, it is interesting to note that the firm can have enough information about them.

However, it should be taken into account that it is necessary to forecast the total production to be able to estimate appropriately the variable costs of the investment project. The total production is a variable which is caused by the demand. The demand is usually difficult to forecast.

The comparison of costs has other disadvantages. First, it does not have into consideration significant variables such as cash-flows, the moments in which they are produced, risk, etc. Second, it does not consider the different value of money over time. Finally, it does not allow the determination of the profitability of each investment project.

Concerning the dynamic methods, it is interesting to mention the net present value (NPV), the internal rate of return (IRR), the discounted payback period, the present value rate (T) and the profitability index (IR). These methods are complementary among them. Among all these dynamic methods, the net present value (NPV) and the internal rate of return (IRR) are the most used. Next, each dynamic technique is described in detail:

- The net present value (NPV)

The net present value of an investment project is defined as the total gain in monetary units of the initial time moment, that is, the net profitability discounted to the initial time moment. In a context without tax the net present value is obtained as follows:

$$NPV = -A + \frac{Q_1}{(1+k)} + \frac{Q_2}{(1+k)^2} + \dots + \frac{Q_n + VR_n}{(1+k)^n} = -A + \sum_{i=1}^n \frac{Q_i}{(1+k)^i} + \frac{VR_n}{(1+k)^n} \quad (5)$$

where A represents the initial investment cost, k is the discount rate, n is the duration of the investment, VR_n represents the residual value of the assets (i.e., a possible sale value of the assets which were bought to develop the investment project at the end of the project when they are out of use) and Q_i is the cash-flow in the i -th period. The cash-flow is obtained by subtracting the sum of the annual labour expenditure, annual raw material expenditure and overhead, from the multiplication between the sale price and the number of sold units.

Once the net present value of the investment projects considered are obtained, the decision criterion will be to develop any investment project which has a positive net present value, whereas those investment projects whose net present value is negative should not be carried out. Finally, if the net present value of an investment project were zero, it would be indifferent to carry out the project. If there were several investment projects whose net present value was different, the one which has the highest net present value would be chosen.

Regarding the discount rate (k), it is interesting to note that if the investor has no specific profitability requirement, the weighted average cost of capital will be used. Using this discount rate, the net present value allows the determination of the total net profitability of the investment project discounted to the initial time moment. In other words, the net present value allows the computation of the total net gain expressed in monetary units of the time moment of the assessment, once the capital which was invested at the beginning of the investment project has been given back through the cash-flows and the compensation of the capital which has been used to finance the investment project has been made through the payment of interest and / or dividends.

In a context with tax, the net cash-flows and the residual value are defined as follows:

$$Q_{i)di} = Q_{i)ai} \cdot (1 - t) + CAF_i \cdot t \quad (6)$$

$$VR_{i)di} = vc_i + \Delta P_i \cdot (1 - t) \quad (7)$$

where $Q_{i)di}$ is the cash-flow after tax in the i -th period, $Q_{i)ai}$ represents the cash-flow before tax in the i -th period, t is the tax rate, CAF_i is the tax-deductible depreciation in the i -th period, vc_i represents the

accounting value of fixed assets in the i -th period, $VR_{i,di}$ is the residual value of fixed assets after tax in the i -th period and, finally, AP_i represents the increase in equity resulting from the sale of assets in the i -th period.

To conclude, the most important problem of the net present value is that it was thought to be preferably used under circumstances of certainty or quasi-certainty. Under risk conditions, it is difficult to determine the estimated cash-flows and to establish the appropriate discount rate.

- The internal rate of return (IRR)

The internal rate of return is defined as the value of the discount rate (r) which makes the net present value be equal to zero. Therefore, the internal rate of return is obtained as follows:

$$0 = -A + \frac{Q_1}{(1+r)} + \frac{Q_2}{(1+r)^2} + \dots + \frac{Q_n + VR_n}{(1+r)^n} = -A + \sum_{i=1}^n \frac{Q_i}{(1+r)^i} + \frac{VR_n}{(1+r)^n} \quad (8)$$

As the internal rate of return is a discount rate, this method provides the maximum interest rate which can be paid for the capital during the life of the investment project. In other words, this technique provides a relative return on investment. According to this technique, an investment project is convenient if the internal rate of return is higher than the weighted average cost of capital (i.e., $r > k$, where r is the internal rate of return and k is the weighted average cost of capital). In other words, an investment project is profitable if its net profitability is positive (i.e., $r_n > 0$, where r_n is obtained by subtracting k from r).

In order to compute the weighted average cost of capital under certainty conditions, the internal rate of return can be defined as the discount rate which makes the present value of the funds received for the investment be equal to the present value of the outflows expected to meet the repayment of principal and payment of dividends and/or interest.

Regarding its economic meaning, the internal rate of return provides the annual relative gross profitability of the capital which remains invested at the beginning of each year. Therefore, the internal rate of return is an annual profitability because it refers to the capital which remains fixed at the beginning of each year in the investment project and it does not refer to the capital which is fixed at the beginning of the project. Additionally, the internal rate of return is a gross profitability due to the fact that it contains the payment of the invested capital to the financial resources (i.e., $r = k + r_n$).

The result of the internal rate of return (r) provides a profitability measure of the investment. Therefore, in order to decide whether a certain investment project is developed or not, the profitability which is obtained by the internal rate of return (r) and the market interest rate (i) should be compared. First, if r were lower than i , the profitability of the investment would be lower than the one of the market and, consequently, that investment project would not be desirable. Second, if r were equal to i , the profitability of the investment would be equal to the one of the market and, as a result, only the investment would be recouped. Finally, if r were higher than i , the investment profitability would be higher than the one of the market and, therefore, it would be profitable to make the investment.

Finally, it is interesting to note that the most important drawback of the internal rate of return is the same as the one mentioned earlier for the net present value. It is suggested being preferably used under certainty or quasi-certainty conditions. Under risk conditions, it is difficult to compute the estimated cash-flows and establish the appropriate discount rate.

- The discounted payback period

This technique is a dynamic version of the payback, which is a static method. To obtain the discounted payback period, the nominal cash-flows which are discounted by the discount rate are used rather than using the nominal cash-flows which are not discounted by the discount rate. As was stated earlier for the payback, the project which presents the shortest payback period will be selected first. This method presents several drawbacks. First, it does not consider the cash-flows which are produced after the payback period. Second, it puts the liquidity in front of the profitability.

- The present value rate (T)

The present value rate (T) is defined as the net present value which is obtained by the investment for each monetary unit involved:

$$T = \frac{NPV}{A} \quad (9)$$

where NPV is the net present value and A represents the initial investment cost.

According to this method, an investment project should be developed if its present value rate is positive. This will occur if the net present value is higher than zero. As a rule of decision, the investment project which has the highest present value rate will be chosen.

- The profitability index (IR)

In order to apply this technique, the sum of the present value of all the cash receipts produced by the investment project is divided by the sum of all the required cash payments, which contain the initial investment cost. Therefore, the profitability index is obtained as follows:

$$IR = \frac{\sum_{t=1}^n c_t}{\sum_{t=0}^n p_t} \quad (10)$$

where c_t represents the discounted cash receipts and p_t is the discounted cash payments.

However, the profitability index does not provide much additional information regarding the aforementioned methods because if the net present value were positive, the profitability index would be higher than one and vice versa.

In addition to the aforementioned investment assessment techniques, we have studied and described a set of ratios in order to analyse the economic financial structure of firms. In particular, the main objective of the economic financial analysis of a firm is to analyse the economic situation of the firm and to measure the profitability of the invested capital. The word ratio simply means proportion. A ratio is a quotient between two accounting items regardless of their degree of aggregation. It is expressed as a fraction of unity or as a percentage. The computation of these ratios is usually based on the financial statement of a firm such as the balance sheet, the operating account, the profit and loss statement, the statement of sources and uses of cash-flow and the statement of sources and uses of the rotation fund. Nevertheless, in order to compute them, non-accounting information is sometimes used as well. Each ratio considers a certain aspect of the firm and, consequently, the firm should be seen as a whole in order to obtain a correct overview of the firm.

In this regard, we have considered ratios which allow the study of the aspects of the firm such as liquidity, solvency, total indebtedness, stock rotation, economic maturity, financial maturity and profitability. The calculated ratios for a firm should be compared with the average sector ratios or the ratios of the same firm in previous periods of time or the desirability ratios so that the computation of these ratios is really useful.

- Ratio of liquidity

The ratio of liquidity is used to measure the company ability to meet its short-term debt by means of its current assets. In order to compute it, the current assets are divided by the short-term debt. It is defined as follows:

$$\text{Ratio of liquidity} = \frac{\text{Current assets}}{\text{Short-term debt}} \quad (11)$$

Regarding its interpretation, it is desirable that the value of the ratio of liquidity is higher than one.

- Ratio of solvency or financial autonomy

The ratio of solvency, which is also known as the ratio of financial autonomy, measures the degree of dependency of the firm in relation to external financing. To determine it, the stockholder's equity is divided by the external funds. Therefore, it is obtained as follows:

$$\text{Ratio of solvency} = \frac{\text{Stockholder's equity}}{\text{External funds}} \quad (12)$$

Alternatively, the stockholder's equity can be divided by the total liabilities. Regarding its interpretation, a high value means that the risk of insolvency is low in principle. However, from the standpoint of business owners, this situation is not sometimes ideal because the firm may miss the opportunities which are provided by debt.

In short, the solvency ratio is intended to determine the optimal level of indebtedness of a firm. As for its interpretation, it is desirable that the value of the solvency ratio is more than 0.40.

- Ratio of total debt or financial dependence

The ratio of total debt or financial dependence gives the importance of external financing over the total liabilities. It is determined as follows:

$$\text{Ratio of total debt} = \frac{\text{External funds}}{\text{Total liabilities}} \quad (13)$$

Regarding its interpretation, the value of total debt ratio should be less than 0.70 (70%). Its optimal value is between 0.5 (50%) and 0.6 (60%).

- Ratio of stock rotation

The ratio of stock rotation indicates the number of times a year that the stock is renewed. To compute this ratio, the cost of sales is divided by the average value of the warehouse stock. Therefore, it is calculated as follows:

$$\text{Ratio of stock rotation} = \frac{\text{Cost of sales}}{\text{Warehouse stock}} \quad (14)$$

The average sale period is calculated using this ratio. In order to compute it, the number of months a year is divided by the rotation. The average sale period is the time that the product has been in storage until it has been sold.

As for the interpretation of this ratio, the lower the ratio is, the slower the outflow of products from the warehouse of the company will be. In contrast, the higher the ratio is, the more sales there will be. Also, when interpreting the value of the ratio of stock rotation, the average ratio in the sector to which the company belongs has to be taken into consideration. In this regard, if the company ratio were low compared with the sector average, it would indicate low sales and an excessive stock. Therefore, it would lead to an increase in charges for storage of products.

- The average maturity period of the firm (PMM): average economic maturity period and average financial maturity period

The average maturity period of the firm is defined as the average time length, expressed in days, of the operating cycle of a company. In other words, it is the average time between purchasing stock and receiving cash which proceeds from its sale.

In the operating cycle of the firm the following five stages are distinguished:

- Average period of storage of raw materials (PA):

It represents the average time (measured in days) that raw materials are stored. Therefore, it provides information about the number of days between purchasing raw materials and using them to manufacture the product. In principle, the average period of storage of raw materials should be diminished as much as possible because of its impact on the liquidity of the company. However, it is interesting to note that the company should not be deprived of raw materials. This period only occurs in industrial companies and, therefore, it does not exist in commercial firms. It is obtained as follows:

$$PA = \frac{360}{\text{Raw material rotation}} \quad (15)$$

where

$$\text{Raw material rotation} = \frac{\text{Consumption of raw materials}}{\text{Average stock of raw materials}} \quad (16)$$

$$\text{Consumption} = \text{Initial stock} + \text{Purchases} - \text{Final stock} \quad (17)$$

- Average period of production (PF): It is the average time between the inflow of raw materials in the production process and the outflow of finished products. As occurred with the average period of storage of raw materials, this period should be reduced as much as possible because it affects the liquidity of the company. This period does not exist in commercial firms and only occurs in industrial firms. It is computed as follows:

$$PF = \frac{360}{\text{Rotation of goods in process}} \quad (18)$$

where

$$\text{Rotation of goods in process} = \frac{\text{Annual cost of finished production}}{\text{Average stock of goods in process}} \quad (19)$$

$$\text{Annual cost of finished prod.} = \text{Initial stock of goods in process} + \text{Prod. cost in the period} - \text{Final cost of goods in process} \quad (20)$$

$$\text{Production cost in the period} = \text{Consumption of raw materials} + \text{Labour} + \text{Industrial overhead} \quad (21)$$

- Average sale period (PV): It is the average time between the inflow of finished goods in storage and the outflow of them from storage because of their sale. This period should be reduced as much as possible because it influences the liquidity of the firm.

$$PV = \frac{360}{\text{Rotation of finished products}} \quad (22)$$

where

$$\text{Rotation of finished products} = \frac{\text{Cost of sales}}{\text{Average stock of finished products}} \quad (23)$$

$$\text{Cost of sales} = \text{Initial stock of finished products} + \text{Production cost of finished products} - \text{Final stock of finished products} \quad (24)$$

- Average period of customers (PC): It is the time between the sale of products and the cash receipt. It should be decreased as much as possible because it has an influence on the liquidity of the firm. It is calculated as follows:

$$PC = \frac{360}{\text{Rotation of sales}} \quad (25)$$

where

$$\text{Rotation of sales} = \frac{\text{Sales}}{\text{Average balance of customers}} \quad (26)$$

- Average period of payment to suppliers (PP): It is the time between purchasing and payment. This period should be increased as much as possible due to its influence on the liquidity of the company. It is obtained as follows:

$$PP = \frac{360}{\text{Rotation of purchases}} \quad (27)$$

where

$$\text{Rotation of purchases} = \frac{\text{Purchases}}{\text{Average balance of suppliers}} \quad (28)$$

Once the stages of the operating cycle of the company have been described, we should distinguish between the average financial maturity period and the average economic maturity period. The average financial maturity period is defined as the time that the company uses to recoup the money which is invested in the production process. It is obtained as follows:

$$\text{Average financial maturity period} = PA + PF + PV + PC - PP \quad (29)$$

Furthermore, the average economic maturity period is defined as the time of the operating cycle of the company between the inflow of raw materials in the warehouse and the cash receipts from customers. Therefore, it is determined as follows:

$$\text{Average economic maturity period} = PA + PF + PV + PC \quad (30)$$

In short, the firm should decrease the maturity period as much as possible and it would have a positive impact on its liquidity.

- Profitability of the stockholder's equity or financial profitability

The profitability of the stockholder's equity, which is also known as the financial profitability, is the percentage of profits over the stockholder's equity. It is determined as follows:

$$\text{Financial profitability} = \frac{\text{BAI}}{\text{Stockholder's equity}} \times 100 \quad (31)$$

where BAI is the profit before tax.

Equally, this ratio could be obtained after the corporate tax as follows:

$$\text{Financial profitability} = \frac{\text{BDI}}{\text{Stockholder's equity}} \times 100 \quad (32)$$

where BDI is the profit after tax.

Regarding their interpretations, the higher these ratios are, the higher the return on the stockholder's equity will be.

Finally, another relevant issue to consider in the analysis of the economic and financial structure of a company is the breakeven point, which is also known as point of equilibrium or break point. The breakeven point is reached when the company does not make any profit or loss, that is, when net sales are equal to total costs. Total costs are determined by the sum of fixed costs and variable costs. Fixed costs, which are also known as overhead costs, are those costs that do not experience any variation which is directly attributable to sales.

In contrast, variable costs are those costs that change depending on sales. Consequently, they increase or decrease in proportion to sales.

A method to determine the breakeven point consists of computing the mark-up that equals the fixed costs. Therefore, the breakeven point is obtained as follows:

$$\text{Breakeven point} = \frac{\text{Fixed costs}}{\text{Mark-up (as a fraction of unity)}} \quad (33)$$

If we wish to determine the break-even point in physical units, it is computed as follows:

$$\text{Breakeven point} = \frac{\text{Fixed costs}}{\text{Mark-up}} \quad (34)$$

Finally, it is interesting to note how the breakeven point of a company could be reduced. First, it could be diminished by increasing the sale price of products. Second, it could be reduced by decreasing the total costs. This could be done either through the fixed costs or through the variable costs.

4. Conclusions

In this study a description of investment assessment techniques has been carried out. First, we have described a series of static investment assessment methods such as payback (P), the total net cash-flow per unit of money involved (FNT), the average annual cash-flow per unit of money involved (FNM), the accounting rate of return (ARR) and the comparison of costs. Second, several dynamic investment selection methods have been detailed such as the Net Present Value (NPV), the Internal Rate of Return (IRR), the discounted payback period, the present value rate (T) and the profitability index (IR). Then there have been a set of ratios that help to explain the economic and financial situation of the company. In particular, we have considered ratios which are related to the following aspects of the firm: liquidity, solvency, total debt, rotation of stock, economic maturity, financial maturity and profitability.

Finally, we have described the breakeven point because of its importance in the study of the economic and financial structure of the company. To conclude, a spreadsheet has been developed in order to implement these techniques on the diversification initiatives which are chosen by the participating partners in the PRESPO project.

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